The 4\textsuperscript{th} International Conference on Sustainable Future for Human Security

SUSTAIN 2013

Editorial

The 4\textsuperscript{th} International Conference on a Sustainable Future for Human Security (SUSTAIN 2013) was held at Kyoto University (Japan) on 19-21 October, 2013. The conference was organized by SustaiN Society and the Indonesian Students Associations of Kyoto, with the support of the Organization for the Promotion of International Relations (OPIR) Kyoto University, Research Institute for Sustainable Humanosphere (RISH), Global Center for Education and Research on Human Security Engineering (HSE), Global COE Program for Sustainability / Survivability Science for a Resilient Society Adaptable to Extreme Weather Conditions (GCOE-ARS), and Inter-Graduate School Program for Sustainable Development and Survivable Societies (GSS).

The conference originated from the need to provide an inter-disciplinary forum where the most serious problems affecting a sustainable future for human security could be discussed, in recognition of the fact that many future problems cannot be solved by a “siloed” approach. The emphasis on sustainable futures is in response to the general awareness of the need to solve numerous human-related problems resulting from the rapid growth of modern society. The topic of sustainable futures for human security needs to be discussed in an integrated way, in accordance with the principles of sustainability, considering energy and materials supply, economies and trade, technology, cities, agriculture, social and environmental aspects.

To continue providing adequate technology to cope with the demands of human quality of life requires intensive research and development with multidisciplinary perspectives. Research and development towards achieving future human security should embrace sustainability perspectives, to avoid negatively impacting the environment and necessitating or exacerbating inefficient use of natural reserves, increasing emissions and hazardous wastes and jeopardizing human health and society.

The conference covered a wide range of issues with the aim of highlighting potential issues and paths towards a sustainable future. It attracted a high level of attendance from countries of the global North and South, with a wide geographical coverage. Overall, 160 participants were involved, with 120 presentations over the course of the conference. The quality of papers received was a testament to the reputation that the conference has been building over the past 3 years.

Papers presented at SUSTAIN 2013 were divided into five thematic areas: (1) Energy and Environment (EnE); (2) Sustainable Forestry and Agriculture (FA); (3) Sustainable Built Environment in Tropical Hemisphere Countries (BE); (4) River Basin and Disaster Management (RnD); (5) Social Science and Economics (SE). Under these broad areas, a wide-ranging series of presentations was given, which elaborated on current research across Asia and the world. Being held in Kyoto, a city of great cultural heritage, the participants also took part in a tour of some of the main sights and experiences that link modern and ancient Japan.

The two programmed days of the conference each commenced with keynote presentations which, like the conference itself, were wide-ranging. In the first session on day one, Dr. Ir. Edi Effendi Tedjakusuma, delivered an address on issues of a sustainable future for human security in the context of Indonesia. Dr. Puppim de Oliveira, Assistant Director and Senior Research Fellow at the United Nations University Institute of Advanced Studies (UNU-IAS), then discussed the future sustainability of cities in Asian nations. In the last keynote, Professor Satoshi Fujii, a Japanese cabinet adviser on Disaster Prevention and Reduction, introduced Japanese policy towards a more resilient country.

The organizers appreciate the support and assistance of the co-operating organizations, the participants, presenters and staff. The next SUSTAIN conference is highly anticipated by all the attendees of SUSTAIN 2013 and the committee expect to further build on the success of this year’s event.
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The 4th International Conference on Sustainable Future for Human Security
SUSTAIN 2013

Table of Contents

EDITORIAL.............................................................................................................................................. i

TABLE OF CONTENT................................................................................................................................... iii

..................................................................................................................ENERGY AND ENVIRONMENT................................................................. 1

Optimal Scheduling of Fossil-Fuel Power Plant in Anticipating Peak Load Demand: A Case Study in PT. PLN
Manokwari
Adelhard B. Rehiara, Elias K. Bawan, Bibiana R. Wiyaywari................................................................. 2

Economic and energy policy for coalbed methane development in Indonesia: a review paper
Heru Prasetyo, Danang Sismartono, Bambang Wicaksono, Ika Kaifiah.................................................. 13

N-CBlast: Disinfectant innovation from nanochitosan shrimp shell waste as antimicrobial for Bogor’s mall toilet
Asya Fathya Nur Zakiah, Mada Triandala Silero, Nadia Fitriana............................................................ 20

Bioethanol production from Nipa Sap in Riau Province Coastal Zone
Chairul, Silvia Reni Yenti, Heriyanti, Iryyad Abdullah................................................................. 24

FAME (Fatty Acid Methyl Ester) Based on Mahkota Dewa Fruit (Phaleria macocarpa) as A New Alternative
Bio-Fuel
Iga Nugraheni, Mariani Yunita, Asep Andi A.......................................................................................... 27

................................................SUSTAINABLE BUILT ENVIRONMENT IN TROPICAL HEMISPHERE COUNTRIES.................................................. 34

Wood Originality Based Evaluation on Restoration of Third Alang as Wooden Cultural Heritage of Tana Toraja
Traditional Houses Components on Nanggala Sites
Yustinus Suranto........................................................................................................................................ 35

Urban Acupuncture: Revival of Urban Spaces and City Villages by Community Activation and Creativity
Dwinita Larasati, Tb. Fiki Ch. Satari........................................................................................................ 43

Nachawit Tikul.......................................................................................................................................... 50

Toward a better life: Aged-Friendly City, sidewalks layout design influence in elders Active Living (Taipei Taiwan, La
Plata, Argentina)
Marjorie E. Mejia...................................................................................................................................... 56

Landscape Infrastructure as Strategy in the Design of Transport Infrastructure. Case study: Surabaya and Malang,
Indonesia
Subhan Ramdani................................................................................................................................. 64

On the Sustainable Management and the Reuse Strategies of Taiwanese Elementary Schools
Trai-shar Kao, Hui-fen Kao, Yi-jen Tsai, Chung-chien Tsai.................................................................... 71

Development of Connection System Bamboo Truss Structures
Astuti Masdar, Bambang Suhendro, Suprapto Siswosukarto, Djoko Sulistyoko...................................... 78

..................................................RIVER BASIN AND DISASTER MANAGEMENT.................................................. 87

The Ecological Perceptions and Communities Participations on River Conservation Based on Bioindicator Odonata
Knowledge in Upper Watershed Area: A Case Study in Batu District, East Java, Indonesia
Abdulkadir Rahardjanto, Haryoto Kusnoputranoto, Dwita Sutjaminingsih, Francisca SSE Seda............. 88

Kukuyaan program as a form of community empowerment and river revitalization (case study Cikapundung river,
Bandung, West Java, Indonesia)
Karina Isna Irawan.......................................................................................................................... 97

The Analysis of Community Adaptation Process in Constructing Disaster-Prone City (a Study on West Padang) 104
<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Status of Heavy Metal Concentration in Water of Citarum River at Selected Sites in Bandung Residence</td>
<td>112</td>
</tr>
<tr>
<td>Difference of Response Hydrology Using Mock Model and Integrated NRCS with Base Flow at Krueng Peusangan Watershed, Aceh, Indonesia</td>
<td>121</td>
</tr>
<tr>
<td>PIIKAD: Clans, Ethnic Revivalism, and Local Democracy in Indonesia (A Lesson from Lampung)</td>
<td>130</td>
</tr>
<tr>
<td>The Conservation of Temuan Indigenous Cultural Heritage at Kampung Chariz, Johol, Kuala Pilah, Negeri Sembilan, Malaysia.</td>
<td>137</td>
</tr>
<tr>
<td>Strategies of Rural Transport Service Provision</td>
<td>143</td>
</tr>
<tr>
<td>Impact of AEC Connectivity on Local Communities: Comparative Studies of Dawei Deep Sea Port in Myanmar, the Eastern Seaboard in Thailand and the Strait of Malacca in Malaysia after the Implementation of the ASEAN Economic Community in 2015: Challenges and Opportunities</td>
<td>151</td>
</tr>
<tr>
<td>Contributing Factor of Military Assistance Toward Police In Handling Social Conflict In Indonesia</td>
<td>164</td>
</tr>
<tr>
<td>The Effect of Infrastructure on Food Security</td>
<td>170</td>
</tr>
<tr>
<td>Fair trade organic coffee production in Southern Lao PDR.—Vulnerability or strength of household coffee farmers</td>
<td>176</td>
</tr>
<tr>
<td>Effect of Gibberellic Acid and Nitrogen on Dry Matter, Harvest Index and Solar Radiation Conversion Efficiency in Peanut at Wetland</td>
<td>183</td>
</tr>
<tr>
<td>Analysis of Ear Mushroom (Auricularia sp.) Cultivation using The Cutting Waste of Forest Tree Species</td>
<td>189</td>
</tr>
<tr>
<td>Spatio-Temporal Analysis of Sacred Groves in the Raigad District, Maharashtra State, India</td>
<td>193</td>
</tr>
<tr>
<td>Land use change of urban agriculture using GIS in Nakhon Ratchasima Municipality, Northeast Thailand</td>
<td>201</td>
</tr>
<tr>
<td>Message Appeal and Presentation Order of Public Service Ads: Experimental Study of Egg Enriched with Omega-3 Promotion</td>
<td>208</td>
</tr>
<tr>
<td>Assessment of LD50 of physic nut (Jatropha curcas L.) Seeds Extract as Bio-Insecticide for Controlling Disruption Rove Beetles (paederus sp.)</td>
<td>213</td>
</tr>
<tr>
<td>Prospects of School Milk Program in Rural Indonesia: Case study at Bantul Regency, Daerah Istimewa Yogyakarta Province</td>
<td>219</td>
</tr>
<tr>
<td>Zooneses Impact Endoparasites of Orangutan Ex-Captive at Lamandau River Wildlife Reserve, Central Borneo</td>
<td>223</td>
</tr>
<tr>
<td>Market Conduct of Vegetable Seed Industry In Indonesia</td>
<td>227</td>
</tr>
<tr>
<td>Author(s)</td>
<td>Title</td>
</tr>
<tr>
<td>--------------------------------------------------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Bambang Sayaka</td>
<td>Resistance for Two Woods Species from School Building with Cigarette Waste Water to Subterranean Termites Attack</td>
</tr>
<tr>
<td>Niken Subekti</td>
<td></td>
</tr>
<tr>
<td>Deviona, Muhadam Syukur, Aslim Rasyad, Elza Zuhry, Arip Hidayatullah</td>
<td>Combining Ability of Yield Component in Chili (Capsicum annuum)</td>
</tr>
<tr>
<td>Deviona, Muhadam Syukur, Aslim Rasyad, Elza Zuhry, Arip Hidayatullah</td>
<td></td>
</tr>
<tr>
<td>Analysis of Shallot-Farming Risk &amp; Food Security of Farm-Household in Bantul Regency, Yogyakarta Province</td>
<td></td>
</tr>
<tr>
<td>Any Suryantini, Slamet Hartono, Cungki Kusdarjito</td>
<td></td>
</tr>
<tr>
<td>Trichoderma virens isolated from Cocoa plantation in Aceh increases viability and vigor of expired seed</td>
<td></td>
</tr>
<tr>
<td>Rina Sriwati, Hasanuddin, Zwina Savitri, Takeuchi, Y</td>
<td></td>
</tr>
</tbody>
</table>
Optimal Scheduling of Fossil-Fuel Power Plant in Anticipating Peak Load Demand: A Case Study in PT. PLN Manokwari

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Abstract
Optimization of fossil-fuel power plants plays an important role in increasing efficiency of the plants. Economic dispatch of well combined power plants in unit commitment may place those plants in maximum efficiency. Lagrange multiplier, a method in economic dispatch, was utilized for rescheduling the demand of peak load in power system of PT. PLN branch Manokwari. The power system of the electrical company includes nine units and the other rental units of diesel power plant. Based on the investigation in the time of peak load for a week operation, diesel power plant units in the company system had not worked in optimal operation while handling the peak load. This condition has increased the operation cost of the generating system. By rescheduling the power plants using Lagrange method, the company can save operation cost about USD 9548 per week of operation in peak load time. On the other hand, by recommitting efficient power plants for handling the peak load using simple unit commitment, the company can save cost about USD 11869 per week. This condition can also save fuel and reduce emission of carbon dioxide.

Keywords: Economic dispatch; Lagrange multiplier; diesel power plant; optimize; peak load.

1. Introduction
Fossil-fuel power plant is a type of power plant that burns fossil fuels i.e. coal, natural gas or petroleum oil to produce electrical energy. Diesel power plant is a type of fossil-fuel power plant that converts diesel fuel to be electrical energy. The conversion process in diesel power plants may not over 80% of its efficiency and it will deliver some pollutants as the effect of the process [1]. Optimization of fossil-fuel power plant including diesel power plant will be a challenge in minimizing operation cost and reducing pollutants.

In optimizing a power plant, unit commitment can be applied to have optimal solution in power plant operation. The unit commitment is the process to take optimal solution of machine operation and this process is scheduling on and off the machine in best time. Many constraints can be applied to unit commitment in order to have maximum optimization.

Normally, the usage of electricity will increase before until mid-night because most of people will be at home at the time and those will need electricity, at least for lighting. This condition is called peak load and in this moment, power plant units installed to the power system should work maximum to fulfill the high demand load. The demand load can be in between afternoon and the mid-night where the usage of electrical energy is significantly increasing. According to the standard of PLN, peak load time can start from 18.00 – 22.00 pm of local time [2]. The peak load time depends on the load characteristic and also on the local environmental; therefore the peak load time can happen faster or later from the standardization time.

The oldest method in economic dispatching is Lagrange method and its basic formulation had been used in some previous research [1][3-10]. After unit commitment is applied to schedule machines, economic dispatch should be used to determine how the machines should be occupied to fulfill demand load. As an electrical company of Indonesian government in the area of Manokwari, which is the capital city of West Papua Province - Indonesia, PT. PLN Manokwari has done unit commitment in scheduling its power plant units. This paper will investigate the effectivity of scheduling operation especially in anticipating peak load demand of diesel power plant units in power system of the company.

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Nomenclature

\( i \) number of unit
\( a, b \) the coefficient of the cost input of the \( i \)-th generator
\( c \) equivalent to fuel consumption of the generating unit operation without power output
\( n \) total number of units in the system
\( F_i \) fuel cost function of the units
\( P_i \) generation of unit \( i \)
\( P_R \) total system load
\( P_{\text{min}, i} \) lower limit of the unit \( i \)
\( P_{\text{max}, i} \) upper limit of the unit \( i \)
\( L \) Lagrange function
\( \lambda \) the Lagrange multiplier.

2. Economic Dispatch

Economic dispatch (ED) is the operation of generation facilities to produce energy at the lowest cost to reliably serve consumers, recognize any operational limits of generation and transmission facilities [10]. The economic dispatch (ED) problem is how to minimize a total generation cost of power system for a given demand load with satisfying various constraints including power balance constraint and generation power limits of each unit. While the load has been varied, the output of generators has to balance the load variation. The fundamental of the ED problem is the set of input-output characteristic of the power generating unit and the ED problem can be expressed as [1][3-12]:

Minimize

\[
F_T = \sum_{i=1}^{n} F_i P_i \quad (1)
\]

\[
F_i (P_i) = (a_i P_i^2 + b_i P_i + c) \quad (2)
\]

Subject to:

\[
\sum_{i=1}^{n} P_i = P_R \quad (3)
\]

\[
P_{\text{min}, i} \leq P_i \leq P_{\text{max}, i} \quad (4)
\]

The fundamental components in ED are planning for future dispatch and dispatching the power system today. Generally target function of ED can be investigated by Lagrange multiplier method, first or second order gradient method, and lambda iteration, but these methods may encounter some difficulties for complex generation cost functions [5]. Lagrange formulation can be rewritten as [1][11-13]:

\[
L = F_T + \lambda \phi = \sum_{i=1}^{n} F_i P_i + \lambda (P_R - \sum_{i=1}^{n} P_i) \quad (5)
\]

The function of output generating power is assumed that optimal condition is reached if gradient operation equals to zero. In other word, the first derivative of the Lagrange function \( L \) with respect to each of the independent variables has to be set equal to zero as follows.

\[
\nabla L = \nabla F_T + \nabla \lambda \phi = 0 \quad (6)
\]
\[
\frac{\partial L}{\partial P_i} = \frac{\partial F_i}{\partial P_i} + \lambda \left( \frac{\partial P_i}{\partial P_i} - \frac{\partial P}{\partial P} \right) = 0
\]

By solving 7th equation, we get:
\[
\frac{\partial F_i}{\partial P_i} + \lambda (0 - 1) = 0 \Rightarrow \frac{\partial F_i}{\partial P_i} = \lambda
\]

Eq. 8 shows that optimum condition can be reached if the incremental of each power generation connected to the system is equal. This condition should respect to the constraint defined in eq. 4.

3. Unit Commitment

Unit Commitment optimization enables utilities to minimize power generation costs. Unit commitment (UC) is different from ED. ED consists of fitting a given set of power plants into a certain electric demand, while UC appoints to the set of plants from which dispatching can choose. The problem of UC involves finding the least-cost dispatch of available power plants that should be considered to supply the demand load. In dispatching decisions, there is no time to rapidly activate a power plant because the inertia of most plants will not allow this. UC, therefore, prepares a set of plants and stipulates in which time period they have to be on-line and ready for dispatching [14].

The most talked-about techniques for the solution of the unit commitment problem are Priority-list schemes, Dynamic programming and Lagrange relation [10]. Priority-list scheme is a very simple method in unit commitment based on listing priority in which power plants are logically ranked. Normally, the plants are ranked according to full load cost, and then there will be some bias of the rank since not all of plants will be operated at full load. Dynamic programming is a strategy to build optimal problem formulated in some stages that have correlated each other. There is no standard formulation in dynamic programming and it has many advantages over the enumeration scheme, the chief advantage becomes a reduction in the dimensionality of the problem. The dynamic-programming method of solution of the unit commitment problem has many disadvantages for large power systems with many generating units. It is due to the necessity of forcing the dynamic-programming solution to search over a small number of commitment states to reduce the number of combinations that must be tested in each time period. In the Lagrange relaxation technique, these disadvantages disappear.

Some considerations that should be taken into account while doing the unit commitment including power constraint are minimizing objective function, minimum up and down operation time, and spanning reserve margin [13]. Simple UC can be applied when every generator has fulfilled the point of 1 to 3 and complex UC will be effective by taking into account the point of 4 and 5 as follows:

1. Minimum and maximum generation level which is power constraint of the generator. This level is preferred to be maximum level because producing over this level causes significant pollution.
2. Startup fuel consumption coefficient which is the coefficient of a generator while it starts with no load.
3. Linear fuel consumption formula which is the fuel cost function.
4. Minimum up times and down times which is the minimum number of hours a generator must be on or off once turned on or off.
5. Maximum ramp up and ramp down rate which is the maximum amount that a generator can increase or decrease production in an hour.

4. Result and Discussion

4.1. Power plant units

Maximum electrical energy produce of PT PLN Manokwari machines is 7610 kW by operating nine diesel power plant units. The power plant units of are operated in the same location and directly connected to the grid system [1]. This condition makes an amenity to investigate the system since there is no loss in power transmission between each power plant. The specification of each machine is provided in table 1.
Table 1. Machine specifications

<table>
<thead>
<tr>
<th>No of machine</th>
<th>Type of machine</th>
<th>Serie</th>
<th>Output power, kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DEUTZ</td>
<td>BV8M 628</td>
<td>950  180</td>
</tr>
<tr>
<td>2</td>
<td>DEUTZ</td>
<td>BV8M 628</td>
<td>1100 180</td>
</tr>
<tr>
<td>3</td>
<td>MAN</td>
<td>6L 26/32 H</td>
<td>900  150</td>
</tr>
<tr>
<td>4</td>
<td>MAN</td>
<td>6L 26/32 H</td>
<td>900  150</td>
</tr>
<tr>
<td>5</td>
<td>DAIHATSU</td>
<td>6DL - 28</td>
<td>1000 180</td>
</tr>
<tr>
<td>6</td>
<td>MITSUBISHI</td>
<td>S12 R -PTA</td>
<td>800 150</td>
</tr>
<tr>
<td>7</td>
<td>MITSUBISHI</td>
<td>S12 H -PTA</td>
<td>600  120</td>
</tr>
<tr>
<td>8</td>
<td>MITSUBISHI</td>
<td>S16 R -PTA</td>
<td>900  150</td>
</tr>
<tr>
<td>9</td>
<td>KOMATSU</td>
<td>SAA 6D 170-P800</td>
<td>460  75</td>
</tr>
</tbody>
</table>

The fuel cost function of each power plant had been defined in previous research [1] as provided in table 2. The functions are constrained to minimum and maximum output of power plant.

Table 2. Fuel cost functions

<table>
<thead>
<tr>
<th>Unit</th>
<th>Fuel cost function $F_i$</th>
<th>Power constrain, kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$-1.42e^{-4}P_1^2+0.343P_1-1.994$</td>
<td>$180 \leq P_1 \leq 950$</td>
</tr>
<tr>
<td>2</td>
<td>$1.17e^{-2}P_2^2+0.200P_2+15.800$</td>
<td>$180 \leq P_2 \leq 1100$</td>
</tr>
<tr>
<td>3</td>
<td>$0.90P_3^2-1.178P_3+554.8$</td>
<td>$150 \leq P_3 \leq 900$</td>
</tr>
<tr>
<td>4</td>
<td>$2.38e^{-4}P_4^2-4.90e^{-2}P_4+118$</td>
<td>$150 \leq P_4 \leq 900$</td>
</tr>
<tr>
<td>5</td>
<td>$1.23e^{-4}P_5^2+0.261P_5+0.860$</td>
<td>$180 \leq P_5 \leq 1000$</td>
</tr>
<tr>
<td>6</td>
<td>$0.001P_6^2+0.2P_6+1.006$</td>
<td>$150 \leq P_6 \leq 800$</td>
</tr>
<tr>
<td>7</td>
<td>$0.001P_7^2-0.62P_7+187$</td>
<td>$120 \leq P_7 \leq 600$</td>
</tr>
<tr>
<td>8</td>
<td>$4.64e^{-4}P_8^2-0.44P_8+285$</td>
<td>$150 \leq P_8 \leq 900$</td>
</tr>
<tr>
<td>9</td>
<td>$0.002P_9^2-1.014P_9+144.8$</td>
<td>$75 \leq P_9 \leq 460$</td>
</tr>
</tbody>
</table>

As the case study, data from 27 May to 2 June 2013 had been used and it was noted from 1st to 7th day. Although peak load can start from 18.00 to 22.00 pm at local time, the calculation was taken ± 1 hour of the peak load time. There are two scheme of case study in discussing the data i.e. economic dispatch first case study and unit commitment in second case study.

4.2. Economic dispatch case

The procedure of optimizing in a power system was done by applying unit commitment and it was followed by applying economic dispatch. In this case, unit commitment was applied by the company and the job here to apply Lagrange optimizer to the system by following the chosen unit commitment. Data and solution of 1st day are provided in table 3.

On the first day operation, machine 5 and 8 were not operated along peak load time and total operation cost was USD 9872. As mentioned in previous research [1], machine 1 will be the most economic unit and machine 6 is the least economic unit; therefore to decrease the operation cost, unit 1 should be operated in its maximum while unit 6 should be operated in its minimum and its output will be increased after all of the units have been operated in maximum. This scheme was done in Lagrange solution and it cost only USD 7908 to produce same amount output. As shown in table 3 that the most saving cost was done by reducing power output of unit 6 and the cost was down from USD 3233 to USD 397. It is also shown that the cost of the other units was increased as the risk of handling load from unit 6.
4.3. Unit commitment case

In the previous case study, it is simply known that the operation of power plants in the company may not be optimized. In second case study, a simple unit commitment will be used to combine a group of power plants, and a very low cost of the combination will be the candidate to be selected to solve the demand load. The combination and solution on the 1\textsuperscript{st} day is provided in table 4 and the other days are in Appendix B.

Table 4. Unit commitment solution of 1\textsuperscript{st} day

<table>
<thead>
<tr>
<th>No of machine</th>
<th>Unit commitment solution, kW</th>
<th>Operation cost, USD</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>17:00</td>
<td>18:00</td>
</tr>
<tr>
<td>1</td>
<td>950</td>
<td>950</td>
</tr>
<tr>
<td>2</td>
<td>1100</td>
<td>1100</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>7</td>
<td>461</td>
<td>248</td>
</tr>
<tr>
<td>8</td>
<td>900</td>
<td>900</td>
</tr>
<tr>
<td>9</td>
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<td>222</td>
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Priority list of machine for minimal operation will be unit 5, 1, 2, 6, 4, 7, 8, 9 and 3, while for maximum operation it can be unit 1, 9, 8, 7, 4, 3, 2 and 5. The maximum sequence means that a machine should work until it reaches its maximum rate before the other machine starts to charge the load. On the other hand, minimum sequence means that the machine starts to supply the load at its minimum rate before the other unit starts to work. Since PT. PLN may have

Table 3. Data and Lagrange solution of 1\textsuperscript{st} day

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<th>No of machine</th>
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On second to seventh day operation (see appendix A), total prize was the lowest cost while unit 6 was not operated as shown on fifth day operation. The second lowest prize was also shown on third day operation which operated unit 6 for only two hours. The Lagrange solution for both days operation could only save USD 298 and USD 557 compared with the other days that could save more than USD 1000.

While the output of power plants follows the Lagrange schemes, the saving cost for a week operation is USD 9548. The saving cost is the difference of real operation and Lagrange solution about USD 1964, 3065, 557, 1216, 298, 1054 and 1393 from 1st to 7th day operation respectively. The cost may reach USD 38190 to 42282 for whole month works and saving cost means saving money for the company. The other importance of saving cost is saving fuel for sustainability of the power plant operation, and then the effect of saving fuel may cause reduction in carbon dioxide emission.
other consideration for hour’s works, maintenance, etc, the company has to operate machines out of the list, but in principle the company should obey the maximum sequence to get the maximum optimal works.

Using the method of priority list in unit commitment, the units that commit to work tend to be homogenous for all days. It also shows that most of plants will work at their maximum limit while the other two units will work in range. Overall, the designed unit commitment schemes show best optimization and they will save cost about USD 7404.7, 8654.7, 6850.9, 9459.1, 6784.5, 6933.8, and 7330.4 from first to seventh day operation respectively. The saving cost will reach USD 11869 per week or USD 47478 per month operation in peak load time. The result may not always be true since the company may have other consideration according to the work hours, maintenance, etc.

5. Conclusion

The result of investigating the scheduling in PT. PLN Manokwari shows that the effort done to anticipate peak load demand may not be effective to reduce operation cost. This evidence can be seen from the difference between real operation cost and the refine cost scheme with economic dispatch and unit commitment method. The result of rescheduling with this method has decreased operation cost at least USD 38190 per month by following the real unit commitment and USD 47478 by applying the designed unit commitment. The system in the company will be effective and efficient by rescheduling the machine to handle the peak load.

Acknowledgements

Special appreciation goes to the head and the staff of PT. PLN Manokwari, many thanks for their cooperation along the research. Authors also want to thank to general director of higher education of the ministry of education and culture who found the presentation of this paper. Many thanks for those who indirectly contributed in this research.
Appendix A. Data and Lagrange Solution

Real operation and Lagrange solution for optimizing the operation is provided in following table. The table is used to show data from second to seventh day of peak load operation while the first day is shown in table 3.

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Appendix B. Unit Commitment Solution

Unit commitment solution for optimizing the plants operation is provided in following table. The table is used to show data from second to seventh day of peak load operation while the first day is shown in table 4.

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<td>160</td>
<td>290</td>
<td>230</td>
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<tr>
<td>Total</td>
<td>1110</td>
<td>2340</td>
<td>4980</td>
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</tbody>
</table>
References

Economic and Energy Policy for Coalbed Methane Development in Indonesia: A Review Paper

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Abstract

Indonesia has abundant potential Coalbed Methane (CBM) both in Sumatera and Kalimantan Island. The total potential amount of CBM is about 453 trillion cubic feet (TCF) in-place. According to CBM roadmap, in 2015 the production was targeted 150 Million Metric Standard Cubic Feet Per Day (MMSCFD). However, the development of CBM in Indonesia is growing too slow and needs to be improved in order to conduct sustainable development. The monitoring results indicated that only 26% of CBM Contractors committed on their project in Indonesia. The purpose of this review paper is to update and improve CBM development in Indonesia. Economically, the best conditions for CBM contract between the government and contractor is Production Sharing Contract (PSC) scheme 55:45 with non-shareable FTP 10%. The authors suggest government to use Gross PSC (GPSC) with no cost recovery and more incentive for CBM development.

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Keywords: coalbed methane; economic review; CBM policy; Indonesia

1. Introduction

Basically, CBM is natural gas trapped in coal, or adsorbed in deeply buried coal seams [1]. Common name for Coalbed Methane (CBM) are Coal Bed Gas, Coal Seam Methane (CSM), Coal Seam Gas (CSG), and Coal Mine Methane (CMM). Through certain drilling, the CBM is extracted from the coal layer. This process will not reduce the coal deposit because it only takes the trapped CBM. Indonesia is the sixth largest CBM resources in the world with a potential 453 trillion TCF, twice more than the country’s natural gas reserves [2]. It is spread over the areas, especially from Central Sumatera to Southeast Sulawesi. In more detail, Fig. 1 shows the location for each block in Sumatera, Kalimantan and Sulawesi. Gas production from CBM is expected to help Indonesia boost its declining gas output from conventional gas production.

The first pilot project of CBM in Indonesia was begun in 2004, it was located at Rambutan field, South Sumatera. Then, the next development project was being scheduled following the existing CBM working acreages. In short term (2009-2011), the major target activity was focused on making guidance for CBM development, acceleration of firm commitment by 5 PSCs Contractor, CBM regulation for electricity, offering of 25 CBM field and study incentive for CBM Contractors. In long term (2012 – 2025), the major target is pointed to offer 70 CBM fields, GMB production up to 500 MMSCFD in 2015, GMB production up to 1000 MMSCFD in 2020, GMB production up to 1500 MMSCFD in 2025. However, since the first CBM development is conducted until now, the progress is too slow and it seems not meet the roadmap target in 2015. Therefore, the purpose of this review paper is to update and improve the CBM development in Indonesia. Fig. 2 shows the CBM roadmap in Indonesia.

In this paper, the study will be divided into 4 chapters. Chapter 1 is introducing the CBM development in Indonesia. Chapter 2 is reviewing the economic of Indonesian CBM development. Chapter 3 is giving illustration about the current situation of CBM development and CBM policy implementation in Indonesia. Chapter 4 is summarising and concluding the overall study.
Fig. 1. CBM resources in Indonesia

**ROAD MAP of INDOONESIAN CBM DEVELOPMENT**

- **1998**
  - Feasibility study
  - Technical and Economical

- **2000**
  - Ministerial regulation No.1659

- **2004**
  - PP: CBM – 1 Rambutan (GOI Sponsor)

- **2005**
  - Minister Decree No.033/2006

- **2006/2007**
  - CBM for Electricity Pilot Project
  - CBM Estimated Production ~500 MMSCFD
  - CBM Estimated Production ~1000 MMSCFD

- **2010/2011**
  - CBM Estimated Production

- **2012**
  - Increasing number of CBM Contract
  - Average production = 250 MSCFD/ well

Legend:
- Government Participation
- Start of Commercial Period (Exploration)
- Estimated CBM Production
- PP: Pilot Project

Fig. 2. CBM Roadmap in Indonesia
2. Economic review of Indonesian CBM development

The term and condition of CBM contract is generally identical to oil and gas PSC contract. Some important clauses in the contract are:

- Signature bonuses as amount US$ 1 million
- Firm commitment for the first three-year exploration phase
- Privilege for the government in the form of FTP is taking 10% of the production before the cost recovery
- Domestic market obligation (DMO) a maximum of 25% of the contractors gross share, and
- Government policies to take 10% participating interest to be offered to the local state-owned enterprises.

Contractor share for CBM is greater than oil and gas share; one thing that underlies the policy is the period to get the first production of CBM takes up to 9 years longer than conventional oil and gas development. For coal bed methane production by 45%, for the contractor, is considered more promising to give a normal investment level [3]. Some forms of fiscal incentives such as tax exemption of imported EPC materials are also being considered in order to accelerate of CBM development. PSC schemes offered are:

- Production Sharing Contract scheme
  PSC scheme still uses pattern-sharing contract with the cost recovery. Current split for coal bed methane development within frontier area is offered at 45% to 55% for contractor and government with 10% non-shareable FTP. This condition of the economic development of coal bed methane can be achieved by the contractor with a reasonable level and provide optimum government revenue.
- Gross production sharing contract scheme (GPSC)
  GPSC scheme is all direct production split between the government and contractor or without cost recovery. Meaning that, coal bed methane development costs incurred are not charged to the government.

The difference between the basic principles of contract PSC and GPSC is located on the presence of cost recovery. In PSC contract, government will recover all investments if investors successfully produce the coal bed methane. While in the model GPSC, there are no longer cost recovery terms. All investment capital investors are purely his own business, so that getting gas or not is a business risk investors. The authors suggest the GOI to introduce GPSC on the new CBM contract in the future. By using GPSC, the benefits are that contractor will be more serious and carefully to develop CBM fit on its economic life time.

Economic evaluation had been investigated due to production of 616 BCF of coal bed methane by assuming investment cost of US$ 248.2 million. Drilling expenses for ± 350 wells reach US$ 155 million. The drilling is done gradually over 23 years, and the most drilling is conducted in the period of 2nd to 6th with an average drilling 36 wells/year. Facility costs to produce gas with peak production at 80 MMSCFD are around US$92.4 million. While operating costs consist of maintenance of existing wells, the cost of production, processing units, water treatment, and compression/gas transportation. Average operating cost is US$ 1.5 per MMBTU [4].

Assuming that gas price is US$ 5 per MMBTU, it is shown on the contract PSC that FTP 10% non-shareable gives IRR in the range 37-39% for any value DMO fee. The calculation of profit sharing schemes PSC is presented in Table 1.

Changing the amount of production and the price is more sensitive to the contractor NPV, followed by the capital and operating expenditure. Every 10% change in the volume or price of the parameter value causes a shift in the contractor NPV of US $17.2 million. Whereas, each 10% change in the capital or operating expenditure provides contractor NPV shift of US $2.3 – 2.8 million.

3. Current CBM Development and Policy Implementation in Indonesia

3.1 CBM development in Indonesia

In 2008, after being announced an attractive incentive for CBM split sharing production to the contractors, the GOI signed its first CBM contracts. There were totally 7 (seven) CBM working acreages developed. Then, in 2009 the GOI signed 13 (thirteen) CBM working acreages which were almost two folded from the previous year. After that, every year the CBM working acreages increased gradually as 3 working acreages in 2010, 19 working acreages in 2011, and 12 working acreages in 2010. By August 2013, there were a total of 54 CBM[5] working acreages with the government targeting a total of 210 by 2025. These are likely to be spread wider than just South Sumatra, as major basins are exist elsewhere: South Sumatera (183 tcf), Barito (101.6 tcf), Kutai (89.4 tcf), Central Sumatra (52.5 tcf), North Tarakan (17.5 tcf), Berau (8.4 tcf), Ombilin (0.5 tcf), PasirAsam-asam (3 tcf), NW Java (0.8 tcf), Sulawesi (2 tcf), and Bengkulu (3.6 tcf). However, according to the GOI monitoring and evaluation for CBM development, out of the total 24 contractors, only 14 contractors committed on their firm commitment with performance over than 3 years. The number of CBM contractors increases, but the whole performance of CBM development in Indonesia is low.
Table 1. Evaluation Result on various PSC Scheme

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Unit</th>
<th>PSC</th>
<th>GPSC</th>
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<tbody>
<tr>
<td>Cumulative Prod.</td>
<td>MMSCF</td>
<td>612,000</td>
<td></td>
</tr>
<tr>
<td>Gas Price</td>
<td>US$/MCF</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Gross Revenue</td>
<td>M.US$</td>
<td>3,060,000</td>
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**Expenditure**

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</thead>
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<tr>
<td>Pre-ops.</td>
<td>10,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capex Tangible</td>
<td>131,338</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Capex Intangible</td>
<td>116,813</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O&amp;M</td>
<td>465,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rec of Op. Cost</td>
<td>%</td>
<td>24%</td>
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**PSC Indicator**

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>20% Shareable</th>
<th>10% Non-shareable</th>
<th>-</th>
<th>-</th>
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</thead>
<tbody>
<tr>
<td>FTP</td>
<td>%</td>
<td>55 : 45</td>
<td>30 : 70</td>
<td>10 - 90</td>
<td></td>
</tr>
<tr>
<td>DMO</td>
<td>%</td>
<td>25%</td>
<td></td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>DMO Fee</td>
<td>%</td>
<td>25%</td>
<td>100%</td>
<td>25%</td>
<td>100%</td>
</tr>
<tr>
<td>Tax</td>
<td>%</td>
<td>44%</td>
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**Contractor Entitlement**

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<tr>
<th></th>
<th>%</th>
<th>39%</th>
<th>42%</th>
<th>37%</th>
<th>39%</th>
<th>22%</th>
<th>33%</th>
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<tbody>
<tr>
<td>Contractor IRR</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Contractor NCF</td>
<td>M.US$</td>
<td>851,750</td>
<td>1,046,083</td>
<td>739,236</td>
<td>908,383</td>
<td>476,370</td>
<td>819,090</td>
</tr>
<tr>
<td>Contractor NPV_{@10%}</td>
<td>M.US$</td>
<td>127,055</td>
<td>156,818</td>
<td>107,819</td>
<td>133,511</td>
<td>48,232</td>
<td>106,319</td>
</tr>
<tr>
<td>Contractor NCF / GR</td>
<td>%</td>
<td>28%</td>
<td>34%</td>
<td>24%</td>
<td>30%</td>
<td>16%</td>
<td>27%</td>
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</table>

**GOI Entitlement**

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>49%</th>
<th>42%</th>
<th>52%</th>
<th>47%</th>
<th>61%</th>
<th>50%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government PV</td>
<td>M.US$</td>
<td>1,485,100</td>
<td>1,290,768</td>
<td>1,597,614</td>
<td>1,428,468</td>
<td>1,860,480</td>
<td>1,517,760</td>
</tr>
<tr>
<td>GOI PV_{@10%}</td>
<td>M.US$</td>
<td>236,506</td>
<td>206,743</td>
<td>255,742</td>
<td>230,049</td>
<td>315,328</td>
<td>257,241</td>
</tr>
<tr>
<td>GOI / GR</td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

According to the CBM road map, in 2015 CBM production in Indonesia is targeted to 100 MMSCFD. Currently, from the realization as per March 31st, 2013 the production from existing dewatering well was 0.11 MMSCFD. Later, in 2013, by using assumption average production per well is 0.25 MMSCFD, the prediction of production from 34 wells is 34 x 0.25 = 8.5 MMSCFD. In 2014, the prediction of production by improving the status of 118 exploration wells becomes 118 x 0.25 = 29.5 MMSCFD. By using the same calculation, to meet the target of 100 MMSCFD in 2015, 400 wells are required. The GOI should solve all of problems in order to achieve CBM production target in 2015 as well. The technical problems identified in the fields are rig procurement, G&G re-evaluation, water handling before production and environmental treatment. The non-technical problem issues are land overlapping licensing, land acquisition, differences waiting time for exploration and exploitation permits issued by two different ministries in the overlapping area, and cooperation between central and local governments due to decentralization.
3.2 CBM Policy Implementation

3.2.1. CBM Regulation

The introduction of oil and gas Law No. 22 of 2001[6] significantly reformed Indonesia’s oil and gas upstream and downstream industry sectors[7]. It replaced the Oil and Gas Law of 1960 and the Law for Pertamina No. 8/1971[8]. The Oil and Gas Law stripped the regulatory role from Pertamina, the State oil and gas company. Under the new Oil and Gas Law No. 22 of 2001, Pertamina should release its monopoly in upstream field development and downstream regulatory and administrative functions. This regulatory role has now been split in two separate regulatory bodies: Badan Pelaksana Kegiatan Usaha Hulu Minyak dan Gas Bumi, known as BPMIGAS which regulates upstream activities such as exploration and production, and Badan Pengatur Hilir Minyak dan Gas Bumi (BPHMIGAS) which regulates downstream activities, such as processing, transportation, storage and trading activities. Government regulation (Peraturan Pemerintah, PP) No. 35 of 2004 is still used as a common reference, especially regarding the pattern of Production Sharing Contract (PSC) term, where each block of CBM must be managed by a single business entity. Another regulation is Minister of Energy and Mineral Resources Regulation no. 35 of 2008, which regulates the offers procedure of unconventional oil and gas working acreage. Later on, the Minister of Energy and Mineral Resources Regulation no. 5 of 2012 was released to cover the offers procedure of unconventional oil and gas working acreage.

Indonesia’s CBM regulations are managed under the upstream oil and gas regulator, a Special Task Force for Upstream Oil and Gas Business Activities (SKKMIGAS), which exercise the production sharing contract (PSC) awarded to CBM investors. The CBM Regulations grant the holders of existing conventional oil and gas or coal rights preferential rights to apply for a CBM PSC.

In an effort to attract funds into the CBM development, the GOI announced in November 2007 that it would offer investors a 45% production split for coal bed methane contracts as best terms in the country[9]. This incentive is quite larger than the oil operator that has only split 15% of production sharing or conventional gas operator with 30% of production sharing. Since then, several successful contracts have been taken up. Lately, the GOI considers another fiscal incentive to encourage CBM by making imported goods and materials exempted from import tax. Under its blueprint for the development of CBM, the government is targeting production of 1 billion standard cubic feet per day, or about 0.18 million barrels of oil equivalent, by 2025.

Based on differences on provisions, there are 2 (two) generations of CBM PSC. The first generation was implemented in the period of 2008-2009 and the second generation has been implemented from 2009 until now. The second generation is better than first generation due to its flexibility. In addition, it is more attractive to the contractor. Table 2 shows the differences between first generation and second generation of CBM PSC.

Table 2. Two generations of CBM PSC

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Production handling</td>
<td>Production before POD has not been sold (Government owned)</td>
<td>Production before POD may be sold and with the distribution of results according to the split in the contract but the cost has not been recovered yet</td>
</tr>
<tr>
<td>2.</td>
<td>Cost recovery</td>
<td>Max 90% (ceiling cost)</td>
<td>100% (without ceiling cost)</td>
</tr>
</tbody>
</table>

There are some specific regulations related to the business of CBM in Indonesia, such Minister of Energy and Mineral Resources Regulation No. 27 of 2006[10], Minister of Energy and Mineral Resources Regulation No. 28 of 2006[11], Minister of Energy and Mineral Resources Regulation No. 35 of 2008[12] and Minister of Energy and Mineral Resources Regulation No. 36 of 2008[13].

Minister of Energy and Mineral Resources Regulation No. 36 of 2008 is a revision of the Minister of Energy and Mineral Resources Regulation No. 33 of 2006. The regulation was revised following a variety of issues related to the overlap between oil and gas working acreage (Wilayah Kerja, WK) and coal mining concession (Konsensi Pertambangan, KP). Significant change from regulation no. 33 to 36 is related to the requirements of the coal mining concession which has the first priority in the CBM working acreage in the region of overlap. Under Minister of Energy...
and Mineral Resources Regulation No. 36 of 2008, the first priority for CBM new acreages is given for:

- Existing oil and gas working acreage
- Existing coal concession
- Existing oil and gas working acreage will have priority if the proposed area is overlapping with existing coal concession

Under the Minister of Energy and Mineral Resources Regulation No. 36 of 2008, it is stated clearly that only coal mining concession with exploitation status for three (3) years, will get priority on CBM working acreage in the overlapping region. For coal mining concession whose status is still in general investigation or in exploration status, will not get the first chance in that CBM working acreage. However, in the transitional clause which stated that coal mining concession has filled Joint Evaluation of CBM working acreage before regulation no. 36 born, still got the first chance (although its status has not been exploited). It makes the problem previously appeared not easy to be solved.

Oil & Gas working acreage (WK Migas) which is overlapping with WK CBM, still has to accommodate the coal mining concession. Problems grew worse when we look at that the licensing and renewal procedures of coal mining concession, before the Mining Law 4 of 2009 was born, was in the district/city level. Extension of coal mining concession at the district/city is done very easily, without the control of the local government officials.

### 3.2.2 Fiscal policy

Legal arrangements of CBM are subject to the laws and regulations in the oil and gas sector. Tax incentives are given to the upstream activities of oil and gas, among others, exemption from import duty, value added tax borne by the government, as well as operating costs in the calculation of refundable tax revenue and income. There are several alternative forms of fiscal incentives for the CBM development in Indonesia. Form of fiscal incentives that are likely to be given is mainly related to aspects of the production sharing contracts (PSC) between the contractor and the government, among others, shareable FTP, credit and investment, and tax holiday.

In the PSC scheme, FTP is a part of government. Changes in regulations regarding FTP from a non-shareable to be a shareable (FTP divided between the government and contractor) can only be done through the mechanism of a contract amendment with the approval of the contracting parties. The consequences of the contract amendment are cancelled prior to agreement and make a new agreement. The recommendation for Indonesian policy maker is to sustain CBM development in Indonesia. The potential emergence of post-bidding issue can arise in contract amendments (problems that arise are subsequent to the auction to determine the winner of the tender contract). By the time a contract is offered for CBM, exploitation is auctioned to contractors who are interested, and the winning bidder is willing to agree the terms of the contract offered. If it turns out after the current contract, there is a change to the contract, then the parties that lost the tender will object to the contract due to changes. In case conditions change shall be notified at the time of the auction, bidding them may be different, and maybe they will be the winning bidder. Amendments to the contract after the contract run will cause injustice to the losing bidders and potential legal dispute.

Government Regulation (PP) No. 79 of 2010[14] regulates the Operating Costs and Refundable Income Tax Treatment in the Field of Upstream Oil and Gas. Given the provisions of the Decree of the Minister of Mines and Energy No. 1669 of 1998, Article 2, which stipulates that the legal arrangements Coalbed Methane and subject to applicable laws and regulations in the field of oil and natural gas, the provisions of PP above also applies to CBM. The regulation set the investment credit (investment incentives) and refund certain amounts of capital, which is directly related to the production facility and given as an incentive for the development of the oil and / or gas is certain. In the PSC scheme, investment incentives, along with FTP and cost recovery, a reduction of the production are available to be shared (lifting) to obtain equity to be split. To encourage the development of the working area, the Minister of Energy established a great form of investment incentives (as stipulated in article 10 PP. 79 of 2010). Furthermore, in Article 24, verse 5 of the Regulation stipulates that the investment incentives in accordance with statutory provisions converted to natural gas, the price is agreed on the contract of sale of natural gas (in the context of CBM). Provision of investment incentives in the form of credit is possible to be given to the Minister of Mineral and Energy Resources (MEMR), issue under the provisions of the PP. 79 of 2010 is mentioned above. However, given that until now there is no incentive in the form of investment credit, the MEMR needs to review the proposal before issuing the Regulation of the Minister referred.

Provisions regarding the tax holiday regulation of the Minister of FinanceNo.130/PMK.011/2011[15] dated August 15, 2011 is about the Granting of Facility Exemption or Reduction of Corporate Income Tax. In the PMK, it is arranged that the corporate taxpayer may be granted exemption or reduction of corporate income tax (Article 2, verse 1). The corporate income tax exemption may be granted for a maximum period of 10 (ten) years tax and a minimum of 5 (five) of the fiscal year, at the beginning of the taxable year of commercial production. After the expiration of the exemption provision, the taxpayer is given corporate income tax reduction of 50% (fifty percent) of the income tax payable for 2
(two) years tax. Nevertheless, taking into account the interests of maintaining the competitiveness of the national industry and the strategic value of certain business activities, the Finance Minister may give the exemption or reduction of corporate income tax for a period exceeding the period as mentioned before. CBM concession was not included in industry pioneer who was listed on the PMK no. 130/PMK.011/2011. However, the provisions of Article 3 verse 3 of the PMK allows the Minister of Finance to establish industry pioneers granted exemption or reduction of corporate income tax, as mentioned above to coverage of industry pioneer. Thus, if the tax holiday incentives in the form of concessions is given to the CBM, the PMK No. 130/PMK.011/2011 should be modified. In addition, CBM concession contracts should be subjected to the provisions of the PMK in order to qualify the exemption or reduction of corporate income tax.

4. Conclusions

The economic review shows that the best condition for the development of PSC profit sharing between the government and the contractor is 55 : 45 with 10% non-shareable FTP. This profit sharing portion will give optimum condition of the economic development of coalbed methane. It can be achieved by the contractor with a reasonable level and provide optimum government revenue. However, GPSC with no cost recovery is more interesting to be implemented in CBM contract scheme. Therefore, the authors suggest to the GOI for using GPSC in the future CBM contracts. Changing the amount of production and the price is more sensitive to the contractor NPV, followed by the capital and operating expenditure. Every 10% change in the volume or price of the parameter value causes a shift in the contractor NPV of US $17.2 million. Whereas each 10% change in the capital or operating expenditure provides contractor NPV shift of US $2.3 – 2.8 million.

Currently, existing CBM policy in Indonesia is on going to be improved. The latest regulation Minister of Energy and Mineral Resources Regulation No. 36 of 2008 is a breakthrough CBM regulation to solve problems during implementation. Yet, another regulation to support technical aspect is under development by GOI. The authors suggest the GOI for offering incentive to attract more contractor in CBM development.

Acknowledgements

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N-CBlast: Disinfectant Innovation from Nanochitosan Shrimp Shell Waste as Antimicrobial for Bogor’S Mall Toilet

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Abstract

Cleanliness is a factor which is very important to prevent the spread of diseases. N-CBlast is a smart solution to prevent the spread of disease from a public toilet use. This product is an antibacterial spray made from shrimp shell waste which is processed to make chitosan with nano size particles. Utilization of shrimp shell waste as a source of chitosan has a high potential. This is supported by the data that shrimp production in Indonesia increases every year. Indonesian Statistic Department said that the number of shrimp production in 2011 reached 343,644 tons or increased 13.48\% in 2010. Shrimp is usually utilized as seafood that has high nutrition with good taste. Shrimp seafood is relatively expensive so that many people use this opportunity to make culinary business. This causes the shrimp shell waste quite a lot in urban areas around 50-60\% of the weight of shrimp. Indonesian Ministry of Health also said that shrimp’s shell contains 15-20\% chitosan. Nanochitosan is made from ionic gelasi method by magnetic stirrer. Into 50 mL chitosan solution is added Twin 80 0.1\%, then slowly added by TPP solution 100mL, and geraniol acetate as fragrance until nanochitosan is formed. The data shows in 60 seconds, bacterial can be reduced until < 25\, cfu/mL. The utilization of N-Cblast as antibacterial agent applied on toilet surface may improve human security in healthcare and also an initial step in the application of the principle of zero waste to support the blue economy of Indonesia.

Keywords: antimicrobial; disinfectant; nanochitosan; shrimp; solid waste

1. Introduction

Botani Square is one of a modern shopping centers in Bogor, Indonesia. Approximately 56\% of residents visits Botani Square more often than other modern shopping centers, namely Ekalokasari Plaza (18\%), Bogor Trade Mall (17\%), and Pangrango Plaza (8\%). Interest rate of 15 parameters is used, the availability of a good toilet is the second thing that becomes a visitor's attention after the availability of places of worship [1]. Feses derived from metabolic waste of the human body must be removed so as not to poison the body. Feces consists of tens of billions of microbes and worm eggs. A total of 19 phyla were observed across all restroom surfaces with most sequences (=92\%) classified to one of four phyla: Actinobacteria, Bacteroidetes, Firmicutes or Proteobacteria. Infections caused by these bacteria are boils, acne, impetigo, pneumonia, mastitis, plebitis, meningitis, urinary tract infections, osteomyelitis, and endocarditis [2]. The prevalence of skin bacteria on restroom surfaces is not surprising as most of the surfaces sampled come into direct contact with human skin, and previous studies have shown that skin associated bacteria are generally resilient and can survive on surfaces for extended periods of time [3].

A disinfectant is one of a diverse group of chemicals which reduces the number of present microorganisms (normally on an inanimate object). Disinfectant destroys bacterial cells through different mechanisms including causing structural damage to the cell, autolysis, cell lysis, and the leakage or coagulation of cytoplasm [4]. Within these groupings, the spectrum of activity varies with some disinfectants being effective against vegetative Gram and Gram-negative micro-organisms only, while others are effective against fungi [5]. Bacteria can be found in all places such as water [6], land [7], air [8], foods [9], us [10], public place [11], and etc.

Shrimp is a commodity that has a high economic value in Indonesia. Shrimp processing facility in Indonesia reaches about 170 places with a production capacity of 500,000 tons per year. Shrimp freezing process is done in headless and skinless. The head and skin for 60 to 70 percent by weight of shrimp become a waste [12]. Domestic product of chitosan processing is expected to create additional value from shrimp shell waste and minimize pollution problems from its waste. Chitosan is a linear, semi-crystalline polysaccharide composed of

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(1→4)-2-acetamido-2-deoxy-b-D-glucan (N-acetyl D-glucosamine) and (1→4)-2-amino-2-deoxyb-D-glucan (D-glucosamine) units [13]. Chitosan is a natural nontoxic biopolymer produced by the deacetylation of chitin, a major component of the shells of crustaceans such as crab, shrimp, and crawfish [14]. Chitosan is a quite unique biosourced polymer characterized by primary amines along the backbone. Such structure imparts to this polysaccharide highly not only valuable physico-chemical properties but also particular interactions with proteins, cells and living organisms [15]. Chitosan can be used as a flocculant, clarifier, thickener, fibre, film, affinity chromatography column matrix, gas-selective membrane, plant disease resistance promoter, anti-cancer agent, wound healing promoting agent, and antimicrobial agent. It can be used in pet food and GRAS (generally regarded as safe) status has been applied for it. It is used as a processing aid and is being trialled for applications in fruit preservation, wound dressings, cosmetics, artificial organs, and pharmaceuticals [16]. Modification of chitosan in nanoparticle may improve its efficiency as antibacterial agent. The aim of this study is to evaluate antimicrobial properties nano particles of shrimp chitosan for public toilet, case study in Bogor’s mall toilet.

2. Method

N-CBlast was made in Microbiology Laboratory of Aquatic Product, Department of Aquatic Product Technology, Faculty of Fisheries and Marine Science, Bogor Agricultural University on Saturday, July 6th 2013. Testing of antimicrobial activity of N-CBlast was done in the toilet one of the malls located in the city of Bogor on Saturday, July 28th 2013. Incubation of bacteria was carried in the Microbiology Laboratory of Aquatic Product, Department of Aquatic Product Technology, Faculty of Fisheries and Marine Science, Bogor Agricultural University on Saturday, July 28th 2013.

Materials used in the manufacture of N-CBlast are chitosan from shrimp shells, aquades, H2SO4 solution, Tween 80, and STTP, while the tools used are a magnetic stirrer, 1L glass backer, and N-CBlast container. Materials used in the antimicrobial activity test are N-CBlast, aquades, Nutrient Agar (NA), and physiological saline, while the tools used are reaction tube, cotton bud, toilet, micro pipettes, and incubators.

This study is divided into two parts, manufacture of N-CBlast and effectiveness test of N-CBlast with TPC method. The raw material of N-CBlast is nanochitosan. Chitosan nanoparticle is made from chitosan derived from shrimp shell waste. Chitosan weighing 1.5 grams was mixed with acetic acid to taste, stirring to form a chitosan gel. Chitosan gel formed was dissolved using sterile aquades as much as 500 mL, stirred using a spatula. Chitosan solution was changed to nano size using magnetic stirrer for two hours, then added 25 mL of emulsifier (TWEEN 80) 0.1% gel which could be separated between the gel and another gel. Surfactant (TWEEN 80) was given by drop wise way to the chitosan which has been cut and allowed to stand for 30 minutes, then adding STTP 100 mL by slowly shedding it. The next step was test activity of N-CBlast. The test was done in a toilet located in one of the malls in Bogor. N-CBlast was sprayed on the surface of the toilet and then given treatment time for 0 seconds, 10 seconds, 20 seconds, 30 seconds, 40 seconds, 50 seconds, and 60 seconds. There is no N-CBlast treatment in 0 seconds. Each treatment period, the toilet surface was sprayed with N-CBlast and then it was scratched using sterile cotton buds. Then cotton buds was put into physiological saline, this dilution was 10^2. The next step was diluted using physiological saline for dilution 10^2 and 10^3. Each dilution of 1 mL physiological saline was inserted into a petri dish. After dilution, the next step was pouring NA media into petri dishes that already contained 1mL physiological saline dilution. Then, wait until NA media freezeed and NA media was incubated for 48 hours. After 48 hours of incubation, the number of colonies and ALT was calculated.

3. Results and discussion

Chitosan is applied in various fields. These materials have several advantages over other disinfectants; it has a higher antibacterial activity, a broader spectrum of activity, and has a low level of toxicity to mammalian cells [17]. Therefore, efforts to develop chitosan continuously are done by making modifications, including chemically and physically. Physical modifications include changes in chitosan particle or grain size becomes smaller chitosan for wider utilization. Development leads to a form of physical modification of nanoparticles [18].

The method used in the manufacture of chitosan nanoparticles in this research was ionic gelation process, in this ionic gelation method there was a mixing of chitosan polymer with sodium polyanion tripolyphosphate (TPP) which resulted in the interaction between the positive charge on the amino group of chitosan and tripolyphosphate charge. Tripolyphosphate as crosslinking agent is considered as the best [19]. The usage of TPP to chitosan gel formation can improve the mechanics of the gel formed. This is because tripolyphosphate has a high negative charge density so interaction with the polycationic chitosan will be greater [20]. TPP role as a crosslinking agent will strengthen the matrix of chitosan nanoparticles. With the increasing number of crosslinks formed between chitosan and TPP, the mechanical strength of the chitosan matrix will be increased so that the chitosan particles becomes stronger and harder,
and it is more difficult to split into smaller parts [18]. There are some researchers using the ionic gelation of chitosan with TPP: Kumar (2000) in the formation of chitosan nanoparticles of poly (ethylene oxide), the size of nanoparticles obtained ranged from 200-1000 nm [21]. Wu et al (2005) conducted a loaded chitosan nanoparticles formation of ammonium glisirizinant produced nanoparticles of 20-80 nm size [22]. Besides TPP, Twin 80 was also added as the surfactant. The addition of this surfactant can reduce the particle size of chitosan [23]. Nanochitosan applications as antibacterial on the surface of public toilets can be seen in Table 1 and evidenced by ALT values.

Nanochitosan, which had been formed and tested for antibacterial activity on the surface of the public toilets, was test by the quantitative assay method ALT. This test was done twice repeatedly for 60 seconds exposure with 10 second intervals, there were 10, 20, 30, 40, 50, and 60 second with dilution up to 10^{-3}. Based on ALT values on Table 1, N-CBlast was efficient as antimicrobial agent in 60 second after being sprayed.

Pathogenic bacteria that was found in public toilets are Staphylococcus sp. and Escherichia coli. Infections caused by these bacteria are boils, acne, impetigo, pneumonia, mastitis, plebitis, meningitis, urinary tract infections, osteomyelitis, and endocarditis. Staphylococcus aureus is a major cause of nosocomial infections, food poisoning, and toxic shock syndrome. On the other hand, Escherichia coli is one of the bacterial pathogens that cause gastroenteritis, with symptoms ranging mild diarrhea to hemolytic uremic syndrome, renal failure, and death [24]. Nanochitosan is a physical modification of chitosan with a working system that binds material to the cell membrane since protein amine groups (NH) are reactive. Some bacteria such as S. aureus and Enterobacteri aerogenosa will undergo lysis as a result that chitosan binds to membrane phospholipid, especially phosphatidyl choline (PC). It causes the inner membrane permeability (IM) increased and provides an easy way to discharge cells [25]. Simpson (1997) showed E. coli bacteria will experience the release of β-galactosidase enzyme resulted in cytoplasmic fluid will come out and bring the other components or metabolites known as lysis [26]. Chitosan is able to inhibit the growth of E. coli due to the cell surface electronegativity [27].

Physical modification by applying nanotechnology increases the efficiency of chitosan performance as a disinfectant. Chitosan nanoparticle has low molecular weight so it can be spread and work well on bacterial surface. It is known that the antibacterial testing has been done with cotton and showed that antibacterial activity last up to 20 washes cotton [28]. Nanotechnology is a study about particles in the solid form particles in the size range about 10-1000 nm [29,30]. Nanoparticles have good properties because the increased surface area and quantum effects are able to increase the reactivity, strength, electrical properties, and in vivo behavior [31]. Nanoparticle research is growing rapidly as it can be widely applied in such fields as environmental, electronic, optical, and biomedical [32]. Based on this research, nanoparticle technology in chitosan as disinfectant can be used as a healthcare. It is advised that the best time to use the toilet after N-CBlast spray is in 60 seconds.

### Conclusion

Chitosan can be applied in various ways. The physical modification of chitosan as nanoparticle is used as antimicrobial agent in public toilet surface. Data shows that the best time to use the toilet after N-CBlast spray is in 60 seconds. It is proved as in this time microbial colony can be reduced until ALT value <5^6. The utilization of nanochitosan is more effective than chitosan because it has lower molecule weight and causes its particle spreading well on whole bacteria cell.
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References

Bioethanol production from Nipa Sap in Riau Province Coastal Zone

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Abstract
The optimum condition of bioethanol production from nypa sap by Saccharomyces cereviceae under anaerobic condition was determined as a function of both pH and the concentration of Saccharomyces cereviceae in inoculums. Fermentation took place in batch fermentor with a volume of 50 liter of fermentation medium, variations in the pH 4.5, 5.0, 5.5 and variations of concentration of Saccharomyces cereviceae 15, 20 g/l. The stirring speed is 200 rpm and temperature of fermentation at room temperature is 25 - 30 °C. The process of optimum fermentation conditions was indicated in the addition of inoculums at pH 4.5, 15 g/L of S. cereviceae concentration, and fermentation time of 36 hours. Bioethanol obtained in this condition is 14% (v/v) or 112,793 mg/ml with the acquisition of 97.969% yield.

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Keywords: bioethanol, fermentation, nipa sap, saccharomyces cereviceae

1. Introduction
Nypa is a type of palm trees in mangrove forests or areas within tidal water. The scientific name is Nypa fruticans. The nypa stem forms rhizomes, which is submerged by mud. The length of nypa’s root can reach 13 m with length and width of leaflets about 100 cm and 4-7 cm respectively. The old leaves are dark yellow, while the young ones are green. Each cluster of nypa has 25 to 100 pieces of leaflets.

Nypa sap is widely used in beverages, cosmetics, in the health sector as an antiseptic agent, solvent, and as an industrial raw material to produce other products. Besides, nypa is also reported as alternative raw material for bioethanol production through fermentation process. Nypa sap contains 13-17% of sucrose, which is a potential material to be processed into bioethanol. Bioethanol is a renewable energy that can be replaced or as a mixture of fossil fuel. It has been reported that nypa palm is capable of producing up to 15,600 litres of bioethanol per hectare, twice more than the yield of sugar cane, and six times the yield of corn. Recently, the government of Indonesia has given permission the communities in Kabupaten Bengkalis to use the 23 hectares of nypa forest in that area for the development of bioethanol industry. The experiments of nypa sap fermentation to bioethanol at laboratory scale 300 ml and 8000 ml have been done. However, to produce bioethanol from nypa sap in industrial scale needs to be assessed the scale up of fermentation. Therefore, this work attempted to scale up the fermentation of nypa sap into bioethanol on a scale 50L with variation inoculums concentration, and pH. The aim of this work was to determine the optimum condition.

2. Materials and methods
2.1. Microorganisms and inoculums preparation
The microorganisms used was Saccharomyces cereviceae. The inoculum was prepared for two concentrations of S. cereviceae, which were 15 and 20 g/L. 75 g and 100 g of S. Cereviceae for each concentration was grown on 5 L nypa sap as a starter medium. It was shaken using shaker for 1 hour. The inoculums was sterilized in autoclave at...
temperature 121°C for 15 minutes, then cooled to room temperature. The chemicals used in this work were urea, NPK, HCl, NaOH, and Reagen Nelson-Samogyi. The Nypa sap was obtained from Bagan Siapi-api, while the chemicals were from laboratorium of Chemical Engineering University of Riau. The experiments were conducted for two different concentrations of inoculums, which are 15 and 20 g/L. For each concentration of \textit{S. cereviceae}, the pH were variated i.e. 4.5, 5, and 5.5.

2.2. Fermentation conditions and analyses

The medium fermentation was prepared from 50 L nypa sap, 0.4 g/L of urea contained 46\% N, and 0.5 g/L of NPK contained 16\% P. The medium fermentation was sterilized using autoclave at temperature 121°C for 15 minutes, then cooled to room temperature. The initial glucose concentration of medium fermentation was analyzed using visible spectrophotometer. The experiments were carried out in a 70 L biofermentor with mixer (200 rpm) containing 10\% volume of inoculums at anaerob condition and room temperature (25-30°C). The pH was adjusted to addition of HCl or NaOH with variations were 4.5, 5, and 5.5. The samples were taken for certain time of fermentation, i.e. 24, 36, 48, and 72 hours. The fermentation product then was distilled to separate it from impurities. The concentration of bioethanol was determined using alcohometer, while the glucose concentration by Nelson-Samogyi method.

3. Results and discussions

3.1. Effect of pH and inoculums concentration to bioethanol production

Optimum condition of nypa sap fermentation was determined by measuring the bioethanol produced. The bioethanol produced by \textit{S. cereviceae} is presented in Table 1 and Figure 1. Table 1 shows the highest percentage of bioethanol produced was 14\% (v/v) at pH 4.5, 15 g/L of \textit{S. cereviceae} concentration and 36 hours. It was most probably because \textit{S. cereviceae} is easier to adapt and higher fermentation activity at low pH compared with higher pH\textsuperscript{3}. Moreover, the increase in pH affected the formation of by product, which at high pH caused an increase in the concentration of glycerin\textsuperscript{5}. Whereas at pH below 4.5, the enzim activity will be inhibited with the result that the microbe's ability to break down sugar into bioethanol is reduced\textsuperscript{4}. In addition, it can cause denaturation process, which is the process that leads to the disruption of the cell so that the enzyme activity can not work optimally since the structure is damaged. At this condition, the activity of enzymes produced by microbes in yeast will be denatured and the loss of catalytic function of the enzyme to decompose the substrate into bioethanol\textsuperscript{6}.

The effect of \textit{S. cereviceae} concentration on bioethanol produced is shown in Tabel 1. By increasing the \textit{S. cereviceae} concentration, it caused the reduction in concentration of bioethanol produced. This might be caused by the microorganisms only consume the medium to increase their activity to multiply their cells.

Table 1. Effect of variation of pH, \textit{S. cereviceae} concentration, and fermentation time to bioethanol produced

<table>
<thead>
<tr>
<th>Fermentation time (hour)</th>
<th>Bioethanol produced (% v/v)</th>
<th>Concentration of residual glucose (mg/ml)</th>
</tr>
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<tr>
<td></td>
<td>pH and \textit{S. cereviceae} concentration (g/l)</td>
<td>pH and \textit{S. cereviceae} concentration (g/l)</td>
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<tr>
<td>72</td>
<td>9</td>
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</tbody>
</table>
Figure 1 shows the profile of bioethanol produced during fermentation. The optimum fermentation time was 36 hours at pH 4.5 and 5, and 24 (Fig. 1.a) and 48 hours (Fig. 1.b) at pH 5.5 with bioethanol concentrations were 14%, 12%, and 7% (v/v), respectively. In the beginning of fermentation, the longer of fermentation time caused the increased bioethanol concentration. However, after the optimum condition is reached, the concentration of bioethanol obtained tends to decrease. The decrease of bioethanol produced might be due to the substrate in the form of glucose in medium fermentation that would be converted by microorganisms into bioethanol which has been decreased\(^7\) (Fig 2), while the produced bioethanol has been accumulated. Bioethanol could inhibit the growth of \textit{S. cereviceae} and be toxic to \textit{S. cereviceae}, thus the formation of the product in the form of bioethanol will result in the decreased productivity\(^7\). Moreover, microorganisms probably have entered the death phase because they have run out of nutrients. It could be also due to the products which are partially converted into organic acids such as acetic acid, and esters\(^8\) that could inhibit the microorganism activity\(^9\).

4. Conclusions

Fermentation of nypa sap into bioethanol by \textit{S. cereviceae} using biofermentor 70L can be concluded:
1. Nypa sap is potent as a feedstock for bioethanol production, the bioethanol produced reaches 3 to 14% by volume.
2. Acidity condition, \textit{S. cereviceae} concentration, and fermentation time greatly affect the bioethanol produced.
3. The optimum conditions of fermentation nypa sap on a scale of 50 L is at pH 4.5 and fermentation time of 36 hours with yield about 97.969%. The bioethanol concentration was obtained by 14% (v/v) or 112.793 mg/ml.

References

Abstract

Various researches have been carried out on renewable energy sources derived from energy farming. With solar energy, people can cultivate green energy from green plants, primarily as bio-fuel. The purpose of this research is to identify fatty acid methyl ester (FAME) from seeds of mahkota dewa as an alternative bio-fuel to achieve energy self-sufficient communities. Effectiveness in generating FAME of the trans-esterification method is measured by using testing standards for bio-fuels of mahkota dewa. The oil product will be further compared with other bio-fuels. Mahkota dewa is not a food crop so the utilization of its seeds as bio-fuels will not influence the food price stability as the matter for bio-ethanol from cassava, sago, corn, and other food crops.

Mahkota dewa is native from Papua, Indonesia and has become widespread and easily accessible in this country. Seeds of mahkota dewa contain toxic compounds so they cannot be used as food. The methods are quantitative research based on experiment. First, the seeds are separated from flesh, dried, and then the oil is extracted using hot hydraulic pressure, proximate and physicochemical analysis are then carried and the oil is further trans-esterified and analyzed by gas spectrophotometer. The component palmitic oil of mahkota dewa is 57.38% which is closed to palm oil (Elaeis guineensis). While the density of mahkota dewa oil is 0.92 gr/ml compare to J.curcas0.93 gr/ml, so it means that the number of mahkotadewa close to J.curcas. Besides, the other data we got from analyzing water and sediment, kinematic viscosity of mahkotadewa is 0.001% and 43.67 ± 0.01 centipoise (cP). Innovative diversification of alternative fuels from mahkota dewa seeds is expected to contribute in creating energy self-sufficient communities by maintaining the sustainability of national energy.

Keywords: FAME; trans-esterification; bio-fuel; mahkotadewa; alternative fuels; energy independent

1. Introduction

Fossil fuels are sources of emissions and are unsustainable due to their dwindling reserves and depletion [1]. As consequence, alternative source of energy has to be found to replace the non-renewable source. A number of researches have been carried out to acquire different source of renewable energy resources based on energy farming instead of energy hunting. This concept is very potential to be developed in rural areas in Indonesia. Bio-fuels are renewable solutions to replace the ever dwindling energy reserves and environmentally pollutant fossil liquid fuels when they are produced from low cost sustainable feedstock. This research aims to identify fatty acid methyl ester (FAME) based on seeds of Mahkotadewa through characterization of the oil as an alternative bio-fuel to achieve the energy independent communities, effectiveness of transesterification method to produce FAME, the standard test based on the oil of Mahkotadewa and its comparison to other bio-fuels.

Energy referred from photosynthesis is the one produced by plants and converted into bio-fuels. The main factor in the physical meaning for bio-fuels development is the availability of area that can be cultivated the plants producing bio-fuels material. Energy policy, announced in the Presidential Instruction point 1 and Rule no. 5 in 2006, addresses alternative energy, especially bio-fuels as an important instrument in the planning and development of national energy. There are 50 species of plants in Indonesia that are potential to be developed as vegetable oils [7]. Seeds of mahkotadewa are not included in the list of 50 species of plants that can be used as an oil producer. The seeds are commonly not used and become rubbish. In Presidential Instruction, it is mentioned that the cassava field development plan is 29%, palm oil is 28%, sugarcane is 14%, and jatropha is 29%. The roles of bio-fuels are to reduce dependence on fossil fuels, to serve as the main employer (pro-job), to reduce poverty (pro-poor), as well as to strengthen the national economy (pro-growth), and to improve the environment (pro-planet). Knowingly or not, the use of petroleum-based fossil fuels has been a major cause of global climate change [9].
Efforts to find the source of biological energy as alternative energy sources and environmentally friendly have been done through the development of bio-energy by utilizing Jatropha (Jatropha curcasL), coconut (Cocos nucifera), palm oil (Elais oleifera), sugarcane (Sacarum tuberosum), and cassava (Manihot utilisima) [10]. However, procurement of bio-based energy fuels would disrupt national food security, especially in the world, such as raw materials of fatty acid methylster(FAME) in the form of crude palm oil (CPO). Bio-diesel development to palm oil (Elaeisguineensis) could disrupt the supply of crude palm oil (CPO) for domestic oil industry and exports. Thus, it is necessary for us to discover the raw material fatty acid methylster(FAME), which does not compete with the basic human needs.

Based on these problems, the authors have explored some of the plants that can be used as a new energy source. The authors believe one of the plants that can be used for alternative energy sources as an effort to support the government’s program is by using seeds of Mahkotadewa (Phaleria macrocarpa). Mahkotadewa has many advantages over the other bio-fuel crops: (1) Mahkotadewa is not a food crop so if its seeds are used as bio-fuels, it will not interfere the stability of food as happened to bio-ethanol from cassava, sago, corn and other crops. (2) Mahkotadewa is native from Indonesia which is derived from Papua and can be planted and found easily in Indonesia. (3) Seeds of Mahkotadewa have not been registered as bio-fuels source either the print or electronic media. (4) Fatty acid methyl ester (FAME) from seeds of mahkotadewa is bio-degradable and cannot be used as food (non-edible oil).

Through this innovation can be determined that we use the waste of seeds of Mahkotadewa to support national energy security and promote the development of independent community to provide energy, and then to release from the dependence on fossil fuels.

The objective of this research is to identify fatty acid methyl ester (FAME) based on seeds of mahkotadewa through characterization of the oil as an alternative bio-fuel to achieve the energy independent communities, effectiveness of trans-esterification method to produce Fatty Acid Methyl Ester, the standard test based on the oil from mahkotadewa and its comparison to other bio-fuels.

2. Profile of Mahkota Dewa Fruit

Mahkotadewa (Phaleria macrocarpa) is native from Indonesia, which is derived from Papua. Ethnic Chinese call pau or heirlooms drug, the Javanese call it Makutadewo, and the English translation is the crown of God[5]. In the complete plant taxonomy, classification of mahkotadewa can be determined as divisions of Spermatophyta, subdivisions of Angiospermae, class of Dicotyledone, ordo of Thymelaeles, family of Thymelaeceae, genus of Phaleria, and species of Phaleria macrocapa (Scheff.) Boeri. This plant has a height about 1.5 - 5 meters, single leaves like guava but slender and tapered edges. The benefits of this plant were unknown since it was first grown in the courtyard palace of Yogyakarta and Solo [5]. Mahkotadewa (Phaleriamacrocarpa) has a round form and slightly oval with the size of a pingpongballs up to tennis balls. The color of raw fruit is green, and the ripe one is red like the color of blood. Mahkotadewa can live easily in the lowlands to the highlands (10-1200 meters above sea level).

Some parts of this plant used for traditional medicine are mexocarp (flesh), stems and leaves. The stems of mahkotadewa, empirically proven, can treat skin and bone cancer [2]. Parts of the leaf are often used for treatment and the mexocarp(flesh) is used for body health. However, there is no specific explanation regarding the use of the seeds yet.
Fig 2. Benefits of MahkotaDewa Fruit

3. FAME (Fatty Acid Methyl Ester)

FAME (fatty acid methyl ester) or which is popularly referred as bio-diesel is vegetable oils, animal fats, or used cooking oils altered through the process of trans-esterification reaction of oils with methanol and a catalyst NaOH or KOH \[^{[10]}\]. Biodiesel is mono-alkyl esters of long chain fatty acids contained in vegetable oil or animal fats used as the most appropriate alternative to replace alternative fuel for diesel engines. Bio-diesel is biodegradable, and almost does not contain sulfur. Alternative fuels consist of methyl or ethyl ester as trans-esterification resulting both from alkil-glyceride (TG) or esterificaton process of free fatty acids (FFA) \[^{[8]}\].

According Tatang H. Soerawidjaja, there are 50 species of plants in Indonesia that are potential to be developed as vegetable oil or FAME. The oil produced can be either oil or fatty food/fatty non-food. Nevertheless, it is possible to have many other sources that are greatly potential to be developed, especially non-food sources. Seeds of mahkotadewa are not included in the list of 50 species of plants that potentially can be used as an oil producer. The seeds are not commonly used and become rubbish. Besides its mexocarp (flesh) that could be as a traditional medicine, the seeds are also potential for alternative bio-fuels. Indeed, people will be more interested in planting mahkotadewa crops than others.

Fig 3. Chemical Process of Bio-diesel

4. Materials and Methods

4.1. Materials

The research was conducted in the period of September–November 2012 for mahkotadewa harvesting, Mahkotadewa oil extraction and analyzing some physical properties of the oil at Laboratory. The materials for this research were seeds of mahkotadewa, water, knife, tray, hot pressure hydraulic, methanol or ethanol, NaOH or KOH, oven, viskometer Brookfield, pignometer, and a pair of scales.

4.2 Methods
The steps of bio-diesel production were divided into three steps. The first step was mechanical process such as fruit harvesting, fruit peeling, seeds drying, and then hydraulic pressing to get the oil. The second step was chemical process. The method used to get bio-diesel from the oil was transesterification method. This process used chemical materials like alcohol (methanol or ethanol) and catalyst (NaOH or KOH) with certain technique. The third step was analyzing the oil with quality standard of bio-diesel and comparing it with the other bio-diesel.

Fig 4. Process of the research

5. Result and Discussion

5.1 Fruit Harvesting

Fruit harvesting is important in order to obtain a good product. Several aspects should be paid attention; they are the harvest criteria, harvesting technique, drying and seed storage. Fruit harvesting was performed after the fruits were ripe. A ripe fruit is indicated by the changing in color from light green to dark red. If harvesting is done earlier, it will give lower oil content, and if it is late, the fruits will fall to the ground.

Harvesting is commonly done by hitting the branch and the fruits will fall to the ground. This technique is not effective. The best way is to pick the fruits directly from the branch. If 50% of the fruit in one group is ripe, this technique can be used, by cutting the stalk of the fruits with sharp knife. If the location of fruit is too high to get, we can use a long stick with a small trap at the top of it.
If the oil is taken from the seeds, direct sun drying can be performed until all seeds are dry naturally. If the seed is not dried enough, it will be moldy and easily damaged. Besides, the oil produced from extraction could not be optimal. It should be dried until the moisture content is 5-7 %. The seeds with 5-7 % moisture content should be stored quickly in a plastic bag. The pile of the plastic bag in the storage house should not directly receive sunlight and also not directly touch the floor. Considering that *mahkotadewa* seeds content high oil, the storage should be done in short time, and if it is possible, the dried seeds should be processed right away to avoid the increasing of free fatty acid.

5.2 *MahkotaDewa* Oil Extraction

Several methods were used to obtain oil or fat from such material. Before being pressed, the dried seeds were changed to be a small particle.

Mechanical pressing is used if the material is in the form of seeds, especially for the seeds with more than 20 % oil content. *Mahkotadewa* produces seeds with 47 % oil content. If we compare it with *J. curcas* oil that has an oil content about 30 – 50 %, this indicates that *mahkotadewa* can produce oil like *J. curcas*. The method generally used to get
the oil from mahkotadewa seeds is hydraulic pressing or hot pressure hydraulic. Hydraulic pressing uses pressure of about 140.6 kg/cm. The pressure used will influence the oil produced.

5.3 Characterizing of The Oil

Quality standard and biodiesel parameter commonly used in determining the quality standard of biodiesel are density, flame point, cetane number, kinematics viscosity, sulfated ash, calorie, iod number and carbon residue. Analysis of crude oil from seed of mahkotadewa shows that water content of mahkotadewa oils was amount 0.001%.

The explanation below will show the comparison between biodiesel physical properties produced from Jatropha curcas and mahkotadewa. Based on the data analyzed according to several indicators in characterizing mahkotadewa oil, we got 47% for oil rendement though according to literature by [6], J. curcas was 40%. It means that the amount of mahkotadewa oil produced are richer, presenting to the rendement of J. curcas oil. While the density of mahkotadewa oil is 0.92 gr/ml compared to J.curcas0.93 gr/ml, so it means that the number of mahkotadewa is close to J.curcas. Besides, the other data we got from analyzing water and sediment, kinematic viscosity of mahkotadewa is 0.001% and 43.67 ± 0.01 centipoist (cP).

<table>
<thead>
<tr>
<th>Type of oil</th>
<th>Species</th>
<th>Density (g/cm³)</th>
<th>Kinematic Viscosity (Cst, at 40°C)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Edible oil</td>
<td>Soybean</td>
<td>0.91</td>
<td>32.9</td>
</tr>
<tr>
<td></td>
<td>Repeesed</td>
<td>0.91</td>
<td>35.1</td>
</tr>
<tr>
<td></td>
<td>Sunflower</td>
<td>0.92</td>
<td>32.6</td>
</tr>
<tr>
<td></td>
<td>Palm</td>
<td>0.92</td>
<td>39.6</td>
</tr>
<tr>
<td></td>
<td>Peanut</td>
<td>0.90*</td>
<td>22.72</td>
</tr>
<tr>
<td></td>
<td>Corn</td>
<td>0.91</td>
<td>34.9</td>
</tr>
<tr>
<td>Non-edible oil</td>
<td>Jatropha curcas</td>
<td>0.92</td>
<td>29.4</td>
</tr>
<tr>
<td></td>
<td>Palanga</td>
<td>0.90</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td>Mahkota dewa</td>
<td>0.92</td>
<td>29.57</td>
</tr>
</tbody>
</table>

5.4 Analysis of crude oil of Mahkota Dewa using GCMS

Mahkota dewa oil contains of triglycerida and nontriglycerida. The analysis using GCMS shows that Mahkota Dewa oil contains of saturated fatty acid and unsaturated fatty acid.

Chromatogram shows that mahkota dewa oil mainly contains of palmitic acidin and oleic acid. In Hambali (2008) biofuel that has potential is palm oil or Elueis guineensis. Palm oil contains palmitat acid in range of 41.8%–46.8% and oleic acid in range of 37.3–40.8%. On the other hand, we could conclude that mahkota dewa is potentially used as biodiesel and palm oil with percentage of palmitic acid and oleic acid are 57.38% and 12.29%.
After we got data of the oil, we will continue this research to trans-esterified the oil become FAME and analyze it with national standard of bio-diesel.

6. Conclusions and Recommendations

Based on the data that we got from the research, it shows that the oil of mahkotadewa is potentially to be material for producing fatty acid methyl ester (FAME). This oil from extraction needs to be converted into following methods, thus FAME as alternative bio-fuel could be produced. This research has to be continued and it is hoped the government can support this program to contribute in creating energy self-sufficient communities in Indonesia.

Acknowledgment

In this opportunity, we would like to thank to our supervisor Mr. Budi Arifin S.Si, Msi and Mr. Agus Saputra S. Si, Msi for the hardwork in accompanying us to finish this paper, sponsor that accommodate us , and our parents. We also thank to Department Research of Forestry and Bogor Agricultural University for partnering us.

References

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CONFERENCE PROCEEDING
Sustainable Built Environment in Tropical Hemisphere Countries
Wood Originality Based Evaluation on Restoration of Third Alang as Wooden Cultural Heritage of Tana Toraja Traditional Houses Components on Nanggala Sites

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Abstract

Alang and Tongkonan are two kinds of building compilers Tana Toraja traditional houses having a status as a Wooden Cultural Heritage (WCH). WCH has become world tourist site, and nominated as one of the World Heritage. Indonesian Law regarding Cultural Heritage mandates WCH to be preserved through maintenance, preservation, conservation and restoration using archaeological perspective, maintaining the originality. As part of Tana Toraja, The third Alang of Nanggala site was restoring by community. The study is aimed to evaluate whether third Alang restoration was done by application of archaeological principles particularly on timber conservation perspective. Object of the study was the third Alang of Nenggala site. Methods of studies were: (1) observation on the restoring third Alang, (2) taking sample of a new wood and an archaeological wood on each building component, (3) making a macrotomic section to get transversal cut and its portrait and identifying species of both new and archaeological wood based on macroscopic structural image, (4) comparing the new and archaeological wood species functioning on the same building component, and (5) evaluate the level of adherence to the archaeological principles application, particularly on material originality. The result concludes three things. First, all components of third Alang were replaced by new wood (material). Second, identification of a new wood and an archaeological wood produce a sequence of timber as follows: (a) \textit{Pigafetta filifera} Merr and also \textit{Pigafetta filifera} Merr for column components, (b) \textit{Casuarina junghuhniana} Miq and also \textit{Casuarina junghuhniana} Miq for beam components, (c) \textit{Pinus merkusii} Junghuh et de Vries and Elmerrillia ovalis Dandy for plank flooring, (d) \textit{Paraserianthes falcataria} Nielson and \textit{Elmerrillia ovalis} Dandy for wall-board component, (e) bamboo and corrugated iron sheets for roofing components. Thirdly, Third Alang being restored was done without fully compliance on the application of archaeological principles, especially the materials originality.

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Keyword: Bamboo, connection system, truss structure, wooden gusset plate, special wooden clamps

1. Introduction

Indonesia has many heritage buildings that are scattered throughout the islands, both aquatic and terrestrial areas. Every heritage building has a unique, peculiarities and specificities in terms of material, shape, form, period of time, and cultural ethnic backgrounds of ancestor maker. Generally, the heritage buildings are located in a very unique and beautiful landscape sites. One of this kind of cultural heritage area which has the status as a national and even international tourist destination is a traditional settlement of Tana Toraja. As an heritage area, the traditional residential areas of Tana Toraja ethnic includes many sites, one of which is the site Nanggala. As Tana Toraja traditional settlements in general, the traditional settlement Nanggala consists of Tongkonan and Alang traditional houses. Restoration was being done by the owner for the third Alang of Nenggala site.

Because of its status as heritage area, the restoration must be done by following the rules and regulations that apply archaeological principles, such as keeping the original material. This study had two objectives. Firstly is to know what kind of new wood and archaeological wood used as a building component of third Alang. Second is to evaluate whether the principle of material originality was applied during the restoration of Alang.

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2. Literature Study

2.1. Tana Toraja as a Heritage Area and Travel Destinations

Indonesia is a maritime country that occupies a vast area and has a very large diversity, either diversity of island condition, the diversity of ethnic and the diversity of customs and ethnic culture. In line with its unique culture, every ethnicity has the ability to create a superior and distinctive objects and building. Most of the building was established by the Government of the Republic of Indonesia as a cultural heritage. The uniqueness of heritage buildings lies in the material, shape, form, period and time of making and cultural ethnic backgrounds.

The existence of heritage buildings is a true testament to the superior attitudes and mentality possessed by the ancestral community builder ethnic heritage buildings. Attitude to life and winning mentality, is an attitude of life with virtue, diligence, teamwork, togetherness, perseverance, diligence, spirit work, sacrifice, and other cultures noble values. Therefore, Indonesian Archaeologist Mundardjito states that the heritage building is expected to be a mental resource that can provide inspiration and learning source for Indonesian next generation (Akbar 2010) [1].

Because of the high values embodied in the cultural heritage, Indonesian people are aware of their obligation to preserve and to keep the authenticity, as stated in the Law of the Republic of Indonesia No. 11 Year 2010 on Cultural Heritage. This act gave the mandate, that cultural heritage shall be preserved through maintenance, preservation, conservation and restoration. The restoration must be done to comply with the archaeological principles, in order to maintain authenticity of materials, technology, workmanship, size-shape-design, architecture and culture as well as the site (President of the Republic of Indonesia, 2010) [2].

One of the very important cultural heritage areas in Indonesia is a residence of Tana Toraja ethnic. This area covers approximately 3205 km². Geographically, Tana Toraja ethnic occupies a relatively hilly region with altitude ranging from 300 to 2800 meters above the sea level. Administratively, Tana Toraja area are in two districts, North Toraja and Tana Toraja, South Sulawesi Province (Anonymous, 2009) [3].

Tana Toraja settlement is a traditional house and consisting of Tongkonan and Alang Buildings (TAB). TAB is heritage buildings made of wood or wooden cultural heritage whose roof made of bamboo and palm fiber (Anonymous, 2011)[4]. TAB is spread on many sites. Together with the unique socio-cultural conditions and the beautifullness of mountain landscape, TAB has established an area that became the main destination for national and international tourists (Inajati, 2009) [5]. Tana Toraja Traditional Settlement has proposed by the Government of Indonesia to UNESCO on October 6, 2009 to be designated as a World Heritage. The traditional settlement nominated site and their constituents consists of 10 traditional settlements. These ten sites are (1) Pallawa, (2) Parinding Bori, (3) Kande Api, (4) Nanggala, (5a) andes Pune, (5b) Rante Karassik, (6) Ke’te Kesu’, (7) Pala’ Toke’, (8) Londa, (9) Lemo and (10) Tumake (Anonymous, 2009)[3].

Traditionally, a Toraja settlement consists of seven constituents, namely (1) the house (Tongkonan) and (2) granary (Alang), (3) burial place (Liang), (4) field ceremony marked by a menhir (Rante), (5) rice paddies, (6) bamboo forests, and (7) grazing lands or pasture for the provision of food for pets, especially buffalo and pigs (Anonymous, 2009)[3]. In the diversity on Tana Toraja ethnic, Nanggala site was chosen as the object of study. The selection was based on two considerations. First, the Nanggala site is the one of the 10 sites nominated by UNESCO as World Heritage. Second, restoration activities were being carried out on the third Alang building.

2.2. Building Structure of Alang

Alang and Tongkonan are two types of wooden buildings that have an architecturally similar shape but different in size, Alang smaller than Tongkonan. Both are couples constituent components of Tana Toraja traditional house. Based on the structure, Alang building can be divided into three parts, namely feet part, body part and the head or roof (Anonymous, 2011) [4].

Building components making up each part is presented as follows. On under section of Alang, there are five kinds of building components: foundation, columns, beam, floor and stairs. Foundation in the form of hard rock and placed freely on the ground. The foundation is the resting place for the columns. The column itself has a cylindrical shape. Beam serves as a binder between the columns, so shifting that may occur between the foundation and column can be prevented. Sum of beams is only one. The floor is made of planks of wood which are arranged on the beam. Stairs used as a means to bring-up a paddy and put it in the Alang body in order to save it. Stairs are also used as a means to bring down the paddy to bring out of the Alang body after paddy stored long enough in the Alang body. Stairs do not constructed permanently. It can be installed and removed in accordance with the instantaneous function (Anonymous, 2011)[4].

In the body as a second part of the Alang, there are three kinds of components, namely floor, walls, and opening (doors and windows). The floor is made of wood planks which are arranged on a floor beam structure. Setting of the
floor is done on longitudinal direction parallel to the main beam. Alang wall consists of two components, which are wall framework and wallboard. Both of these components made of wood. Wall board consists of wooden planks arranged with tongue and groove connection on the long sides the board (Anonymous, 2011)[4].

The head of Alang is a roof which has a typical shape, the long stretched toward the front and back of the Alang, so that the overall roof form a parabolic arch. Roofs made of split bamboo and arranged overlapping to each other. Bamboo parts were held together by a strips bamboo and tied with bamboo/rattan ropes. Palm leaf fiber layers were placed on top of roof (Anonymous, 2011)[4].

2.3. Wood Identification

Wood identification is an activity to determine the species of wood. Determination is done through observing the wood macroscopic structure and wood texture. Observations wood structure is directed to recognize cellular components of wood, which consist of fibers, tracheids, vessels, rays, parenchyma, and resin canal. Study on wood structure is learning about the presence, position and configuration of components of the wood cells. Macroscopically, wood configuration is related to growth ring, sapwood and heart wood, early wood and late-wood, as well as certain patterns that typically display the wood face. Wood texture is relates to the dimensions of the wood cells. Based on its dimension, wood texture can be divided into three groups: fine, medium and coarse texture (Soenardi, 1977) [6].

Wood science also studies the configurations diversity formed by tissues of wood components. Tissues configuration are forming a certain pattern. This particular pattern is related to the genetic nature of wood species, so the certain wood species will have a certain pattern. Therefore, each particular configuration can be used as the basis for determining the wood species, because each wood species has a unique and specific tissue configuration. It is means that a particular tissue configuration is owned only by certain species of wood as well. Thus, the pattern configuration of cells composing the wood tissue can be used as a basis to identify the wood species (Soenardi, 1977) [6].

3. Materials and Methods

Alang is being restored and is positioned as an object of research, specifically the Alang number three. The Alang number three together with another fifteen Alang units and two units of Tongkonan are the component of Tana Toraja Traditional House Village on Nanggala site, located on North Toraja Regency, South Sulawesi Province.

In general, the research method consists of two stages: in-situ and ex-situ observation. The in-situ observation conducted on every component of the third Alang which was entering the final restoration process, both components of the structure (columns and beams) and non-structural (floor boards and wall boards) building. Observation was followed by taking sample of new wood as a building material in any component of Alang. Archaeological wood sampling was also conducted at the same Alang component. Archeological wood was taken from third Alang demolition. Sampling was followed up by labeling of each of the samples.

Meanwhile, the ex-situ observations was performed with the two-step activities, (1) identification of wood species, both new wood and archaeological wood, (2) comparing the new wood species and archaeological wood species as a constituent of the same component of third Alang building. Ex-situ observations were done in Department of Forest Products Technology, Faculty of Forestry, Gadjah Mada University, Yogyakarta. Several tools were used in sampling activity, such as: cutting saws, chisel, machete, hammer, plastic bags, and labels paper.

Research methods identifying wood species was done in detail by the following procedure.

1. Sliced wood samples using a microtome-made American Optical Model 860 USA corporation to obtain transverse cross section. Transverse cross section was photographed in ten times (10 X) magnification by using Olympus BX-51 microscope. The resulting images were observed macroscopic structural components, which include the presence of growth ring, the distribution and arrangement of vessels, form and pattern of parenchyma tissue, dimensions and diversity of the rays, the presence of resin canal and wood texture. Fiber direction was observed.

2. Based on the description of the macroscopic structure and texture of wood, the process of identification and determination was carried out to determine the species of wood.

3. Confirmation to the identification results were done by comparing it to other wood species which presented in a variety of published sources.

4. Results and Discussion

4.1. Results of In-situ Observations.

In-situ observation to the Alang and Tongkonan buildings on Nanggala site gets the three realities as follows. First, Nanggala site consists of two units Tongkonan and sixteen units Alang. Each Tongkonan and Alang is arranged in
harmony in a lined up position. Tongkonan is facing to the north, while the Alang is facing to the south, so that they are facing each other. Two Tongkonan located in the southern part, while the sixteen Alangs located in the northern part of the complex. Between the rows of Alang and rows of Tongkonan, there is an open space used for drying paddy, family gatherings and social interaction.

Second, Alang being restored is Alang number three. Alang serial number starts from the entrance to the residential areas Nanggala site. The entrance is located at the southwest position. The first Alang has already completely restored, while the second Alang and the forth to sixteen Alang have varying conditions, from the medium to the good condition. Third, on the boundary settlement of Nanggala site, there are many bamboo clumps. The bamboo clump is a home of enormous number of bats.

4.2. Wood Identification Results.

4.2.1 Wood Material for Column Component

To identify the wood as a material for column component of third Alang, two photographs of macroscopic cross-sectional sample of new wood and archaeological wood were presented sequentially in Figures 1 and 2 below.

![Figure 1. New wood cross section of column components of third Alang](image1)

![Figure 2. Archaeological wood cross section of column component of third Alang](image2)

Observations to the characteristics of the new wood structure in Figure 1 can be described as follows.

a. There is no growth ring in the wood
b. Existence of vessels system that consists of xylem and phloem
c. Existence of sclerenchyma sheath with large, very tight and solid fibers surrounds and protects the vascular system
d. Parenchyma tissue as the basic tissue surrounding the vessels system and sclerenchyma tissues

Based on the description of wood structure, the determination of new wood samples leads to monocotyledoneae class. At this stage, the determination moves from internal wood structure to external wood, namely to the trees morphology. Based on the appearance of column morphology which is a cylindrical tree trunk, and do not have nodia, but having a relatively large diameter, the determination in the monocotyledoneae class leads further ordo palmae. Based on more information from the owner of Alang, that the trunk surface is very smooth and having many sharp thorns in tightly arrange, and the leaf sheath is also having a lot of thorny, the determination concluded that this wood comes from the species of *Pigafetta fillaris* Giseke. In 1977, its name changed to *Pigafetta filifera* Merr. (Giusuppe, without year)[7]. Hibitus of *Pigafetta* tree accompanied by morphologic description as mentioned above is very similar to the picture presented in the website of http://www.pacsoa.org.au/palms/Pigafetta/ cultivation.html (Anonymous, undated)[8]. Photos on the website page refer to the name of *Pigafetta*. 
Meanwhile, the observations on the wood structure of the macroscopic cross section of archaeological wood samples presented in Figure 2, was getting a description which is not different to the description for new timber in Figure 1. Therefore, archaeological wood as a material for column is also *Pigafetta filifera* Merr.

### 4.2.2. Wood Beam Component Materials

To identify the wood as a material for beam component of third Alang, two photographs of macroscopic cross-sectional of new wood and archaeological wood sample were presented sequentially in Figures 3 and 4 below.

![Figure 3. New wood cross-section for beam component of third Alang](image1)

![Figure 4. Archaeological wood cross-section for beam component of third Alang](image2)

Observations on the wood structure cross-section of new macroscopic wood samples in Figure 3 can be described as follows.

- **a.** Growth ring to be not so obvious. Growth ring can be seen from different dimensions of vessels in the early wood and late wood.
- **b.** The spread vessels are solitary, not in groups, not in radial or tangential lines. Vessels is arranged in diffuse.
- **c.** Parenchyma type is paratracheal (parenchyma that related to vessels) and apotrakheal (which is not related to vessels) is in the wood. Parenchyma paratracheal include vasisentrik and abaxial. Apotrakheal parenchyma is small-sized forming long ribbons.
- **d.** The Wood rays are not homogen, because there are small and large wood rays.
- **e.** The wood has a slightly rough texture.
- **f.** Wood fiber is not straight and slightly oblique.
- **g.** There is no resin canal.

Based on the description of the new wood structure, determination activity concluded that the new wood sample is genus of *Casuarina*. The conclusion for genus Casuarina is reinforced by Ilic (1991)[9]. Nevertheless, there is a differences in term of the dimensions and distribution of vessels between this new wood species and others *Casuarina* wood species, namely: *Casuarina cunninghamiana*, *Casuarina oligodon*, *Casuarina pappana*, *Casuarina stricta*, *Casuarina sumatrana*, each of which is served by Ilic (1991)[9] in Figure numbers: 180, 181, 182, 183, and 186, as well as the species of Casuarina equisetifolia on Figure number 26 presented Hayashi et al (1973)[10]. Therefore, the possible species of the new wood is *junghuhniana*. So, the name is *Casuarina junghuhniana* Miq. This possibility is reinforced by the *Casuarina junghuhniana* Miq wood that grows on the campus of Gadjah Mada University. The structure of the new wood is the same as structure of *Casuarina junghuhniana* Miq wood that grows on the campus. Casuarina Junghuhniana Miq is also called *Casuarina montana* Leschen ex Miq (Proce,1993)[11].

Observations on the archaeological wood structure in Figure 4 were getting the same description as the description of a new timber in Figure 3. Therefore, archaeological wood as a material for beams element is also Casuarina junghuhniana Miq.

### 4.2.3. Wood Materials of Plank Flooring

To identify the wood as a material for plank flooring component of third Alang, two photographs of macroscopic cross-sectional of new wood and archaeological wood sample were presented sequentially in Figures 5 and 6 below.
Observations on the wood structure macroscopic cross-section of new wood samples in Figure 5 can be described as follows. (a). Growth ring did not appear. (b). Vessels are not present in the wood. (c). Resin canals are present in the wood and the spread are solitary (d). Parenchyma type is epithelial and this parenchyma epithelial forms resin canals (e). The size of the rays is small and uniform. (f). The wood has a rather smooth texture. (g). Fibers orientation is straight direction.

Based on the description of the new wood structure, determination activity concluded that the new wood sample is *Pinus merkusii* Junghuhn et de Vries. This conclusion is reinforced by the similarity between the macroscopic picture this wood with macroscopic wood photograph contained on page 42 Indonesian Wood Atlas Volume 2 (Martawijaya et al, 1989)[12], and the photograph on page 351 PROSEA book Volume 5 (Soerianegara and Lemmens, 1993)[13]. Meanwhile, the observations on the wood structure cross-section of macroscopic archaeological wood samples in Figure 6 can be described as follows.

- a. Growth ring can be seen clearly due to the existence of terminal parenchyma.
- b. The spread of vessel is single and multiple of 2 to 3. Vessels arrangement was real ring order.
- c. Parenchyma type of paratracheal and apotrakheal is in the wood. Parenchyma paratracheal is abaxial. Apotrakheal parenchyma is small-sized forming short ribbons.
- d. The size of the rays are not homogeneous, there are a small and a rather large rays.
- e. Wood has a somewhat smooth texture.
- f. Fibers are in straight direction.
- g. Resin canals is not present in the wood.

Based on the above description on wood structure, the activity determination concludes that the archaeological wood samples are *Elmerrillia ovalis* Dandy. This conclusion is reinforced by the similarities between the macroscopic picture of archaeological wood with macroscopic photograph contained on page 36 of the Atlas of Indonesian Timber volume III (Abdulrohim et al, 2004)[13] and photo number 661 in the book Atlas of Hardwood Csiro (Ilic, 1991)[9]. The caption on the second photo is *Elmerrillia ovalis* Dandy.

Based on the identification of the two results, it can be concluded that there are different species of new wood and archaeological wood used as material for plank flooring. New wood is *Pinus merkusii* Junghuhn et de Vries, while archaeological wood is *Elmerrillia ovalis* Dandy.

### 4.2.4. Wood Material Used for Wall Board

To identify the wood as a material for wall board component of third Alang, two photographs of macroscopic cross-sectional of new wood and archaeological wood sample were presented sequentially in Figures 7 and 8 below.
Observations on the wood structure cross-section of macroscopic new wood samples in Figure 7 can be described as follows.

a. Growth ring is not visible.

b. The spread of vessel is single and multiple of 2 to 3. Arrangement of vessels is diffuse.

c. Parenchyma type of paratracheal and apotrakheal are exist in the wood. Paratracheal parenchyma is vasicentric whereas apotrakheal parenchyma is diffuse.

d. The size of the rays are homogeneous, because there are only a small rays.

e. This wood has a slightly rough texture.

f. Fibers in the timber is in combined direction.

g. Resin canals are not present in the wood.

Based on the above description of the wood structure, the activity determination concludes that the new wood sample is *Paraserianthes falcataria* (L) Nielson. This conclusion is reinforced by the similarities between the macroscopic picture this new wood with macroscopic picture contained on page 62 of the Indonesian wood Atlas Book of volume V (Martawijaya et al, 1989)[12] and the photograph on page 321 PROSEA book volume 5 (Soerianegara and Lemmens, 1993)[14] and also photos number 2035 in the book Atlas of Hardwood Csiro (Ilic, 1991)[9]. All of these are referring to the *Paraserianthes falcataria* (L) Nielson.

Meanwhile, the observations on the wood structure of the macroscopic cross-section of archaeological wood samples in Figure 8 get the same description as the wood description in Figure 5. Therefore, wood as a material for wall board component of third Alang is also *Elmerrillia ovalis* Dandy.

Based on the identification of the two results, it can be concluded that there are different species of new wood and archaeological wood used as wall board component of third Alang. New wood species is *Paraserianthes falcataria* (L) Nielson, whereas archaeological wood species is *Elmerrillia ovalis* Dandy.

4.2.5. **Alang Roof Cover Materials**

Process evaluation of new materials and archaeological material that used as a roof Alang can be done very easy. The new material is a metal material such as corrugated iron, while the archaeological material is bamboo. Therefore, the difference between the two is not just about the type of material, but also the origin and composition of materials. In this context, a new material derived from inorganic materials in the form of metals, while the archaeological material derived from organic materials in the form of bamboo.

5. **Conclusions and Recommendations**

The results conclude three things. First, all of the third Alang building components have been replaced by new materials and new wood species. Second, the identification of new wood and archaeological wood sequentially produces the following species: (a) *Pigafetta filifera* Merr and *Pigafetta filifera* Merr for column components, (b) *Casuarina junghuhniana* Miq and *Casuarina junghuhniana* Miq for beam, (c) *Pinus merkusii* Junghuh et de Vries and *Elmerrillia ovalis* Dandy for floors (d) *Paraserianthes falcataria* Nielson and *Elmerrillia ovalis* Dandy for wall, (e) corrugated iron.
sheets and bamboo for roofing. Third, the third Alang restoration was done without full compliance with the application of archaeological principles, especially the principle of material originality.

Therefore, it is needed to be advised to all stakeholders that if restoration to a Alang building as a wooden cultural heritage should be done, then the implementation of the restoration was to be conducted with the full implementation of archaeological principles, especially principle in maintaining the originality of wood species as a building material.

References

Urban Acupuncture: Revival of Urban Spaces and City Villages by Community Activation and Creativity

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Abstract

As commonly occurred to growing, dense cities in developing countries with inadequate governance, Bandung, the capital city of West Java province in Indonesia, is facing the issues of substandard infrastructure and inferior public facilities and services. On one hand, the majority of Bandung citizens are gradually forced to accept such conditions as “normal”. However, on the other hand, the fact that Bandung is home for more than 200 colleges and universities adds to the growing amount of young people, which has come to a significant number: 70% of Bandung citizens are below 40 years of age\cite{1}. These young people come from different places and backgrounds to live and study in Bandung and therefore have been given Bandung the characteristic of being open, tolerant and progressive. This condition has led these young people, who usually gather in communities with similar interests, to start their own initiatives in improving different aspects of their urban lives. Among these initiatives, Bandung Creative City Forum (BCCF) was established. This paper discusses how the programs and activities of BCCF progressively shifted from mere community festivals to focusing on urban issues, by applying urban acupuncture method, starting 2012. Having Creativity as one of the main capitals, BCCF has also attempted to revive city-kampongs and to encourage the inhabitants to adapt to current urban development, according to their own capacities and competences. This paper also discusses the success factors of this program, and future strategies for implementation, which requires management of various resources in its planning. It is concluded that creative community activation, driven by its own initiatives, may result in a number of prototypes for city-kampongs, which can be applied to other cities with similar issues, provided that the determining success factors are accessible.

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Keyword: Bandung; BCCF; community; creativity; urban acupuncture

1. An Emerging Creative City

In the past few years, communities in Bandung have been gradually contributing to the activities and infrastructures of the city, which led to the establishment of “Creative City” predicate for Bandung; a reputation that is recognized not only within the national scale, but also up to an international scale. Among the communities is Bandung Creative City Forum (BCCF), which has been conducting a number of programs that focused on creative economy activation and development in Bandung since its establishment in 2008.

1.1. Bandung: an Overview

Bandung, the capital city of West Java province, is located at about 700m above sea level; a fact that has given the city a pleasant climate, with the temperature between 19\textdegree C and 23\textdegree C in average throughout the year. It is also located in an economically strategic position, due to its relatively short distance (129km) from Jakarta, the capital city of Indonesia. Historically, the development of Bandung went through three phases: as Traditional City (1810-1900), Colonial City (1900-1945), and Developing City (1945-1990). The first two phases were marked by the interference of Dutch Colonial Government that established and formulated the city planning of Bandung, which reached its “golden era” shortly before World War II. The later phase was marked by an era when Indonesia has become an independent nation, where population boom took place, and creative-based cultural activities formed an art and design community of a great stature, due to a large number of higher education institutions. The economic growth in Bandung in the last two
decades has seen an increase, when the textile industry was replaced by high-tech industries such as airplane and microelectronics, information technology, and service industry such as tourism. Bandung is the 4th biggest city in Indonesia, populated by almost 3 million people (2011), of which nearly 70% are below 40 years of age.

1.2. Creative City

Since 1913, Bandung has been known as the centre for world’s fashion distribution in Indonesia, next to having a reputation as a creative city since 1920. Up to today, Bandung is considered as Indonesia’s favourite city for shopping and culinary experience, marked by a Tourism Award received in 2011. Due to these reputations, Bandung receives up to 150,000 visitors each weekend. This condition has encouraged the expressions of creativity of Bandung people. Compared to other dense, growing cities in Indonesia, Bandung’s creative culture differs in the sense that it is closely related to human creativity. Whereas Yogyakarta is best known as the centre for “traditional” culture, Bali for “religion-based” culture and Jakarta for “commercial-related” culture, Bandung can be described as a city of “creative culture”, hence the vision “Creative City”. Therefore, wider implications regarding the emergence of creative-based cultural industries in this city can be approached through the following issues (Soemardi, 2006)[2]:

- The making of place: regarding the proximity and accessibility of Bandung from Jakarta, the capital city of Indonesia, which provide great opportunities for Bandung to attract cultural consumers from Jakarta. Additionally, within the city, there are places that gradually become hubs where creative communities interact with one another.
- The creative culture of cities: regarding the varieties of creative industries that should be harnessed and encouraged in Bandung, creative-based culture and its related industries, and sustainability of creative-based culture.
- Implications for planning policy: regarding urban planning policies in their relations to becoming generators for the emergence of creative-based industries, including zoning, development permits, and the inherited sectoral systems.

The 3T of economic development of the Creative Class (Technology, Talent, Tolerance) that reflects the role of universities in contributing to the making of places and creative communities (Florida, 2000 in Soemardi, 2006)[2] is obvious in Bandung, home for tens of public and private universities and institutes, of which more than twenty are in the field of design, art and architecture. This condition creates a new type of “cultural industry” in the field of education and encourages the forming of social peer-groups among a large number of young people based on their personal interests, as well as based on the similar educational background and/or educational institutions. Their activities and gatherings are accommodated in public places that exist within the city. This pattern has become one of the success parameters of cultural socialization among Bandung’s young creative actors. It is also due to this pattern of gathering that Bandung Creative City Forum started to take shape.

1.3. Bandung Creative City Forum: a new beginning

Bandung Creative City Forum (BCCF) began as an informal gathering of tens of communities with different backgrounds and interests in Bandung, when they were about to hold Helarfest in 2008, a city-scale event that expressed each community’s program in the forms of festivals, exhibitions, conferences, workshops, etc. The main benefit of Helarfest for these communities was the fact that they could have a collective promotional channel, as well as a shared permission for all the events, whether it was for an international conference, or a rock concert, as long as it was included within the Helarfest event list. At this initial phase, Helarfest was held by BCCF as an incidental organization, where each community organized and funded its own event. However, due to the success of the first Helarfest, and considering the amount of events (30 events within one month) and also the varieties of crowd and audience it managed to attract, the regional and municipal governments and a number of private companies started to show interest in sponsoring and investing in the event. The fact that a certain level of responsibility should take place has driven these communities to form a legal organization that represents them and their aspirations for a “creative city”, which has led to the establishment of BCCF. BCCF became the first legitimate, multi-background community consortium in Indonesia. The first period of BCCF organizational team, 2008-2012, conducted its main programs (focusing on three aspects: Creative Education and Festivals, Creative Economy, and Creative Urbanism) and gradually found its priorities over the years. Figure 1 show several BCCF programs between 2008 to 2012 which directly related to a number of city issues. These programs are represented by the small dots at the frame of the diagram, which are connected to the circles containing city issues in the middle of the diagram, wherever relevant. As described in this diagram, it is obvious that BCCF programs gradually shifted, from accommodating city-scale community events (Helarfest 2008 and 2009), to focusing on certain issues (Semarak.bdg 2010: public space and heritage sites and buildings), next to responding to...
other issues, such as entrepreneurship and mobility, and collaboration with international organizations such as UNEP and MTV EXIT. The diagram also shows that nearing the end of the first period, BCCF held another Helarfest in 2012 with a different format: using Urban Acupuncture concept to respond to four distinct elements of Bandung: park, forest, river and kampong.

Figure 1. Between 2008 and 2012 BCCF conducted about 200 programs. This figure shows several programs that responded to specific city issues, such as urban planning, traffic, mobility, access, and heritage buildings and sites, entrepreneurship and green open space.

In the second period of its organizational team (2013-2017), BCCF continues its Kampung Kreatif (creative kampong) program, maintaining the Urban Acupuncture concept in the process of working with these kampongs. Based on the experience and analysis in reviving urban spaces and kampongs, BCCF also builds up a strategy to format the programs, which used to be impulsive and spontaneous, into a more formal setting, with managerial-based planning, in order to make the programs self-sufficient and sustainable. This paper focuses on Kampung Kreatif program, describes the progressive methods of its management and aims to identify the success factors that should be maintained in order to determine appropriate steps and strategies for the next phase.

2. Urban Acupuncture: a City as An Organism

Urban Acupuncture is a concept developed by Marco Casagrande, a Finnish architect and urban planner, which utilized the tenets of acupuncture: treating the points of blockage and let relief ripple throughout the body. More immediate and sensitive to community needs than traditional institutional forms of large scale urban renewal interventions would not only respond to localized needs, but do so with a knowledge of how city-wide systems operated and converged at that single node. Release pressure at strategic points, release pressure for the whole city [3][4]. The former mayor of Curitiba, Jaime Lerner, suggested Urban Acupuncture as the future solution for contemporary urban issues, by focusing on very narrow pressure points in the cities. Urban Acupuncture emphasizes the importance of community development through small interventions in design of cities, which can be accomplished quickly to release energy and create positive ripple effects [5]. These concepts fit with the nature of how BCCF runs its programs in different parts of Bandung in responding to different issues. Therefore, BCCF uses the term “Urban Acupuncture” in referring to the strategy in running its programs, which mostly also require a relatively small amount of financial, bureaucracy, infrastructure and material capitals, and rely mostly on initiatives, creativity and contributions of time and energy from participating communities. All these programs intervened with urban spaces and kampongs, which lead to a condition where all stakeholders, especially local inhabitants, gradually experience how creativity and community
activation could revive their living environment, and could even improve their confidence and well-being in their effort to adapt to the rapidly growing and changing city.

2.1. Helarfest 2012: Four City Elements

Helarfest was among the first programs run by BCCF since its establishment. As a community festival, Helarfest did not start to directly respond to urban issues. The first Helarfest (2008) attracted about 30 communities to announce their events. In the second one (2009), the second Helarfest, 67 events took place within about 2.5 months. In the next year, 2010, it was decided that BCCF should concentrate on certain issues; in this case, heritage building and public space, and called the program not Helarfest but Semarak.bd. It was only in 2012 that BCCF held another Helarfest. This time, instead of inviting communities in applying their programs, BCCF focused on particular elements of Bandung: forest, park, river and kampong, and inviting communities to activate those elements, using their concepts and plans (see Figure 2). Each of these four elements had its own issues, and therefore needed different treatments. The forest is the only city forest in Bandung, where a developer had permission and planned to build a multi-stories apartment building and to commercialize the area. The park represents about 400 parks in Bandung that are neglected and can actually be activated with small efforts, in order to provide a safe, pleasant space for children and communities. Rivers have so far been treated as the backside of a house where people throw garbage to, as a huge sewer, resulting in clogged streams and flood disasters.

Figure 2. The four distinct elements of Bandung (forest, kampong, park and river) were chosen as 2012 Helarfest themes. In the next Helarfest, the four elements maintained to be celebrated, but more elements can be chosen as themes as well: galleries, heritage sites, terminal, etc.

BCCF responded to these issues by inviting different communities to activate these spaces. At the forest, a free, three-night music and light concerts called Lightchestra took place, relaying the message that local people still enjoy having the city forest as it is. A park was taken over for one weekend by two communities that specialized in traditional games and outbound for children, turning it into a huge adventurous playground. A part of the riverside was turned into an arena for a free open cinema, forcing people to watch the river, too, while they were watching movies, so they could feel that it would be more pleasant if the river were clear from garbage. Kampong is a city element that needed more works compared to the rest, because it involves not only the surrounding physical environment, but also the inhabitants and all the social systems, ideas and expressions of the local people and their specific conditions, which often are the challenges that actually have a lot of opportunities to be solved and developed.

2.2. Kampung Kreatif

For Helarfest 2012, BCCF chose five kampongs in Bandung to conduct the “Kampung Kreatif” (creative kampongs) program. The selection process considered the factors of internal relationship among the kampong dwellers and the willingness of the dwellers to be active in interfering with their habitat. Other factors include specific capacities and characteristics of each kampong as an initial capital to be developed further. BCCF also chose these kampongs based on their geographical positions that represent the five entrances to Bandung: Dago Pojok from the north, LeuwiaNyar if one entered Bandung by bus from the east, Cicukang if one entered Bandung by train from the west, and
Cicadas from the east. Another kampong, TamanSari, was chosen because it represented a kampong that is located right in the middle of the city. This kind of program requires the following phases (see Figure 3):

- **Selection:** where a kampong was selected based on the willingness of its inhabitants to make a positive change in their kampong, and also based on the solid relationship among the kampong inhabitants. This phase is also an attempt to reduce potential problems that might occur at the technical phase.

- **Research:** where BCCF team did research on the statistics of the kampongs, and the specific problems that they currently faced.

- **Advocacy:** where mediators of each kampong gather with the kampong inhabitants and discuss various issues, especially concerning their desires toward a celebration or an event that directly relates to their habitat. This phase commonly takes the longest in periods, which could take up to two or three months with intense interaction between mediators and kampong inhabitants. This phase is important to determine the level of trust between the inhabitants and the mediator. Advocacy is also a part of environmental conditioning, also to map all stakeholders, approaching a new, improved kampong. This phase also sees how mindset and mentality start to form, and to gain collective agreement.

- **Workshop:** after each kampong’s problems are reframed, BCCF, through communities, offers a variety of workshops, depending on the main potentials possessed by each kampong. This phase used to take about three to four weeks, or more. Examples from such workshops are: mural painting for the youth and kite drawing competition for children.

- **Festival:** where kampong inhabitants exhibited the results of their works during the workshops, also as a celebration for becoming a “creative kampong”. Festival is important to motivate and actually encourage that the program should be celebrated, exhibited, and if possible, the benefits should already be enjoyed by the general public.

It can be seen that this kind of program cannot be conducted as spontaneous as the other programs in previous Helarfest. This program needed a more advanced planning phase, involving careful evaluation and mature managerial skills. The activation of these kampongs was actually a translation of an “urban acupuncture” concept, where problematic spots of a city were treated by a “needle” bearing community activities and creativity, with a hope that they would understand about Urban Acupuncture as a method where development and innovation can be achieved without employing complicated bureaucracy, or building massive structures, with huge financial investments.

![Figure 3](image-url)

Figure 3. The four distinct elements of Bandung (forest, kampong, park and river) were chosen as 2012 Helarfest themes. In the next Helarfest, the four elements maintained to be celebrated, but more elements can be chosen as themes as well: galleries, heritage sites, terminal, etc.

3. **Creativity and Adaptability for Program**

Initially, *Kampung Kreatif* started in Dago Pojok, a neighbourhood located at the north of Bandung, where an artist who lives in that area established a community that encourages local children and youths to express themselves through wall painting. This artist, who later becomes BCCF mediator and among the main operators for *Kampung Kreatif* program, collaborates with BCCF in enhancing the creative activities in Dago Pojok prior to the launch of Dago Pojok as *Kampung Wisata, Edukasi & Industri Kreatif* (Neighbourhood for Creative Tourism, Education and Industry) in 2011, supported by BCCF. Since then, similar activities have been spreading to other neighbourhoods in Bandung, initiated by BCCF as one of its programs. In order to be able to manage these Creative Kampongs, all resources that are
required to conduct the program should first be identified and managed. In short, *creativity* becomes the main keyword in activating communities and kampong inhabitants, while *adaptability* would be a condition experienced by kampong inhabitants during and after the program was completed, towards their improved living environment in particular, and within the city, in general.

The functions of management are Planning, Organizing, Actuating and Controlling. In the Planning process, the idea of *Kampung Kreatif* is to synergize all three backbones of BCCF: social, economic and infrastructures, with managerial function. The aim is to organize a program that has a long term applications and results. Since the Planning phase, there is already an indication that, in order to conduct the program’s managerial function, the kampong inhabitants should take an active part. Therefore, the first organizing phase is an advocacy of knowledge transfer to the kampong inhabitants, starting from provoking their creativities, rousing their awareness towards their living environment, and encouraging their compatibility, next to mapping each kampong’s particular potentials. An important note that can be gained from a managerial function is to establish both formal and non-formal institutions, and to organize both existing and new kampong bodies, which are particularly established as a managerial operator for BCCF *Kampung Kreatif* program. An example of an existing kampong body is the youth groups (*karang taruna*) in each kampong as local initiators. For this purpose, there are three layers of organizations:

- A technical team at each kampong
- An inter-kampong community forum, mainly to maintain their compatibility, a competitive environment, and to encourage synergy and collaboration among the kampongs.
- BCCF as an organization that provides concepts and thinking in more strategic areas.

Therefore, in this organizing phase, BCCF considers the program as a public initiative, which should be secured by multi-layer organizations that has its own job descriptions.

The Actuating level belongs to each kampong. BCCF needs a realization in this actuating phase as a prototype in order to have more massive replication effects. With its current networks, BCCF could also publish the idea and disseminating it to a wider network, both within national and international scale. The Controlling level sees the function of an organization that has been made into those three layers, which have been taking the part to evaluate their activities and in order to plan the phases of a managerial function in the next level. The first level in 2012 was more like a festival, while in 2013 the issues develop into empowering the economic condition of these kampong inhabitants.

The process of acceptance and rejection lays in both knowledge and cultural contents. In order to cope with rejection, the multi-layer organization is established, which allows the kampong communities to conduct things their own way, without having to be directly related to BCCF. The second organization is an inter-kampong network that has collaboration power (communication, compatibility, etc.); a forum that BCCF could strategically control, since the forum is headed by the program director of BCCF. Such adaptation is what has been created, starting from the organizational management strategy, up to the phase of program implementation with the issues of adaptability through workshop programs that are implementative, design that contributes to environment, enhancing skills, etc.

### 4. Revival of Urban Spaces and City Villages

After one year of *Kampung Kreatif* activation program, local leaders are formed, creative perspectives and new aspirations are open, and networks among kampong community have also been running. What should be conducted in the nearest future is the implementation of programs related to sustainable economy, considering the emerging local enterprises such as a wooden toy and photo-puzzle makers, and a women musical group using kitchenware, which could all turn into a tourism destination content.

Workshops and trainings at the kampongs did more than a mere upgrading skills and training, but also building up to a concrete economic activity, initiated by the plan to turn these kampongs into tourist destinations. The management strategy used in this case maintains the three layers, which eventually added stakeholders: professional tourism actors and the Tourism Department of the Municipality. An analysis from the external and internal conditions found that if one goes into the area of tourism industry, or the sustainability of an institution with business orientation (including social business), it is necessary to have a more formalized managerial function, with more complex phases. It is also necessary to have a more comprehensive business plan and feasibility study. This includes phases from how a company is established, ranging from SWOT analysis to studies by segmenting, targeting and positioning of tourism market. It is necessary to analyze and formulate a strategy of managerial function, starting from operational and human resources, to marketing and finance. BCCF has so far prepared for all these requirements by forming a platform and Term of References in strategic areas. The technical level is divided into two other organization layers and collaborates with new stakeholders. Among the issues that are coped by this program is migration. Each kampong has its own local leader. If this local leader is gone, then the whole program will be disrupted. Therefore this local leader should be maintained in his/her kampong, while regeneration for future leaders is also important.
Another point taken from conducting the program is that the local communities are actually actively involved, from the level of RT and RW, to Camat and Lurah (levels of neighbourhood associations). A challenge appears when people at the higher positions, or those with authorities to make decisions, are replaced, since there could be a consequence if the new authorities disapprove of the ongoing projects.

5. Future Plans

Considering the experience in conducting Kampung Kreatif program since 2012, it is apparent that the steps applied to the kampongs have so far been appropriate, and that along the way each kampong can gradually conduct a more complex task, such as forming a network among the involved kampongs, training in entrepreneurship, and improving their facilities in order to establish themselves as a tourist destination. The success factors of this program are mainly the involved key persons, such as the mediator and a local kampong inhabitant that acts as a leader, a relevant roadmap for each kampong, and supervision and evaluation systems that administer the program as a whole. After succeeded with the steps taken for the first five kampong, BCCF has become confident in applying them to other kampong in Bandung, and plans to compose a guideline should the steps be applied in other neighbourhood in Bandung or outside Bandung, with similar conditions, provided that the determining success factors are accessible. In the future, BCCF plans to maintain the existing Kampung Kreatif by improving their services and systems, while adding more kampongs in Bandung in the program.

From the perspectives of Creativity and Adaptability, this program could be considered as producing positive results. At the Controlling phase, the launch and implementation of the program have occurred. However, it remains a challenge to maintain the energy to be continuously consistent with the initial Plan. This is due to the nature of BCCF as a voluntary organization with many other programs to handle and implement, while having to be in touch with the two other layers, in order to secure that everything goes according to Plan. As a part of the evaluation, it was found that each kampong has different problems, such as lack confidence after the first phase of the program is completed, individual interests of kampong stakeholders, and conflict with local government. These problems should be anticipated by employing personnel to intensively supervise the program.

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References


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Abstract

This project aims to collect and study the details of the available LCA data of building materials in Thailand. The information of present and future LCA projects in Thailand is also studied by gathering data related to LCA projects from various sources i.e. Thailand research funds, academic institutes or universities, government agencies, NGOs and the private sector. 49 types of building materials are found in the LCA researches which in practice cannot be applied to evaluate environmental impact values or to compare with materials in the design of buildings since the data is not yet complete and insufficient and does not cover a building behind the research. In addition, each source has different details in doing their research so cannot be compared, by which the values and results derived in each project are also different. Additionally, in-depth interviews with research workers also showed that the important problems in their research related to the life cycle assessment of building materials, namely the lack of good data for calculation of environmental impact values, both primary and secondary data, the lack of knowledge in the study process, the lack of analysis tools, the costs of research, and complicated LCA procedures.

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1. Introduction

Selecting materials for building traditionally involves the following considerations: functionality, cost, aesthetic, and personal preferences on the part of designers and owners. Past experience of designers also plays a key role in materials selection process. As environmental problems exacerbate, environmental impacts of building materials become an increasingly important consideration [1,2]. The challenge for modern building designers, architects and engineers, as well as building owners, is to improve environmental-friendliness of buildings while also meeting traditional requirements such as functionality and cost. To meet the challenge, building designers need to have accurate and reliable relevant data for various building materials so that comparisons among alternatives can be made. To evaluate environmental impacts of buildings, reliable LCA (Life Cycle Assessment) data of building materials are required [3,4].

In several countries in Europe, America and Asia, information on environmental impact from construction materials have been developed by assessing the product life cycle such as information of Minesota (USA), Ecoinvent (Europe), and CASBEE (Japan). In addition, various researches have been conducted to assess the environmental impact of construction materials so there are many sources of information in the form of research, book, database in applications or report of agency or organization. However, after studying the documents from the existing sources in relation to each type of material, it is found that the information there of is different. If the said information is required for selection of material or for analysis of environmental impact of a building, an error may occur. This corresponds to the research of Heijungs and Huijbregts [5,6] stating that currently, information from the LCA analysis are uncertain or there are more than two sets of information so users do not know which one should be used most. This becomes a question in the LCA assessment experts.

Due to the said problem, Peterson and Solberg [7] recommended a guideline for making a decision on choosing environmental impact information of the existing produces that users should choose the information audited by the reliable authority and consider using the information from an analysis of the process most similar to the process of...
required material. Furthermore, details on the LCA process should be taken into account. However, information prepared in such an area or locality should be mainly use. Thus, if building designers have to choose or compare the information on environmental impact from construction materials manufactured and sold in Thailand, they should choose the information of construction materials from the analysis of production process and use of raw materials in Thailand.

Currently, there is no clarity on developing values of environmental impact from construction materials in Thailand as the database is being created. It is to accept that the study of values of the environmental impact from the products by ways of life-cycle assessment is new for Thailand so the research or study of information is not grouped and systemized. As a result, there are the waste of information, duplicate researches, different research results and information quality, by which the users cannot know which part of information or information of which type of material exists and its details. This problem will render a disadvantage to the consumer who may use accurate information. In addition, the industrial manufactures may lack of confidence in information development and the researchers and relevant agencies may encounter difficulties in performing their work. Therefore, to ensure effective development of information in Thailand, it is necessary to know the statue of information on values of environmental impact from construction materials in Thailand and to study problems and obstacles from developing LCA information in Thailand as information for further development of values of environmental impact from construction materials in Thailand.

2. Methodology

2.1. Study the status of LCA of construction materials in Thailand

Information from the researches and projects of government agencies, private sector, educational institutions and studies of the manufacturers or business operators nationwide are gathered. In this regard, only the details of the researches in relation to materials used for construction are studied i.e. type of studied product, objective, methodology, scope and system boundary, functional unit, assumption and limitations, study results of only five problems, namely global warming, acidification, eutrophication, ozone depletion and smog. The information obtained is classified and analyzed and the study results are applied. Finally, the observations from the research are summarized.

2.2. Study problems and obstacles in preparing the LCA

In doing the study, the Delphi Technique is applied by making in-dept interviews of four groups of relevant persons totaling 14. In this regard, experts with work products in relation to the product environmental impact assessment from relevant agencies i.e. four government agencies, four private entities (business operators), two independent organizations and four educational institutions. All interviewees are experienced in LCA for three years in average. The semi-structure in-dept interview developed by the researcher to cover the research experience, problems and demand, assistance in assessment of product life cycle is conducted and the information is analyzed by the grounded theory method. The entire content is related to the theories and problems to lead to an analysis of problems and obstacles in the product life-cycle assessment.

3. Results and Discussion

3.1. Number of related researches

From studying the researches of the domestic educational institutions and research supporting agencies nationwide, it is found that there are 48 researches relating to the product life-cycle assessment i.e. 10 researches of agricultural products and food (20.8%), 13 researches of industrial products (27.1%), 14 researches of energy (29.2%) and 11 researches of others (22.9%) as shown in Fig. 1. Five researches relating to the LCA of construction materials are included in the researches of industrial products or 10% of all researches on life cycle assessment of all products. In the life cycle assessment, there are a total 16 types of construction materials i.e. hand-tufted carpet [8]; mortared brick wall, mortared cement block wall, light-weight concrete wall, form concrete wall, external insulation wall [9]; life-cycle assessment of cement and steel production [10]; life-cycle assessment of ceramic tiles [11]; and life-cycle assessment of light-weight concrete and floor tiles i.e. ceramic, marble, granite and granite, grazed porcelain tiles, parquet wood floor [12].

Furthermore, the private entities’ studies include the studies on 33 types [14] of construction materials and some studies relates to the same type of materials but with different sources. The studies done by the construction material companies have the aim to obtain the carbon footprint label to be fixed on their goods or products so as to create good image of their products as environmentally-friendly products and enhance their competitiveness in the global market.
The studies with the aim to obtain carbon footprint label or sign are made with 14 items of construction materials i.e. three items of tiles, two items of carpets, three items of cement and two items of prints, one item of light bulb and water tap each.

![Fig. 1 Researches on product life-cycle assessment by group](image)

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The studies done by the relevant agencies are the studies of the database of life-cycle of basis materials and energy of the country with the aim to develop the database. With this regard, MTEC [15] is the central unit in operation, and there are 16 items of construction materials are included in the database i.e. steel (steel bar, steel wire, fiberglass steel billet, steel slab), glass (insulating glass, tempered safety glass, laminated safety glass and float glass), tiles (wall and floor tiles), print (resin paint, emulsion paint for buildings, epoxy paint and lacquer paint) and sanitary ware – water closet (flush, toilet bowl and wall urinal).

It can be summarized that the researches on construction materials in Thailand is in a small number. There are studies on the life-cycles assessment of only 49 types of construction products and they do not cover the materials for constructing the whole building and some of these are duplicated. In addition, there are certain information pending the study and being unable to disclose so the information deriving from these studies cannot be actually applied by architects or designers. In considering each group of researches, it is found that the researchers are interesting in studying the life-cycle assessment of alternative energy the most. This may be because of the lack of energy. In particular, Thailand has to import energy at the average increasing rate of 6% per year [13]. However, the environmental problems from construction of buildings seem to be more serious [16,17] because a building is a product requiring a lot of construction materials or raw materials for its production and each building has different particular nature. Understanding of construction materials and severity of environmental impact from each type of construction material partially helps the environmentally-friendly architectural design. Hence, the support of researching on construction materials and dissemination and promotion of the application of this information mainly help reduce the current environmental problems.

3.2. Details of information and existing research results

Details of each research are much different until they cannot be compared from the selection of study method. Although the same of life-cycle assessment principle is used, the selected environmental impact assessment methods are different such as EMERGY CML EDIP or TRACI. In addition, the system scopes and study units are also differently determined. Consequently, the information obtained cannot be compared to select the materials for construction of buildings for architects or designers. Furthermore, most of the researches have limitations in terms of database used...
for calculation as existing information is abroad so different databases are used for the same type of material as per opinions of the researchers. Even though the same principle is applied i.e. selection of information reflecting the factual condition the most [18,19].

The study result of each project is different. This can be seen that the existing information on construction materials is different, including environmental impact values and units although they are the same type of construction material. For example, the value from the assessment of environmental impact from cement 1 shows sulfur dioxide, nitrogen dioxide, carbon dioxide and carbon monoxide which are substances mainly causing the global warming from manufacturing one tone of cement, while cement 2 shows the study result by environmental impact so the users cannot use the existing values to make a comparison of materials during conducting a research. Although the presentation of values by environmental impact and the study scopes are similarly set, indifferent impact values are generated as to be explained in the following heading. This circumstance does not happen only with the researches in Thailand but in the product life-cycle assessment worldwide. For instance, from the life-cycle assessment of ceramic tiles according to the study of Berge [20] shows the global warming of 571 kgCO$_2$eq/Mg throughout its life cycle. However, the study scope in this document is not much clear. With reference to the study of Bribian and co-workers [21] with the assessment of environmental impact of building which ceramic tiles is its main component. The environmental impact values of the global warming from ceramic tiles are at 5.36 kgCO$_2$eq/Mg according to Bribian, 806 kgCO$_2$eq/Mg according to the database of Curran [22], 494 kgCO$_2$eq/Mg only in the ceramic tile production process according to the study of Remmerswaal [23], 16200 kgCO$_2$eq/Mg according to the study of Li and co-workers [24] of China, 706 kgCO$_2$eq/Mg according to Goldoni and Bonoli [25], and 1.07E-9 Pt/Mg according to Nicoletti [26]. With this reason, the environmental impact values are qualitatively improved such as sequencing by symbol or grouping by alphabet A, B, C, D for groups of construction materials generating the environmental impact from the least to top figures. However, with this grouping approach, the comparison of materials in detail cannot be made since if such materials are in the same group, they will be judged that they generate the similar value of environmental impact. This idea may cause an error in design.

### 3.3. Source of information difference

The difference of information deriving from the studies of environmental impact by the product life-cycle assessment have been mentioned since 1989 until present, and the researches and agencies have tried to analyze the cause of information difference. It can be summarized that the cause of this difference arises from parameters, scenario, model, researcher’s decision, sampling, estimation, uncertain database, lack of good related information, lack of actual representative information, error calculation system, complication of method, uncertainty due to unexpected event, change of price and change of raw material source [6,27,28]. This corresponds to the detailed information of the researches with different causes of problems i.e. different scope of research, different analysis method and lack of information.

With the aforesaid concepts, importance is first given to the causes from of being unable to control or difficult to examine such as error in the measurement or data collection method, error of measurement tool, evaluation of the researcher, error in data input, as well as uncertainty of the production process of operation. Secondly, the importance is given to the cause of complicated LCA process starting from the goal and scope setting i.e. difference determining the unit and function of such material, system scope, number of items and definitions of environment impact to be studied, study period, assumption and assessment method, as well as inventory analysis and impact assessment process. Thus, there is an effort to manage such uncertainty by making an examination. There are four approaches as summarized as follows: scientific approach or laboratory approach, constructivist approach, legal approach, and statistical approach. These are used for examination widely.

### 3.4. Problems and obstacles in researching

The interviews reveal that the major obstacles are lack of information for calculation of environmental impact values, both preliminary and secondary information, lack of study process, lack of analysis tool, expense and complicate method, which the government sector can provide assistance. This is in line with the study of Grant [17] that studies the uncertainty in the product life-cycle assessment process, finding that the major problem of LCA is that information used in calculation is inaccurate. Moreover, Sonnemann and Leeuw [29] studied the environment management in the developed countries and found that the selection of tools and management and analysis methods as well as accurate information mainly help the environmental management. This study points out that these factors are related to each other. Thus, the government sector or relevant agencies should diligently start planning the development of information on construction materials and give support and knowledge to the relevant parties in relation to provision
of information to ensure that they can conduct studies themselves. Additionally, the policy providing the direct support to the business operators should be drawn up instead of assigning the responsible to any agency for fast study process. In this respect, the government sector’s role will be changed to examiner of information and accuracy or provider or advisor only.

4. Conclusion

a) After collecting the researches in relation to the life-cycle assessment of construction materials in Thailand from educational institutions, research sponsors, government agencies, independent organizations and private entities, it is found that there are studies of 49 types of construction materials, but they cannot be applied for the assessment or comparison of materials used for building design because such information are incomplete and insufficient and do not cover the materials for a entire building.

b) The researches from each source are considerably different until no comparison can be made e.g. different study method. Although the same life-cycle assessment principle is applied, the environmental impact assessment method, system scope, study unit are different so the values or study results of individual projects are different. Thus, they cannot be compared for the purpose of selection of building construction materials by the architects or designers.

c) The most serious problem from doing researches on construction material life-cycle assessment is lack of accurate and complete information used for calculation of environmental impact values, both preliminary and secondary information. This results from the lack of knowledge on study process, lack of analysis tool, expenses and complicate method.

References


Abstract

The main purpose of this document is to analyze the influence of open spaces and sidewalks in elder's active living from how they consider and perceive pedestrian areas design; their social network and built environment, since this popular useful medium is their way of interaction with others when passing by, or have a certain kind of physical and social activity. Determine the need to apply a universal design strategy in our daily life environment specially those who links social and built environment like sidewalks/pedestrians, trials that form part of our daily life, also determine the barriers with its characteristics so changes can be achieve in our cities layout as an alternative to the actual problems and a more suitable living spaces can emerge, since for 2030 the statistics indicate that there is going to be 1,000 million of elderly people in the world. This document makes a description of the different aspects of Elders becoming a strong group in our society, their needs, barriers and elders active living in cities open spaces concluding to the fact of how a better built environment design helps maintain an active living among elders where a universal design strategy evolves into an Aged Friendly city acceptable environment. Elder's needs are all similar regarding culture or ethnicity, they can enjoy, and feel a stronger link to what is design keeping them integrated and active in neighborhoods and cities.

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Keyword: Aged-friendly; Friendly city; barriers; Sidewalks; pedestrians; elders

1. Introduction

The present study in sidewalks layout design in elders Active Living proposes an insight to different considerations that should be taken in sidewalks design to encourage and enhance the quality of aging persons in the (architecture) built environment [2]. Since developing countries are ageing at a much faster rate than developed countries. Within five decades, just over 80% of the world’s older people will be living in developing countries compared with 60% in 2005 and : (Figure 1) the number of people aged 60 and over as a proportion of the global population will double from 11% in 2006 to 22% by 2050 [1]. Including strategies used by different countries who integrate the World Health Organization and the Aged-Friendly City program; what is working, how is working and what should be apply in the near future respecting the universal design rules and strategies. However it is a very complicated task it requires comprehensive planning as well the removal of barriers that segregate older people and limit their activities (Figure 2). Senior Friendly urban planning has moved beyond health care to include neighborhood design and increasingly sophisticated conceptions of place, urban planners now emphasize the value of inclusive design for preserving heterogeneity in the community.[3]

The general purposes of this study are:

- Understand how planners/designers outdoor layouts must produce a better and more efficient, effective and responsible environments.
- Mark cultural differences to understand how they influence elders active living in the built environment
- Estimate barriers that elders might encounter in the actual built environment design
- Defining the new elderly generations as actives ones

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1.1 Statements and Issues

Although we know housing life style is very important for humans being comfort and development for such we know that elders feel safe in their homes. Their house is the place they recognize, they interact and know every detail, but when it comes to public spaces might not be the same way since they don’t know what kind of situations may encounter. So how has been the evolution of this age friendly social-spatial environment?

Elders who are as active as us, and use the same facilities as we do even using the new technologies such as internet, or moving around public transportation such as subways, or participating in social groups, or just transferring by walking from one space to other by sidewalks/pedestrian areas. How are the Social-spatial spaces layout plans around the cities working for the new elderly active generation? Does the built environment layout such as sidewalks or footpaths improve our wellbeing? How safe elders feel in narrow or no sidewalks neighbourhoods?

The benefits of Parks and other natural areas are well documented and researchers have begun to acknowledge the problems associated with access to and utilization of natural environment. In communities physically and psychologically they promote physical activity, improve users mood. Socially the may help to build social relationships between community members; aesthetically they give a prettier and healthier environment view. And environmentally they help with the absorption of CO₂ improving air quality, creates shade reducing building heating and its trees may be used as buffers for traffic, and so on. Does a green design pedestrian area, will have more influence on an elder to use it more often? Does it make a difference to elders a greener design sidewalk? Are elders able to socialize more in a better layout design area?

A neighbourhood environment can be made healthier for older adults by changing characteristics to increase activity, create a sense of community, and hence benefit wellbeing. They fall into 3 categories:

1. Functional place related wellbeing
2. Social Place related wellbeing
3. Emotional place related wellbeing

Are elders perceptions of pedestrian design positive and fulfill their desires? What are most common obstacles elders find in Taiwan’s pedestrians areas? Existing Pedestrian sidewalks conditions Satisfies elders?

Even thou aging is the main factor all over the world not in every city this group of people will choose to settle or live this part of their life in the same way. Elders values and customs or traditions will influence of how the adapt to this regulations that are being develop for them. So how does Social and cultural differences impact in the development of social-environment spaces?

1.2. Healthy City

The healthy cities approach a coalition of local governments and community organizations to address priority problems related with urban design, health and environment. Some things that the City Health Profile emphasis is on the communities life style, environmental and social factors in the city that affect its citizens health and wellbeing. It is important to get strengths and weakness of cities for them to improve, and one weakness identified was the difficulty cities experience in maintaining or keeping long term strategic Orientation. All profiles that were review included a structure content of the cities; its demography, health status lifestyle, socio-economic conditions, physical environments, inequalities, infrastructure, public health and services. (WHO Regional Office 1995)

Using architectural perspective and, emphasizing more in lifestyle, since spaces are created according to the needs of users. Physical Environment due to this has to be well preserved in order to achieve a better and healthier life since
everything starts with a well design concept that will be created in this environment, and infrastructure that’s is basically where all our different activities take place regardless if it is an outer or inner space.

A healthy city will be that one that will try to cover its population needs bringing them access to facilities that will improve their life style, will try to adopt a universal design concept where “all for one and one for all” will be apply and create a harmonious environment for its integrants.

1.3. Built Environment barriers among elders

It is state that walking within an urban community should be a pleasant and enjoyable experience for healthful exercise and relaxation on the way to work, shopping or other destinations. Instead pedestrians often encounter obstacles that might be unsafe and unpleasant due to the urban design and sometimes would prefer to stay at home, or just go out and walk when is just absolutely necessary and where there will be no other kind of transportation. This can affect significantly if we want our elders to still feel active and part of a community.

Studies involving older people demonstrate the need to improve the design of the built environment Factors of particular relevance to older people include pavement quality and ease of street crossing, mental health research also suggests that improvements in the built environment positively impact upon older people more than other demographic groups.

“Statistics in the United States register that nearly 40% of adults over age 65 have difficulty with physical movements (Altman and Bernstein 2008) . Twenty percent of the adult’s populations residing in the United States have a disability compared to the 51.8 % of those over the age of 65. (Braault 2008)” when the built environment is supportive, individuals can use the outdoors for multiple activities including exercise and utilitarian purposes also can find a better access to neighborhood facilities.

In the outdoor built environment problems with sidewalks, pavements, puddles and poor drainage were environmental barriers among people with visual and motor impairments. In a recent study, adults over age 65 with higher levels of mobility impairment reported less physical activity and higher mass index but were more able to do more physical activity for transportation when they lived in walk-able neighborhoods. And having sidewalks was associated with more physical activity, since older adults can have a safer and better access to the diverse of community spaces [27].

A recent review concluded that higher street connectivity, safe street and traffic conditions and proximity to destinations enhance mobility. Elders tend to feel unsafe while walking or wheeling in streets without sidewalks, and some of them or not even able to walk. Uneven sidewalks were tricky to navigate while using walkers, or sometimes were to narrow and the space that bikes left to pedestrians was not wide enough, or was not well from traffic. Having shelters available while waiting for buses or just for resting on local streets on trails was found to be important and were even demanded to be necessary. It has been shown that mobility barriers are related to daily activities limitations, and usually barriers tend to center around how the built environment impacted general mobility and ability to get to important places [27][30][31].

2. Research Methodology

Observation; monitor behaviour among older adults in these areas. Which are more transit by elders and see if I find a particular behaviour? Interview; with the help of translator request interviews with elders resident on the area. A group of 42 Taiwanese elders from an age range of 55 to 85 years old, from 2 different city areas one a commercial area ZhongXiao East Road surroundings and the other one is Heping East Road section 3 surroundings Residential area both Taipei Areas Da An District. Elders were asked their perception and comfort of the sidewalks design and their active living. While a deep interview with former expert employee of the NGO Fundacion Biosfera in sustainable development from the Plata Argentina branch was held in other to obtain information of an already existing Aged-Friendly city and their elders active living and culture, to establish a comparison between Taipei’s sidewalks and La Plata’s sidewalks design and life style, if they actually influence elder's life style activities. Analyzing case studies by comparing 2 Age friendly cities, one already accepted in by the WHO and other applying for the next review. Compare possible similar and different obstacles between La Plata (Argentina) and Taipei’s city pedestrian areas. Reviewed articles, surveys, Books, Newspaper articles, Web search, and Project developments results.

3. Taipei, Taiwan elders and walking environment

According to the United Nations, “an advanced age society” is one where the percentage of the population over 65 is higher than 7% by this definition, Taiwan became a society of advanced age in September 1993. The main reasons why Taiwan, as any other industrialized country, has meet a rapid growth of the elderly population are related with all
the changes in the family composition that these countries have experienced in recent decades. These changes can be measured in the higher divorce rate, decrease in fertility, delay in the first child, longer lifespan, and extension of the education and subsequent delay of emancipation of young people. This data has been recently presented by the Taiwan Directorate General of Budget and Statistics (DGBS), showing trends and presenting forecasts. 

"At the end of 2005, there were 2.22 million people over 65 in Taiwan, and by 2050 it will triple. Statistics show that younger generations will rely more than the older generations on the government as a substitute for their economic, material and even affective ones wellbeing." (according to social indicators 2008)

Taipei is a large city, after some research, interviews and observations, Taipei's citizens do walk but it is not a primary activity. A good advantage of living is such a busy city is the convenience of public transportation having the Metro Rail Transit (MRT) and bus to almost everywhere in the city, people is usually in a hurry to work, to school, to a date always in a rush and making this accessible makes people's life easier, with the lack of time, everything well sign it's just logical to take advantages to a well developed and modern city. Some of Taipei citizens even take a bus for just one stop, something that will take them around 5 to 10 minutes by foot. Elders do appreciate this advantages they have makes their life easier, but grand part Taiwanese older adults know that in order to continue enjoying a healthier life they should exercise, walking is one of those exercises that helps regulate your blood pressure while burning fat, not in great amounts but is a nice cardio one. It is nice to wake up at 5 in the morning in Taipei city and go out around the streets and roads with best facilities and wide sidewalks, about 80% of the people you can see walking are elders some of them alone, some of them look they are couples and others group of friends chatting while walking around. People do walk the best the neighbourhood facilities are the most of it the citizens will get and a comfortable environment will be establish.

4. La Plata, Argentina elders and walking environment

La Plata is the capital city of Buenos Aires Province, Argentina. Dardo Rocha its first governor founded La Plata in 1882, La Plata purpose was to host the provincial government institutions and a University, this city didn’t just emerge was planned by Petro Benoit (Argentine architect-urban planner). Benoit designed a city layout based on rational conceptions of urban centers. The city has a square shape with a central park and two main diagonal avenues (north-south and east-west), the design is copy in self similar small blocks of six by six blocks in length. Every six blocks you find a small park and besides the two main diagonals all the streets are divided in squares, this pattern goes all around the city. La Plata city fighting against hostile city environments for elderly people: In 2030 there is going to be 1,000 million of elderly people in the world. In Argentina people over 60 years old is already the 14% of the population that’s why all measurements should be taken since this moment. All the projections assure that this number will increase and by a psychiatric evaluation made from 1950 to 2050. The argentinians over 70 years old will be multiply 14 times more. 15% of the population is over 60 years old and 2.7% of the population is over 80 years old

The new elderly generations are active ones. We have to stop seeing them as cute passive grandpas. They are as active as we are the use the same facilities as we do and they try to even use the technology facilities to communicate with family such as cell phones or internet.

According to some statements, La Plata's sidewalk environment if suitable to all ages with more pros than cons. With a real safe environment compared to other cities in Argentina. People of La Plata like to spend their time outdoors, thou is different compared to other more live and colourful cities in Latin America. La Plata with its European environments tend for more intimate and calms gatherings in the outside which are found every few blocks in each community all around the city, its habitant tend to walk to the closest park or plaza to chat, drink Mate (traditional tea drink) and do some “asados” (traditional BBQ's). What people love most about the outdoor built environment is that mostly where they walk there are green passages that makes that transition from place to place more comfortable.

Even though there is high traffic La Plata's habitants feel comfortable walking in the city, since they feel sidewalks are wide enough, well sign although those signage are not big enough and persons with visual problems might have problems with it, some aspects of sidewalk is the furniture like trash cans, most of the sidewalks were with a width of 3.00 meters, and even in the some commercial areas, some roads have been closed and become part of the sidewalks for a better circulation and interaction of the users when it comes to community integration and active living this design characteristics influences in their social life, but not everything is perfect some cons are the lack of ramps that connect sidewalks to building, also it can be found some tiles from sidewalks coming apart or being out of place, all this can make those who suffer physical impairments getting into a building much harder and annoying, since might have to look down to see where you step instead of the nice green surroundings and limiting all activities they want to do by their own, becoming even more passive persons something that might affect their physical health for not exercising too much as their psychological health making them feel useless in daily life activities.
5. Discussion

When we think about elders and the influence sidewalks may have in them, we getting to this point so they can have a healthier and active life to enjoy themselves. The ways cities are design shouldn't limit elders to continue and even better encourage them to a diverse of activities. Since "Active living is a way of life that integrates physical activity into your everyday routines, such as walking to the store or biking to work. Active living brings together urban planners, architects, transportation engineers, public health professionals, activists and other professionals to build places that encourage active living and physical activity. One example includes efforts to build sidewalks, crosswalks, pedestrian crossing signals and other ways for children to walk safely to and from school, as seen in the Safe Routes to School program. Recreational opportunities (parks, fitness centers etc.) close to the home or workplace, walking trails and bike lanes for transportation also encourage a more active lifestyle. Active living is a combination of physical activity and recreation activities aimed at the general public to encourage a healthier lifestyle." Understanding active living and elders needs will help to design better spaces. According to different statements from elders they tend to appreciate more their surroundings and the details in everyday life environment.

5.1. La Plata and Taipei Elders active living

Since we are born we start to get active is our ways as human beings to discover the world we live in, is our way to display what is around us, our way to understand our surroundings, to learn what we need and obtain more knowledge to survive day to day; helping us keeping healthier and becoming smarter. That's why is indispensable to keep an active living and of course we do it differently depending on our age, physical strength and customs it is something that should never stop.

In this research focusing in the built environment sidewalk design influence among elders of two culturally different cities in different continents but with the older adult population increasing as a common factor, it has been notice that cultural background is important to design a better and functional public space. Taiwanese elders are more spiritual, they believe in the balance of forces and universe, with the idea that in order to keep that inner balance our body also has to be healthy. The use of open social spaces for them is to relax, connect with the nature forces through the practice of Taijiquan for example, they already served their society is time to enjoy, and part of that enjoyment is to keep themselves healthy. Most interviewers agree that the sidewalk built environment won't incentive them to walk more as exercise than what they do already due to they are older and don't have the strength to do it, but it is certain that the better the sidewalk layout design is, the more they are incentive to keep the routine, not increase but keep it since it will be more enjoyable and safe to walk in better design areas and the interaction with the outdoor environment will be easier link them to different possibilities and places of their neighborhood. As walking for exercise most of them spend 1 to 2 hours, but will feel nice to use sidewalks for their daily activities and for passive elders can increase their social life which will increase the feeling of a better life style since emotions can be fulfill and they can feel completely part of the society again. Considering those factors making changes on those navigation layouts that are not suitable or safe to walk can be the difference for several persons in their active and social life.

As La Plata goes older adults active living flows around their families and house chores. They do walk around the city, but different from Taiwan that older adults take walks as exercise in La Plata city is not the most common activity for elders. In La Plata elders do walk around their neighborhood since is easier to navigate it due to the nice diagonal grid design the city has. It's also easier rather than wait a while for a bus to pass by. Elders feel strong whenever their activities have to do with house chores or helping any of their family members. They feel useful regarding their age, sometimes when elders go to the market even thou sidewalks are wide enough to walk and have green landscaping, those features can give them shelter from the sun or enjoy a nice shadow during hot days. Elders encounter barriers with the materials the sidewalks are made off such as miss placed tiles, tree roots over the surface, and garbage, which makes the displacement annoying and dangerous if they do not walk carefully. Even elders who remain active in their home with their families there are a lot of them who are abandon at homes for (elders). They deserve better quality of life style within their built environment which can even influence them in do more outdoors activities instead of remain at their houses and just go out when they have to. Sometimes a city has all the characteristics and space to be plan well, friendly and intelligently which can influence and incentive everyone specially elder citizens to keep as much active as possible and independent, too bad this cities don't utilizes wisely all the resources they poses.

5.2 Elder's needs in the sidewalk building environment design

In both cities La Plata and Taipei older adults needs are similar, this is because we are all human beings and all our bodies suffer the same changes during all our time life cycle although some changes are more notorious depending on
the life quality elders had. It is important that all cities around the world acknowledge that aging is happening more and more elders live in the big cities and with medical advances that aloud people live a longer life, the design of the built environment also has to advance and improve.

Among both cities some of the elder needs will be:

1. Safe outdoor built environment from robbery but also safe paths that will protect from the traffic.  
2. Clear navigation systems to facilitate the displacement through their neighbourhoods.  
3. Non slippery sidewalk material 
4. Non misplace sidewalk material neither easily break sidewalk material.  
5. Furniture to rest among the most transit-able sidewalks  
6. Shelter sidewalks that will protect from nature  
7. Ramps that will make their transitions from space to space easier.

“Changes in level can cause ambulatory pedestrians to trip or catch the casters of a manual wheelchair, causing the chair to come to an abrupt stop. People who are blind or who have low vision might not anticipate changes in level such as a buckling brick sidewalk.” (Pedestrian Design Model Guidelines for San Diego, California U.S)

The following conditions may cause changes in level:
- Buckled bricks
- Cracks
- Curbs without ramps
- Drainage grates
- Grooves in concrete
- Heaving and settlement due to frost
- Lips at curb ramp frames
- Roots
- Small steps
- Tree grates
- Uneven transitions between streets, gutters, and ramps

All the above mention can influence of the different barriers that the elders will have, the most insignificant things can make big changes and alterations on the built environment, La Plata didn't pay attention to several of this issues, and bad maintain cause the flooding that happen in April of this year 2013 be more severe than what it should, dealing with many elders broken hearts of all the memories they had lost and things that remember all the way through life. The building environment can have major impact in life, and for elders can even lead to a sedentary life where they don't fill comfortable walking in their neighbourhood sidewalks.

6. Conclusion

After the different discussions and interviews on elders feelings about the sidewalk design in their neighbourhoods, it is stated that walking with in an urban community should be a pleasant and enjoyable experience for healthful exercise and relaxation on the way to work, shopping or other destinations. Instead pedestrians often encounter obstacles that might be unsafe and unpleasant due to the urban design and sometimes would prefer to stay at home, or just go out and walk when is just absolutely necessary and where there will be no other kind of transportation. This can affect significantly if we want our elders to still feel active and part of a community.

The built environment are all those spaces design to protect people from nature, held different activities, work or just beautify the present environment, in order to develop, obtain comfort and leisure. In other words spaces built and design for a better life quality. As a designer we need to ensure the space that is being design has a homogenous interaction between people and space and vice versa.

When we design a space maybe the first thing we think of is "happiness". Everyone should be pleased with space functions. When we think about life style we often want to have more of it, more often. Or maybe it reminds us of remodeling and restructuring life, changing everything around. Thinking lifestyle design could even bring up images of your perfect self – the happiest, healthiest, most successful and educated and productive ‘you’ you could be. We should always find a balance between, to cover everyone's needs. Usually simplistic will cover most people needs doesn't matter the age. Especially for children or older adults that will have problems with real complex designs. The better an outdoor environment is design the better will be for and it will suit everyone, and for elders maintain an active life style, since for them the spaces where their activities are held also affect them emotionally, all of this is important when an Aged-friendly city is emerging. Since its goals it's to satisfy everyone's needs. Sidewalks and open spaces make a difference in elders life, they are the spaces that links them to what is in the world to enjoy, and to keep learning and
enriching their soul. An improved and well-maintained sidewalk can lead elders to a better life style in their surroundings since they tend to be more aware of what is around them and details. When elders encounter a green sidewalk, well maintained, with shelter and rest able furniture they change their routes and transit by this paths.

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Landscape Infrastructure as Strategy in the Design of Transport Infrastructure.
Case study: Surabaya and Malang, Indonesia

Subhan Ramdlani, a

Abstract

Transportation has been recognized as one of the indicators of the sector was instrumental in the development of the city. However, the development of transport was found to have an impact on the environment in spatial and temporal coverage of large (Rini, 2005). The impact of high transportation movement, resulting in high usage vehicles contributes to air pollution, thermal energy (temperature) and noise (Soedomo, 1999). In Indonesia, station, airport, terminal and other public transport infrastructure, has a noise level up to 70 dB (SK.MLH 24/11, 1996). The new urban design based on Landscape Infrastructure is one strategy that expands the performance parameters of a designed landscape to a multi-functional, high performance system, including those originally ascribed to traditional systems infrastructure. Thinking in terms of Landscape Infrastructure adds multiple additional benefits to traditional infrastructure: city beautification and re-vegetation/forestation; water and energy conservation; restoration of natural systems; storm water management; energy farming; wildlife habitat expansion; favored pedestrian use; and expanded park land and open space built in neglected segments of existing urban infrastructure (Aquino, 2011). This paper will discuss when and how to optimize the landscape infrastructure for the urban transport infrastructure design to minimize air pollution, noise and energy conservation in case of transport infrastructure in Surabaya, Indonesia.

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Keyword: Landscape Infrastructure; transport infrastructure

1. Introduction

There are differences between the designs of eco-conscious city infrastructure with traditional city in general. Traditional city infrastructure generally incorporates transportation and communications systems, as well as water and power lines, and other utilities and structures. While the city is looking at the infrastructure part of the urban design, landscape looked Infrastructure as a methodology that expands the performance parameters of a designed landscape to a multi-functional, high performance system. Including those originally ascribed to traditional systems infrastructure. In general, traditional urban design is oriented towards building massing and grids. Urban design based on principles of Landscape Infrastructure is focused on landscape-based integration of the built and natural environments-seeking out opportunities for building innovative nature and public amenities into the infrastructure of a city. (Aquino, 2011).

Nomenclature

SK.MLH: Surat Keputusan Menteri Lingkungan Hidup/Decree of the Minister of Environment

1.1. Landscape Infrastructure

Initially, infrastructure landscape understood as a fundamentally relational concept including both “boundary objects” and “passagepoints” (Boris, 2009). Due this concept following the Star (Star & Ruhleder, 1996) instead of seeing landscape Infrastructure as a substrate for other things it needs to be seen as a substance in itself, with its own experiential qualities based on time and engagement in different landscape situations. Thus Landscape emerges infrastructure through practice by being connected to different

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forms of activity. It was concerned about of "the spatial negotiation" between city and landscape likewise suggested the potentiality in introducing, thus the forest and the forested geina Fragmented Urban Landscape (Sieverts, 2008).

On the other side, in the development of the urban environment, foresting the city has to be one alternative to improve the quality of life the building environments via the ecosystem services provide and psychosocial restoration (Staley, DC2009). The majority of formal cost-benefit analyzes finds that the urban forest benefits exceed their costs, sometimes substantially. For example, urban forest slow traffic thereby improving roadway safety, intercept and absorb gaseous particulate air pollution, surrounding areas and buildings cool by shading room evapotranspiration and also reduces low-level ozone and smog formation, as well as the increase of pavement longevity. Urban forests intercept and a slow precipitation roommate reduce storm water peak flow and soil erosion. Urban forests also increase of residential and commercial property values and improve business performance in well-landscaped areas. Built environments would be far less desirable urban forest without (Staley, 2012).

From that all frames of reference, landscape infrastructure, is not altogether new, but is definitely one of the more emerging ideas within landscape architecture and urban design. And it is not limited to the area between city and landscape. He thrives in the context of the city's infrastructure to better serve the environment better quality. Thinking in terms of Landscape Infrastructure adds multiple additional benefits to traditional infrastructure: city beautification and re-vegetation/forestation; water and energy conservation; restoration of natural systems; storm water management; energy farming; wildlife habitat expansion; favored pedestrianuse; and expanded park land and open spacebuild in neglected segments of existing urban infrastructure. Landscape Infrastructure can transform urban blight into urban destination. It can help to create an iconic identity for a city based on the city's latent natural and cultural features. (Aquino, 2011)

1.2. Transport Infrastructure’s problem

Table 1 Characteristics of the Service Level Road in Surabaya city (source :Surabaya Transportation Dept., 2011)

<table>
<thead>
<tr>
<th>Street</th>
<th>V/C Ratio</th>
<th>Road Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jalan Urip Sumohardjo</td>
<td>1.08</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Raya Darmo</td>
<td>0.70</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Diponegoro</td>
<td>0.83</td>
<td>Primary arterial</td>
</tr>
<tr>
<td>Jalan Kusunabangsa</td>
<td>0.74</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Yos Sudarso</td>
<td>0.76</td>
<td>Secondary Collector</td>
</tr>
<tr>
<td>Jalan Basuki Rahmad</td>
<td>0.99</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Gubeng Pojok</td>
<td>0.95</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Gemblongan</td>
<td>0.75</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Pemuda</td>
<td>0.60</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Pasar Kembang</td>
<td>0.75</td>
<td>Primary arterial</td>
</tr>
<tr>
<td>Jalan Kedundoro</td>
<td>0.40</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Raya Gubeng</td>
<td>0.46</td>
<td>Secondary arterial</td>
</tr>
<tr>
<td>Jalan Panglima Sudirman</td>
<td>0.87</td>
<td>Secondary arterial</td>
</tr>
</tbody>
</table>

Around the world, the transport sector plays a crucial and growing role in world energy use and emissions of Green House Gasses (GHGs). To 2004, transport energy use amounted to 26% of total world energy use and the transport sector was responsible for about 23% of world energy-related GHG emissions (IEA, 2006b). Meanwhile, one of the main problems in the transport system in big cities in Indonesia, such as Jakarta, Surabaya is the mixing of all kinds of vehicles (light cars, trucks, motorcycles, and even rickshaws etc.) As well as a wide range of activities (park, street vendors, pedestrians etc) further adding to the burden. According Morlok (1999), the movement patterns of
traffic flow influenced the vertices of the city itself and the activities of the nodes in the vicinity of the city, all of which are traffic generation. To describe the traffic density on the roads in the city of Surabaya, it can be seen from the many volumes of traffic with a high V/C ratio (degree of saturation) are higher as well. A high degree of saturation resulted in low vehicle speeds and reduced level of service.

1.3. Noise level

Noise can be defined as unwanted sound shape or form sound that does not fit with the place and time. Within the Decree of the Minister of Environment no. KEPL.48/MENLH/11/1996 on Raw Noise, noise is defined as unwanted soundout of business or level of activity within a certain time and can cause human health problems. And noise caused by transport is also a problem in the context of a comfortable environment. In the classification of noise sources, transportation infrastructure such as airports, terminals and stations had the highest noise position.

Table 2. Noise levels according to SK. MLH no 48/11/1996

<table>
<thead>
<tr>
<th>No.</th>
<th>Zonedesignation</th>
<th>Noise Level (dBA)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Settlements</td>
<td>55</td>
</tr>
<tr>
<td>2</td>
<td>Trade and services</td>
<td>70</td>
</tr>
<tr>
<td>3</td>
<td>Office complex</td>
<td>65</td>
</tr>
<tr>
<td>4</td>
<td>Green Open space</td>
<td>50</td>
</tr>
<tr>
<td>5</td>
<td>Industry</td>
<td>70</td>
</tr>
<tr>
<td>6</td>
<td>Government and public facilities</td>
<td>60</td>
</tr>
<tr>
<td>7</td>
<td>Recreation</td>
<td>70</td>
</tr>
<tr>
<td>8</td>
<td>Airports, train stations, ports</td>
<td>70</td>
</tr>
<tr>
<td>9</td>
<td>Cultural heritage</td>
<td>60</td>
</tr>
<tr>
<td>10</td>
<td>Hospitals</td>
<td>55</td>
</tr>
<tr>
<td>11</td>
<td>Schools and the like</td>
<td>55</td>
</tr>
<tr>
<td>12</td>
<td>Places of worship and the like</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 3. Regulation of the Minister of Health No. 781/MENKES/XL.1987

<table>
<thead>
<tr>
<th>Zone</th>
<th>Function</th>
<th>Max Limit (dBA)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Recommended</td>
<td>Be Allowed</td>
</tr>
<tr>
<td>A</td>
<td>Hospital</td>
<td>35</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Research/ lab</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Settlement</td>
<td>45</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>School</td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Offices</td>
<td>50</td>
<td>60</td>
</tr>
<tr>
<td></td>
<td>Trading, market</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>Industry, Fabric</td>
<td>60</td>
<td>70</td>
</tr>
</tbody>
</table>

One of the results of measurements of railway noise level staken at 5 different points is 10 m, 20 m, 30 m, 40 m and 50 min one of the railway lines in Surabaya, found that high noise levels at all points and frequencies (Mayangsari, 2009).
Table 4. Value of Transmission Loss (TL) in railway lines Surabaya

<table>
<thead>
<tr>
<th>Distance</th>
<th>SPLmax (dBA)</th>
<th>TL (SPLmax-55dB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>10</td>
<td>92.76</td>
<td>37.76</td>
</tr>
<tr>
<td>20</td>
<td>85.91</td>
<td>30.91</td>
</tr>
<tr>
<td>30</td>
<td>84.71</td>
<td>29.71</td>
</tr>
<tr>
<td>40</td>
<td>82.86</td>
<td>27.86</td>
</tr>
<tr>
<td>50</td>
<td>81.01</td>
<td>26.01</td>
</tr>
</tbody>
</table>

Note: SPL = sound pressure level; TL = Transmission Loss (Source: Mayangsari, 2009)

With Nomograph method can accurately demonstrate sound pressure level reduction to obtain the desired level of noise by the barrier material. Nomograph method can measure the barrier material that will be used based on the value of transmission loss. With the largest value of transmission loss, the biggest barrier resulting mass is 549.16kg/m. This value is then used as a reference to determine the materials as well as the width of the barrier. The best results of this measurement of the resulting barrier material are brick with 19-23kg/m²/cm density and thickness of 23.88cm-28.9cm (Mayangsari, 2009).

1.4. Emission Level

Air pollution index (Pollution Standard Index) in Surabaya continues to increase along with the increase in the number of vehicles increased 6-fold in two years (BPS Surabaya, 2012). PSI value for the pollutant NO₂ at 15, more than 8.85 normal limits. Relationship with the number of vehicles increased pollutant NO₂ is described Walsh (1996), which the number of vehicles increased 2.5 times would be followed by an increase 1.5 times in pollutant NO₂.

The highest source of air pollution is motor vehicles, in addition to industry and households. So the transport infrastructure such as terminals and stations has an important role in reducing the pollution levels. The largest Bus Terminal "Purabaya" in Surabaya has the largest concentration of particulate matter up to 431.481 μg/m³ (Adib, 2006), especially in the departure area. In addition to the number and physical condition of the vehicle, infrastructure design factor that responds to the source of these pollutants is an urgent need. Various attempts were made, including the use of vegetation, but improper use causes this step was less effective.

1.5. Temperature Level

![Fig.1 average temperature level around station](image-url)
The interesting results obtained from measurements of the temperature level in the area around the stations in Malang, which is shown to be affected by the city parks in front of the station. Malang station have a uniquely design with city parks in front of it. It influence show the station responds to environmental conditions. Concrete data that appears is the temperature change level along the corridor and stations throughout the park. Despite the temperature along the east side (near the station) was increased, but the average temperature is stable and approaching the pedestrian temperatures, even though not as low as the city park temperature.

2. Methodology

Application of landscape infrastructure strategies, starting with measuring the noise and the emission levels in the transport infrastructure. The high level of noise and exhaust emissions will determine the landscape strategy that will be used. Quantitative description would indicate ecological landscape. Quantitative data on urban transport conditions can describe the importance of landscape functions. Transmission of data loss or emission level of transport infrastructure resulting in the barrier models compared with analysis of pollution levels, and the noise of the city. The suitable barrier models are connected to the city infrastructure model. In urban context, the infrastructure has connectivity with every activity centers.

![Diagram of landscape infrastructure as connectivity between transport infrastructure and urban infrastructure](image)

3. Discussion

Based on the above illustrate, it can be discussed that transport infrastructure plays an important role in the decrease in temperature and an increase in the quality of the city environment. Transport infrastructure is a useful public facility as a transportation hub, and one of the biggest sources of pollution. There are two important points in the transportation, the transport hub and the connector between it. The biggest problems with the both of them are the high pollution and noise. Moreover, the number and type of vehicles are not all worthy of carbon emissions. The crowded streets with vehicles has been known as a source of pollution, whereas a transport hub not recognized as a source of pollution inhaled by dozens of passengers even there. In some big cities in Indonesia such as Yogyakarta, the results of the air quality around the train station and terminal in 1992 showed air quality has declined, the average dust concentration 699 μg/m³, SO₂ concentration of 0.03 to 0.086 ppm, levels NO₂ levels of 0.05 ppt and 0.35 to 0.68 ppt for HydroCarbon.

3.1. Urban Design Landscape

It’s most needed based urban design landscape, landscape infrastructure in particular. In general, to solve problems of air pollution and noise caused by vehicles, can be done with the appropriate technology, the use of sound reduction and 3R. (Sadrajat, 2010). Noise and pollution can be controlled by way of:

- Using tools that lower the noise of issuance.
- Uses a less noisy way management.
- Selection of materials that reduce noise.
- Planting silencers fence and plant (plants only reduce noise up to 2.23dB (A) and this value is still much lower than the wall can reduce 6.59dB (A).
- Maintenance and Good Housekeeping to the equipment.
Landscape infrastructure is one way to control these two problems. Utilization of infrastructure landscape can be done along the hub / railway or on point either at rail station or terminal.

However, completion of landscaping in transportation design is not that easy. Precise measurement of noise at different points needs to be made. Jam to determine the appropriate barrier material, suitable landscaping materials to absorb emissions is also absolutely necessary. Some vegetation suitable for the absorption of emission can be utilized. Not only the material, the use of open space for air circulation and reduce both building parts around and in the building itself becomes a consideration in processing landscape.

3.2. Expanded Park Land and Open space

Limitations of land on the design of transport infrastructure in the town center, takes a brilliant idea to address the needs of cooling temperatures and overcome noise and air pollution. Most likely in an effort to expand the park around that is within the scope of the transportation center. This also creates an open space for social interaction and culture of local communities. Parks should not only as an aesthetic property that fills the empty space, but the ecological functions and the buildings meet the needs of the passengers.

The latest design of the bus terminal in Surabaya includes elements of the park in every area, both arrival and departure, as the park expanded to passengers. But this is not optimal as open space because of the general condition of the vehicle that are not worthy as producer of carbon emissions.
3.3. Restoration of Natural System

Utilization of infrastructure landscape in the design of transportation infrastructure will indirectly maintain and restore natural systems in the transportation hub. The point where the build up of vehicle exhaust would be offset by the use of plant, noise barrier material, optimum air circulation and open space as a public space that brings together the interests of passengers in a sustainable transport system.

4. Conclusion

A powerful strategy for reducing the environmental impact of transport infrastructure is a comprehensive implementation of the infrastructure landscape and blend with the buildings and environment. Not only are the aesthetic properties but also ecological functions. Various advantages will be gained by the application of landscape infrastructure, among others; city beautification and re-vegetation/forestation; water and energy conservation; restoration of natural systems; storm water management; energy farming; wildlife habitat expansion; favored pedestrian use; and expanded park land and open space built in neglected segments of existing urban infrastructure.

The application will continue to be the development a compact, which would reduce the development footprint and noise impacts on transportation infrastructure. By utilizing a small space transportation, high density urban centers, and the road system is connected, will deliver a downtown urban desired.

Acknowledgements

The authors would like to thank the department of transportation and local authorities in Purabaya Surabaya Bus Terminal and Pasar Turi Surabaya Train Station, for the permission to conduct the survey in both places.

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On the Sustainable Management and the Reuse Strategies of Taiwanese Elementary Schools

Trai-shar Kao, Hui-fen Kao, Yi-jen Tsai, Chung-chien Tsai

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National Museum of Natural Science, Taichung, Taiwan
National Taipei University, Taiwan
National Taiwan Normal University, Taipei, Taiwan.

Abstract

The issue of abolished schools is found in many countries, and there are also quite some vacant spaces found in the elementary schools in Taiwan. What are Taiwan’s actions and strategies addressing to this issue? What functions can the school vacant spaces have to serve for the public’s good and for sustainable development? How well the school-community relationship developed in the practice? Based on the notion of reuse of school vacant spaces, this study evaluates the current development of some vitalization projects through their occupants of school teachers, students, and community residents (school volunteers included). The findings are as follows: 1. Reuse of vacant spaces would help school in its sustainable management, 2. Reuse of school vacant space can strengthen community relations, 3. There was a significant difference between teachers’ and community residents’ awareness of school sustainability and community relations. From the results some suggestions are proposed for further study.

1. Introduction

Since 2003 Taiwan’s Ministry of Education (MOE) have advocated some programs for reuse of the vacant spaces in schools. From 2008 on, the MOE of Taiwan has sponsored 100 schools each year for developing their distinguishing features by using their vacant spaces. Several studies on this theme have found that the priority of the reuse of school vacant spaces is mainly on sustaining school’s educational function and on meeting school’s need satisfaction. However, only to establish the partnership of school and community can the maximum efficacy of school resources be found. Thus, this study is to: Investigate the outcome of the transformation of the school vacant spaces by using post-occupancy evaluation (POE) Compare the difference between school teachers and community residents of their perceptions of the vitalization of school vacant spaces, school sustainable management, and community relations. Explore the correlation between school sustainable management and community relations.

2. Literature Review

Integrate and share resources between school and community can create a symbiotic relationship. In such a model, both school and community are resource suppliers, partners, and customers to each other. The post-occupancy evaluation (POE) is an objective systematic approach to evaluate the usage of a construction or environment. Through measuring user’s satisfaction and attaching importance to the designed and constructed environment to improve environment quality. In other words, the post-occupancy evaluation is a kind of self-reflection endeavor (Preiser, 2002; von Ahlefeld, 2009).

A questionnaire was developed for this study based on the Elementary School Post-Occupancy Evaluation by the Council of Educational Facility Planners International, CEFPI (2005) and an international pilot project on the quality of educational space by the Centre for Effective Learning Environment, CELLE (2009).

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Keyword: sustainable management, vacant school space, school-community resources sharing
3. Methods

3.1. Fields and Subjects

Two schools located in suburban of Taipei are selected as cases for comparison. One school has 54 classes, the other has 37 classes. They are identified with school features and they have vacant spaces in their schools. The subjects are the schools’ students from 3 to 6 grades (with 5 for each grade), teachers and school administrators, and local community residents (including school volunteers).

3.2. Research Instrument

A questionnaire was developed for this study based on the Elementary School Post-Occupancy Evaluation by the Council of Educational Facility Planners International, CEFPI (2005) and an international pilot project on the quality of educational space by the Centre for Effective Learning Environment, CELLE (2009). And some items related to school sustainable management and community relationship were added to complete the questionnaire of “Reuse of vacant spaces in elementary schools and the sustainable school management and their community relationship”. Five points Likert scale was designed to explore subjects’ perception. 12 professional experts were invited to examine the items of the questionnaire as well as interview outlines for content validity. Coefficient reliability is .8830 for the subscale of post-occupancy, .9251 for school sustainable development and community relationship, and .9260 for complete scale.

4. Findings and Discussion

4.1. Case of ST school

The questionnaire distributed to ST school includes 80 copies to teachers, 180 copies to students of 3 to 6 grades, and 50 copies to community residents (including school volunteers). The valid questionnaire are 58 copies from teachers with response rate of 72.5%, 124 copies from students with rate of 70.5%, and 48 copies from community residents with rate of 96.0%. The data are analyzed as follows:

1. POE survey from teachers

<table>
<thead>
<tr>
<th>Forms of reuse</th>
<th>Accessibility</th>
<th>Large spaces</th>
<th>Full equipped</th>
<th>Comfort</th>
<th>Safety</th>
<th>Maintainable</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toy library</td>
<td>M  4.00</td>
<td>SD .84</td>
<td>M 3.09</td>
<td>SD .93</td>
<td>M 3.53</td>
<td>SD .76</td>
<td>M 3.31</td>
</tr>
<tr>
<td>Toy plant</td>
<td>M  4.05</td>
<td>SD .73</td>
<td>M 3.18</td>
<td>SD .90</td>
<td>M 3.71</td>
<td>SD .61</td>
<td>M 3.34</td>
</tr>
<tr>
<td>Senior learning center</td>
<td>M  4.30</td>
<td>SD .57</td>
<td>M 3.10</td>
<td>SD .72</td>
<td>M 3.85</td>
<td>SD .75</td>
<td>M 4.10</td>
</tr>
<tr>
<td>Art &amp; culture place</td>
<td>M  3.50</td>
<td>SD 1.06</td>
<td>M 3.79</td>
<td>SD .58</td>
<td>M 3.37</td>
<td>SD .85</td>
<td>M 2.86</td>
</tr>
<tr>
<td>Physical fitness place</td>
<td>M  3.66</td>
<td>SD .85</td>
<td>M 3.89</td>
<td>SD .83</td>
<td>M 3.61</td>
<td>SD .72</td>
<td>M 3.36</td>
</tr>
<tr>
<td>Experience farm</td>
<td>M  4.50</td>
<td>SD .58</td>
<td>M 3.92</td>
<td>SD .78</td>
<td>M 3.96</td>
<td>SD .70</td>
<td>M 3.96</td>
</tr>
<tr>
<td>Butterfly &amp; ecology garden</td>
<td>M  4.26</td>
<td>SD .69</td>
<td>M 3.95</td>
<td>SD .66</td>
<td>M 3.82</td>
<td>SD .61</td>
<td>M 3.87</td>
</tr>
</tbody>
</table>

Note: numbers inside shades are higher means, numbers in bold font are lower means.

In this study there are six dimensions to estimate degree of satisfaction on the reuse of school vacant spaces. Six dimensions are: accessibility, large spaces, full equipped, comfort, safety and maintainable. In the case of ST school, there are seven reuse forms of vitalized environments: toy library, toy plant, senior learning center, art and culture place, physical fitness place, experience farm, and butterfly & ecology garden. The mean scores, from high to low, of teacher’s satisfaction to the vitalized environments are: experience farm (M=4.20), senior learning center (M=4.10), butterfly & ecology (M=4.00), toy plant (M=3.89), physical fitness place (M=3.66), toy library (M=3.59) and art
The mean scores, from high to low, of student’s satisfaction to the vitalized environments are: physical fitness place (M=4.28), toy plant (M=4.26), experience farm (M=4.22), butterfly & ecology (M=4.20), senior learning center (M=4.17), art & culture place (M=4.10), and toy library (M=4.08).

Table 2 POE survey from students from ST school (N=124)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Accessibility</th>
<th>Large spaces</th>
<th>full equipped</th>
<th>comfort</th>
<th>safety</th>
<th>maintainable</th>
<th>satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toy library</td>
<td>3.75</td>
<td>1.21</td>
<td>4.06</td>
<td>.88</td>
<td>3.89</td>
<td>1.01</td>
<td>3.63</td>
</tr>
<tr>
<td>Toy plant</td>
<td>3.65</td>
<td>1.22</td>
<td>3.89</td>
<td>1.15</td>
<td>4.12</td>
<td>.96</td>
<td>3.89</td>
</tr>
<tr>
<td>Senior learning center</td>
<td>3.68</td>
<td>1.33</td>
<td>4.14</td>
<td>.93</td>
<td>4.16</td>
<td>.89</td>
<td>3.93</td>
</tr>
<tr>
<td>Art &amp; culture place</td>
<td>3.40</td>
<td>1.22</td>
<td>4.14</td>
<td>.88</td>
<td>3.96</td>
<td>1.01</td>
<td>3.47</td>
</tr>
<tr>
<td>Physical fitness place</td>
<td>3.67</td>
<td>1.22</td>
<td>4.32</td>
<td>.84</td>
<td>4.25</td>
<td>.88</td>
<td>3.51</td>
</tr>
<tr>
<td>Experience farm</td>
<td>3.78</td>
<td>1.19</td>
<td>4.38</td>
<td>.82</td>
<td>4.16</td>
<td>.95</td>
<td>3.93</td>
</tr>
<tr>
<td>Butterfly &amp; ecology garden</td>
<td>3.78</td>
<td>1.20</td>
<td>4.23</td>
<td>.79</td>
<td>4.05</td>
<td>.89</td>
<td>4.06</td>
</tr>
</tbody>
</table>

Note: numbers inside shades are higher means, numbers in bold font are lower means.

3. POE survey from community residents (school volunteers included)

The mean scores, from high to low, of student’s satisfaction to the vitalized environments are: toy library (M=4.11), experience farm (M=4.08), both toy plant and senior learning center (M=4.07), butterfly & ecology (M=3.89), physical fitness place (M=3.78), and art & culture place (M=3.73).

Table 3: POE survey from community residents from ST school (N=48)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Accessibility</th>
<th>Large spaces</th>
<th>full equipped</th>
<th>comfort</th>
<th>safety</th>
<th>maintainable</th>
<th>satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toy library</td>
<td>4.15</td>
<td>.67</td>
<td>3.71</td>
<td>.65</td>
<td>3.68</td>
<td>.62</td>
<td>3.67</td>
</tr>
<tr>
<td>Toy plant</td>
<td>4.32</td>
<td>.56</td>
<td>3.88</td>
<td>.82</td>
<td>3.77</td>
<td>.72</td>
<td>3.51</td>
</tr>
<tr>
<td>Senior learning center</td>
<td>4.12</td>
<td>.54</td>
<td>4.02</td>
<td>.46</td>
<td>3.84</td>
<td>.57</td>
<td>3.81</td>
</tr>
<tr>
<td>Art &amp; culture place</td>
<td>3.53</td>
<td>.83</td>
<td>3.58</td>
<td>.64</td>
<td>3.50</td>
<td>.91</td>
<td>3.24</td>
</tr>
<tr>
<td>Physical fitness place</td>
<td>3.46</td>
<td>.77</td>
<td>3.78</td>
<td>.42</td>
<td>3.78</td>
<td>.48</td>
<td>3.58</td>
</tr>
<tr>
<td>Experience farm</td>
<td>4.36</td>
<td>.54</td>
<td>4.08</td>
<td>.62</td>
<td>4.08</td>
<td>.62</td>
<td>3.85</td>
</tr>
<tr>
<td>Butterfly &amp; ecology garden</td>
<td>4.00</td>
<td>.61</td>
<td>4.00</td>
<td>.51</td>
<td>3.84</td>
<td>.49</td>
<td>3.89</td>
</tr>
</tbody>
</table>

Note: numbers inside shades are higher means, numbers in bold font are lower means.

4. Comparison of awareness from teachers and community residents (school volunteers included)

The vitalization of school vacant spaces is of great benefit to school sustainability and community relations. Can the occupants recognize these advantages/indicators? A comparison shows that there is no significant difference
between ST school teachers and community residents for their awareness of these advantages. After analysis all the mean scores are greater than 4 points from a 5-point scale, which suggests both school teachers and community residents possess positive perceptions to the vitalized school vacant spaces (Table 4).

Table 4: Comparison of awareness toward ST school sustainability and community relations

<table>
<thead>
<tr>
<th>Advantages/indicators</th>
<th>Subjects</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teachers</td>
<td>Community residents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>School Sustainability</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovate curriculum &amp; teaching</td>
<td>4.17</td>
<td>.53</td>
<td>4.07</td>
<td>.62</td>
<td>.93</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Facilitate school transformation</td>
<td>4.09</td>
<td>.60</td>
<td>4.11</td>
<td>.64</td>
<td>-1.8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Support school in sustainability</td>
<td>4.17</td>
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<td>4.17</td>
<td>.57</td>
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</tr>
<tr>
<td>Community Relations</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>enhance community residents</td>
<td>4.05</td>
<td>.63</td>
<td>4.09</td>
<td>.59</td>
<td>-29</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>friendly relations</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>care the health of the senior</td>
<td>4.12</td>
<td>.62</td>
<td>4.11</td>
<td>.60</td>
<td>.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>strengthen the connection of school-community</td>
<td>4.26</td>
<td>.58</td>
<td>4.24</td>
<td>.60</td>
<td>.18</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>assist in community management</td>
<td>4.14</td>
<td>.58</td>
<td>4.22</td>
<td>.59</td>
<td>.11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2. Case of KK school

The questionnaire distributed to KK school includes 73 copies to teachers, 156 copies to students of 3 to 6 grades, and 55 copies to community residents (school volunteers included). The valid questionnaire are 55 copies from teachers with response rate of 75.3%, 136 copies from students with rate of 87.2%, and 47 copies from community residents with rate of 85.5%. Data collected from KK school are analyzed as follows:

1. POE survey from teachers

Table 5: POE survey from teachers from KK school (N=55)

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Accessibility</th>
<th>Large spaces</th>
<th>full equipped</th>
<th>comfort</th>
<th>safety</th>
<th>maintainable</th>
<th>satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forms of reuse</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>Art gallery</td>
<td>4.30</td>
<td>.77</td>
<td>3.48</td>
<td>.91</td>
<td>3.52</td>
<td>.76</td>
<td>2.97</td>
</tr>
<tr>
<td>Story room</td>
<td>3.90</td>
<td>.57</td>
<td>4.20</td>
<td>.63</td>
<td>3.60</td>
<td>.70</td>
<td>3.70</td>
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<tr>
<td>English activity room</td>
<td>4.31</td>
<td>.48</td>
<td>4.23</td>
<td>.60</td>
<td>3.15</td>
<td>.90</td>
<td>3.85</td>
</tr>
<tr>
<td>Little lamb &amp; ecology park</td>
<td>3.53</td>
<td>.63</td>
<td>3.40</td>
<td>.67</td>
<td>3.23</td>
<td>.63</td>
<td>3.60</td>
</tr>
<tr>
<td>After school classroom</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Room for continuing education programs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>English classroom for community</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Local language classroom</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: numbers inside shades are higher means, numbers in bold font are lower means, and no number appearing signifies the environments that teachers did not use.

In the case of KK school, there are eight forms of reuse of its vacant spaces: art gallery, story room, English activity room, little lamb & ecology park, after school classroom, room for continuing education programs, English classroom for community, and local language classroom. However, the school teachers used only four of them. The teachers’ satisfaction to them with mean score from high to low are: story room (M=3.90), art gallery (M=3.73),
English activity room (M=3.62) and little lamb and ecology park (M=3.50) as on Table 5.

2. POE survey from students

There are six vitalized school vacant spaces used by the KK school students: art gallery, story room, English activity room, little lamb & ecology garden, after school classroom, and local language classroom. Table 6 shows the students’ satisfaction to the six vitalized environments with mean score from high to low: English activity room (M=4.51), story room (M=4.38), little lamb and ecology park (M=4.33), art gallery (M=4.28), after school classroom (M=4.20), local language classroom (M=4.16).

Table 6: POE survey from students from KK school (N=136)

<table>
<thead>
<tr>
<th>Forms of reuse</th>
<th>Accessibility</th>
<th>Large spaces</th>
<th>Full equipped</th>
<th>Comfort</th>
<th>Safety</th>
<th>Maintainable</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art gallery</td>
<td>4.16</td>
<td>.96</td>
<td>4.23</td>
<td>.88</td>
<td><strong>4.04</strong></td>
<td>1.00</td>
<td><strong>3.73</strong></td>
</tr>
<tr>
<td>Story room</td>
<td><strong>4.07</strong></td>
<td>1.08</td>
<td>4.28</td>
<td>.86</td>
<td>4.26</td>
<td>.91</td>
<td><strong>4.22</strong></td>
</tr>
<tr>
<td>English activity room</td>
<td>4.11</td>
<td>.82</td>
<td>4.53</td>
<td>.76</td>
<td>4.36</td>
<td>.90</td>
<td><strong>4.02</strong></td>
</tr>
<tr>
<td>Little lamb &amp; ecology park</td>
<td><strong>3.90</strong></td>
<td>1.23</td>
<td><strong>4.05</strong></td>
<td>1.07</td>
<td><strong>4.01</strong></td>
<td>1.08</td>
<td><strong>3.78</strong></td>
</tr>
<tr>
<td>After school classroom</td>
<td>4.33</td>
<td>.74</td>
<td>4.35</td>
<td>1.01</td>
<td>4.29</td>
<td>.96</td>
<td>4.26</td>
</tr>
<tr>
<td>Local language classroom</td>
<td>4.21</td>
<td>.98</td>
<td><strong>4.11</strong></td>
<td>1.20</td>
<td>4.16</td>
<td>1.12</td>
<td><strong>3.95</strong></td>
</tr>
<tr>
<td>Room for continuing education programs</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>English classroom for community</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note: numbers inside shades are higher means, numbers in bold font are lower means, and no number appearing signifies the environments that students did not use.

3. POE survey from community residents (school volunteers included)

Table 7: POE survey from community residents near KK school (N=47)

<table>
<thead>
<tr>
<th>Forms of reuse</th>
<th>Accessibility</th>
<th>Large spaces</th>
<th>Full equipped</th>
<th>Comfort</th>
<th>Safety</th>
<th>Maintainable</th>
<th>Satisfaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Art gallery</td>
<td><strong>3.59</strong></td>
<td>.62</td>
<td><strong>3.50</strong></td>
<td>.63</td>
<td>3.50</td>
<td>.52</td>
<td>3.62</td>
</tr>
<tr>
<td>Story room</td>
<td>3.62</td>
<td>.87</td>
<td>3.58</td>
<td>.79</td>
<td><strong>3.20</strong></td>
<td>.63</td>
<td><strong>3.36</strong></td>
</tr>
<tr>
<td>English activity room</td>
<td><strong>4.00</strong></td>
<td>.82</td>
<td><strong>4.00</strong></td>
<td>.82</td>
<td>3.85</td>
<td>.90</td>
<td>3.62</td>
</tr>
<tr>
<td>Little lamb &amp; ecology park</td>
<td><strong>3.27</strong></td>
<td>1.10</td>
<td><strong>3.36</strong></td>
<td>1.12</td>
<td><strong>3.30</strong></td>
<td>.82</td>
<td>3.40</td>
</tr>
<tr>
<td>After school classroom</td>
<td>3.92</td>
<td>.49</td>
<td>3.70</td>
<td>.82</td>
<td>3.56</td>
<td>.88</td>
<td><strong>3.30</strong></td>
</tr>
<tr>
<td>Room for continuing education programs</td>
<td>4.78</td>
<td>.49</td>
<td>4.65</td>
<td>.66</td>
<td>4.65</td>
<td>.66</td>
<td>4.52</td>
</tr>
<tr>
<td>English classroom for community</td>
<td>4.48</td>
<td>.75</td>
<td>4.57</td>
<td>.51</td>
<td>4.40</td>
<td>.68</td>
<td>4.35</td>
</tr>
<tr>
<td>Local language classroom</td>
<td>3.92</td>
<td>.90</td>
<td>3.69</td>
<td>.63</td>
<td>3.85</td>
<td>.67</td>
<td>3.62</td>
</tr>
</tbody>
</table>

Note: numbers inside shades are higher means, numbers in bold font are lower means.

All the seven vitalized school vacant spaces were used by community residents, including school volunteers, near the KK school. Community residents’ satisfaction degrees, with mean scores from high to low, to the seven environments are: room for continuing education programs (M=4.68), English classroom for community (M=4.45),
English activity room (M=4.00), art gallery (M=3.88), local language classroom (M=3.58), after school classroom (M=3.45), story room (M=3.42), and little lamb & ecology park (M=3.30) (Table 7).

4. Comparison of awareness between teachers and community residents (school volunteers included)

Comparing mean scores, it is found that there is significant difference between KK school teachers and community residents of the awareness of school sustainability and community relations. The mean scores obtained from community residents are significantly higher than that of school teachers (Table 8).

Table 8: Comparison of awareness toward KK school sustainability and community relations

<table>
<thead>
<tr>
<th>Advantages/indicators</th>
<th>Subjects</th>
<th>Teachers</th>
<th>Community residents</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
</tr>
<tr>
<td>School Sustainability</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Innovate curriculum &amp; teaching</td>
<td></td>
<td>3.74</td>
<td>.86</td>
<td>4.12</td>
</tr>
<tr>
<td>Facilitate school transformation</td>
<td></td>
<td>3.75</td>
<td>.92</td>
<td>4.17</td>
</tr>
<tr>
<td>Support school in sustainability</td>
<td></td>
<td>3.79</td>
<td>.82</td>
<td>4.19</td>
</tr>
<tr>
<td>Community Relations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>enhance community residents friendly relations</td>
<td>3.77</td>
<td>.85</td>
<td>4.21</td>
<td>.77</td>
</tr>
<tr>
<td>care the health of the senior</td>
<td></td>
<td>3.53</td>
<td>.87</td>
<td>4.20</td>
</tr>
<tr>
<td>strengthen the connection of school-community</td>
<td>3.81</td>
<td>.86</td>
<td>4.21</td>
<td>.77</td>
</tr>
<tr>
<td>assist in community management</td>
<td></td>
<td>3.79</td>
<td>.82</td>
<td>4.21</td>
</tr>
</tbody>
</table>

Note: ***P<.001, * P<.05

4.3. General Discussion

From Table 4, the case of ST school, there is no significant difference between school teachers and community residents with regard to the awareness of school sustainability and community relations. But for the case of KK school (Table 8), it is found that the awareness from community residents is significantly higher than that from school teachers. There are two possible explanations. First, owing to both school teachers and community residents of ST school possess positive perceptions of school sustainability and community relations, statistically there is no significant difference between them. The other possibility is that both school teachers and community residents can utilize all the seven vitalized school environments in the case of ST school, while teachers in the case of KK can only make use of four out of eight vitalized environments. Therefore, it requires further study to find out the difference.

5. Conclusion

5.1. Reuse of vacant spaces does assist school in a sustainable management

In ST school, both school teachers and community residents are aware of school vitalization would be of great help in school sustainability. The school sustainability indicators of “innovate curriculum & teaching,” “facilitate school transformation” and “support school in sustainability” are all scored with means above 4.0. As to the KK school, the mean scores from school teachers are between 3.74 to 3.79, and from community residents above 4.0. However, their perceptions toward school sustainability are positive.

5.2. Reuse of school vacant spaces can strengthen community relations

In the case of ST school, both school teachers and community residents are strongly believe that vitalized school environments will enhance their community relations, revealing in their awareness scores with all the means above 4.00. In the case of KK school, though the awareness mean scores to the school teachers are between 3.53 to 3.81, less
than that of community residents’, both of them have positive perception with regard to their community relations.

5.3 Users of the vitalized environments having higher awareness on school sustainability and community relations

In the case of KK school, community residents’ awareness on school sustainability and community relations is higher than that of school teachers’. The t-test and significant testing (p value) of the comparison of these two are at significant levels.

6. Recommendation

To the school administration, vitalize school vacant space is an opportunity for school transformation and school sustainability. Therefore, the vitalized school environments are not only meet the requirements of school teachers and students but also open to the community residents. By doing this can strengthen the connection of school-community, and assure a sustainable development of the partnership of these two. To the future studies, schools in rural and aboriginal areas can be included for comparison, and qualitative material can be collected as supplement to quantitative data.

Acknowledgement

I would like to acknowledge with much appreciation for the funding support provided by the National Science Council under the Award No. NSC99-2511-S133-004.

References

Development of Connection System Bamboo Truss Structures

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Abstract

Bamboo is an environmentally friendly material that can be used for construction in civil engineering structures. Bamboo as a structural material can be used for various building components such as beams, columns, partitions, floors as well as a truss structures. Bamboo is commonly used for bridges and truss structures supporting roof. The connection system for joining among element on a truss structure significantly influences the strength as well as behaviour of the structure. Several studies have been conducted to make the strength of the truss structure connections higher. However, the connection systems that had been developed so far using bolts and steel gusset plate are considered to be not simple (in terms of equipment used and skilled labor need) and therefore, it makes the cost of connection become relatively expensive and it also creates significant additional weight to the structure. In this study a relatively simple and cheaper connection system utilizing bolts, wooden gusset plate and special wooden clamps has been proposed. The system has been tested experimentally with full scale model. Test results indicated that the proposed connection system possesses higher strength, yet much lower weight and easier to construct compared to any available systems. The connection system demonstrated high potential for practical applications.

1. Introduction

Bamboo is known as a renewable material for its ease and fast growth as well as short period of planting of about 3 - 5 years. No particular treatment is needed during the planting period and new culms bamboo continually emerges around bamboo plant. In terms of number, bamboo is readily available at large in any seasons. Therefore, bamboo is highly an environmentally friendly construction material that suitable to support green construction program as part of program to combat global warming.

Table 1 shows the comparison of energy needed for the production with the stress when in use for various material constructions, such as bamboo, wood, steel and concrete1. Table 1 gives a comparison of the advantages use of bamboo with other construction materials. It can be seen that steel and concrete make a heavy demand on large part of energy resources of the earth, in contrary to wood and bamboo. Table 1 also reveals that in term of strength and stiffness efficiency, bamboo is comparable to steel, on the other hand, the production energy required for bamboo is only 0.1% of that of steel.

Selection and peer-review under responsibility of the SustaiN conference committee and supported by Kyoto University; (RISH), (OPIR), (GCOE=ARS) and (GSS) as co-hosts

Keyword: Bamboo, connection system, truss structure, wooden gusset plate, special wooden clamps

<table>
<thead>
<tr>
<th>Material</th>
<th>Energy for Production (MJ/kg)</th>
<th>Density (MJ/m3)</th>
<th>Energy for production (MJ/m3)</th>
<th>Stress when in use (N/mm2)</th>
<th>Ratio Energy per unit stress</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
<tr>
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<td>0.8</td>
<td>2400</td>
<td>1920</td>
<td>8</td>
<td>240</td>
</tr>
<tr>
<td>Steel</td>
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<td>7800</td>
<td>234000</td>
<td>160</td>
<td>150</td>
</tr>
<tr>
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<td>1</td>
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<td>600</td>
<td>7.5</td>
<td>80</td>
</tr>
<tr>
<td>Bamboo</td>
<td>0.5</td>
<td>600</td>
<td>300</td>
<td>300</td>
<td>30</td>
</tr>
</tbody>
</table>

Table 1 shows the comparison of energy needed for the production with the stress when in use for various material constructions, such as bamboo, wood, steel and concrete. Table 1 gives a comparison of the advantages use of bamboo with other construction materials. It can be seen that steel and concrete make a heavy demand on large part of energy resources of the earth, in contrary to wood and bamboo. Table 1 also reveals that in term of strength and stiffness efficiency, bamboo is comparable to steel, on the other hand, the production energy required for bamboo is only 0.1% of that of steel.

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As such, bamboo constructions are easy to build, resilient to wind and even earthquake forces and readily repairable in the event of damage. Viewed from the economic aspect, bamboo is very profitable materials construction for its cheap price and readily available at large anytime\(^2\). However, there are a number of important considerations which currently limit the use of bamboo as a universally applicable construction material, i.e. durability, connection system, flammability and lack of design guidance and standardization\(^3\).

Owing to its relatively high strength, stiffness and lightweight characteristics, bamboo is a potential substitute for wood or timber. It is also easily worked using simple tools when employed in construction practices. Bamboo culms is available in variety of length and has high strength-weight ratio that make it suitable to be used as main structural component of buildings, such as column, beam, floor, partitions or trusses structural elements. In truss structures, bamboo is commonly applied as structural members in roof construction and bridge structures. Accordingly, bamboos are widely used just for light structures, such as rafters, roof girders, walls, ceiling and fences. As previously mentioned, connection system of bamboo is one of great problem in utilizing bamboo for structural purposes. The high strength of bamboo cannot be optimized due to limited strength capacity of connection bamboo system available. The conventional connection method of bamboo, such as using as pin, rope results only limited strength and stiffness.

Several studies have been conducted to devise a strong joint for assembling bamboo structural members. Various connections have been carried out in developing new joint systems for bamboo such as, PVC joint, steel gusset plate with filling mortar and wood, wood board inserts, wooden plugs and wood gusset plates\(^4,5,6,7\). However, the existing methods are not adequate from the aspects of strength, stiffness and stability of the connection and ease of application.

2. Development of bamboo connection system

High strength bamboo material cannot be fully utilized due to the constraints of the connection system. Splicing or coupling the whole members is usually done conventionally by using rope, nails and pins. Connection with nails or pins cause tears to the member where the fibers are aligned so that the low shear strength of bamboo easily exceeded. The connection with a rope relies on the strength of the friction of the rope, rope with bamboo or bamboo with bamboo. Connection with a rope on bamboo truss structure is presented in Fig. 1. Restraint rope shown in Fig. 1 influenced to the strength the connection. Due to the changes in temperature, bamboo could shrink and cause the rope slack. This is the problem of the conventional bamboo connection that generally produces very low strength. In addition, the formula for calculating the strength of the rope connections was difficult to be formulated. Due to geometric reasons, bamboo construction often requires extension to prolong the member and connection for joining some members in a gusset or joint. Bamboo new connection systems that had been developed by previous researchers and demonstrated better strength connections are described as follows:

1. Connection with bolts, steel gusset plates and cement mortar or wood filling

![Fig.1 Connection with (a) ijuč rope and; (b) Rattan rope in bamboo truss structure (Source: Fieldwork 2011)](image)

Research to improve the strength of the connection on a bamboo truss structure has been done by Morisco et al\(^4\). Species of bamboo used in this study was *Gigantochloa atroviolacea*. The method used bolts, steel gusset plates, and cement mortar or wood filling as shown in Fig. 2. Bamboo truss structure was made to demonstrate the joint strength as shown in Fig. 2. The loading was applied using a concrete block with a total weight of 40 kN. This jointing method has been made on the structure of the bamboo bridge with span length of 12 m using *Gigantochloa atroviolacea* about 7 cm in diameter.
The results of test show that strengths of the jointing method under investigation is quite high, and an estimated strength of the connection can be formulated. Nevertheless, despite the high strength resulted from this connection, the use of steel for gusset plates and relatively heavy infill material has made this connection system is less desirable because of the significant increase of structure weight and construction costs that make it uneconomical.

2. Connection with PVC joint

Research to maintain the lightweight nature of a bamboo connection with PVC material has been done by Albermani et al. Species of bamboo used in the study were *Phyllostachys Bambusoides* and *Phyllostachys Pubescens*. The culms used were from 3-6 years old, with outer diameters ranging from 50-65 mm. The joint design was based on preserving the good tensile and compression strengths of bamboo culms without weakening them through cleavage or splitting. Fig. 4 shows a prototype of the joint system.

![Fig. 4 (a) Basic components PVC joint system for bamboo](image1)

The joint hub itself is composed of two identical parts that are connected together by a 20 mm diameter bolt. The ends of the bamboo culms are encased inside the cylindrical connector with a mega epoxy grouting material. Three tests were conducted on the PVC material which gave tensile yield strength of 45 MPa and elasticity modulus of 3000 MPa. The testing of the PVC joint was conducted under compression, tension and bending. The PVC component failed under 24 kN load in compression, 9 kN load in tension and 3 kN load in bending. Bamboo double layer grid (DLG) was made to demonstrate joint strength as shown in Fig. 5. The module has been made on DLG with 2.6 x 2.6 m in plane and 0.9 m deep. The loading was applied using a timber pallet loaded with concrete mix bags with a total weight of 10 kN. The highest compression was close to 3.5 kN in web member and the highest tension force was close to 1.8 kN in bottom layer. Disadvantages of using this connection method is that natural bamboo cross section that are not symmetrical complicate the process of installation, construction prices become more expensive and can only be used for medium span bamboo structures.
3. Connection with nails, plywood and hard wooden planks

Research to improve the strength of the connection on a bamboo truss structure has been carried out by Mishra\(^6\). Species of bamboo used in the truss structure was *Bambusa tulda* with a diameter of not less than 8 cm, and thickness of approximately 9 mm. Strong joints are made by placing 25 mm thick pieces of hard wooden planks or 12 mm thick structural plywood shaped according to the configuration of the joint, on both faces of the joint. The joint is composed of hard wooden planks that are connected together by a 3.5 mm diameter nails as shown in Fig. 6.

![Fig. 5. Experimental setup of DLG\(^6\)](image)

There are weaknesses in the system connections using wooden gusset plate and nails that if the bamboos diameter being connected are not uniform, it will cause gap between plate and bamboo that weakened connection. In addition, the use of grafting nails proposed by Mishra\(^6\) has no formula for calculating connection strength.

4. Connection with nails, plywood and hard wooden planks

Research to improve the strength of the connection on a bamboo truss structure with wooden board gusset plate been done by Gunawan\(^7\). Species of bamboo used in the truss structure was *Dendrocolamus asper*. The bamboo used in this study was made in the form of blade. Resin consists of two components, namely adhesive and hardener catalyst that should be mixed before use with a ratio set by the resin manufacturer. The resin used in this study was Ponal epoxy.

Bamboo truss structure was made to demonstrate the joint strength with 6 m in span. The loading was applied using a concrete block with a total weight of 14 kN. The disadvantages of using this connection system are thick and the diameter of the bamboo which varied causes trouble to get constant look. While the curved surface of the bamboo which varied causes difficulty in providing wood filler to match with bamboo blade. Another weakness of the system is weathering since the greater opening the greater contact area exposed to the environment.
3. Research method

The purpose of this study was to develop a bamboo connection system that possesses lightweight nature but higher strength and lower cost while keeping the form of the bamboo being connected remains natural. The proposed connection system consists of bolts, wooden gusset plates and special wooden clamps that have been adjusted with the shape and dimension of the bamboos being connected. The wooden clamps were placed between the bamboo and wooden gusset plates and tightened by the bolts as shown in Fig. 8. The wooden plates were Dipterocarpaceae which has sufficient strength. This effort was done because the wooden gusset plate is much lighter and the price is much cheaper than that of steel. Meanwhile, the wooden clamps provide contact area that capable of mobilizing its friction capacity to transfer the applied load for stronger and reliable connection. The special wooden clamps can also make connection among various diameters of bamboo at the joint easier to construct.

The study was conducted experimentally in two phases of testing. In the early stage of the research preliminary testing on physical and mechanical properties of the materials used have been conducted. The second phase of the research involved designing and fabricating several types of connections with full scale sizes and tested experimentally in the laboratory. Comparison with other available connection systems then could be done to show the superior of the proposed system. Flow chart of the research steps is presented in Fig. 7.

![Flow chart of the implementation of research](image-url)
4. Material

As stated previously, the proposed connection system consists of wooden gusset plates, bolts and wooden clamps as shown in Fig. 8. The type of bamboo used as the main structural material in this study was Gigantochloa atroviolacea. The bamboo was taken from Purwodadi area in the province of Central Java. The average diameters of the bamboos used were 75 mm, while the age of the bamboo varies form 3 to 5 years. The gusset plates were made of Keruing wood (Dipterocarpaceae), while Mahoni wood (Swietenia Macrophylla Kings) was used for the clamps. Screw type of bolts with a diameter of 12.2 mm was used in this connection.

![Connection system on bamboo truss structure](image1)

![Basic components of joint](image2)

5. Specimen preparations

The specimens of physical and mechanical properties such as (moisture content, density, compressive strength, shear strength, tensile strength and elastic modulus) were prepared based on ISO N22157-1 2004 standard for bamboo and ASTM D 143-94 for wood. Bolt specimens were made according to ASTM standard F1585-03-2008. Based on the results of preliminary material testing, the connection specimens were designed and fabricated accordingly. Tastings were conducted to study the influence of wooden clamp shape on the strength of the connection system. The details of connection system for joint with three variations of clamp developed by authors were shown in Fig. 9. The figure depicts three variations of wooden clamps which are distinguished by their ring angles, i.e. α = 60º, 90º, and 120º, respectively. The difference of moisture content in the test specimens should be minimized because it can affect distribution of test data.

![Clamp variation in the form of angles (a)](image3)

![Clamp angle 60º](image4)

![Clamp angle 90º](image5)

![Clamp angle 120º](image6)

Fig. 8. (a) Connection system on bamboo truss structure; (b) Basic components of joint

Fig. 9 (a) Clamp variation in the form of angles (α); (b) Clamp angle 60º; (c) Clamp angle 90º; (d) Clamp angle 120º
6. Test set-up

The testing method of basic material properties was based on ISO N22157-2 for bamboo and ASTM D 143-94 for wood. The testing method of bearing strength of bamboo was adopted from ASTM D 5764 standard test method for evaluating dowel bearing strength of wood and wood based products. Bearing strength test has been carried out on bamboo and wood with deformed bolt diameter of 12.2 mm. Material were tested under compression and tensile using Universal Testing Machine which was integrated with data logger. The test set-up for tensile test for proposed various connection systems and the configuration of specimens are shown in Fig.10. Tensile load was applied gradually by a tensile testing machine. The relative displacement of joint was measured by two displacement transducers.

7. Results and discussion

Resulting average compressive strength, tensile strength, shear strength, bending strength, and bending elastic modulus of the bamboo were obtained and listed in Table 2. The average compressive strength, shear strength and tensile strength on wood obtained from the tests were listed in Table 3, while the average bearing strength on material is listed in Table 4. The connection specimens were tested with moisture content of about 11 to 15%. Given the inherent imperfections in bamboo as a natural material, the results obtained from the current testings are in good agreement with the results of Nugraha et al\textsuperscript{8} and Awaluddin et al\textsuperscript{9}.

![Diagram](image)

**Fig.10.** (a) Test set-up for tension of the connection; (b) detail of the test set-up

<table>
<thead>
<tr>
<th>Material</th>
<th>Compressive strength (MPa)</th>
<th>Tensile strength (MPa)</th>
<th>Shear strength (MPa)</th>
<th>Elasticity modulus (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Ave</td>
<td>Min</td>
</tr>
<tr>
<td>Gigantochloa atroviolacea</td>
<td>51.39</td>
<td>55.90</td>
<td>54.36</td>
<td>150</td>
</tr>
</tbody>
</table>
Table 3. Wood test result on compressive, tensile and shear test result on wood

<table>
<thead>
<tr>
<th>Material</th>
<th>Compressive strength parallel to grain (MPa)</th>
<th>Compressive strength perpendicular to grain (MPa)</th>
<th>Tensile strength perpendicular to grain (MPa)</th>
<th>Shear strength (MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Min</td>
<td>Max</td>
<td>Ave</td>
<td>Min</td>
</tr>
<tr>
<td>Dipterocarpaceae</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Swietenia Macrophylla King</td>
<td>22.16</td>
<td>31.2</td>
<td>26.8</td>
<td>12.8</td>
</tr>
</tbody>
</table>

Table 4. Bearing test result

<table>
<thead>
<tr>
<th>Material</th>
<th>Grain direction</th>
<th>Density (g/cm$^3$)</th>
<th>Moisture content(%)</th>
<th>Bearing strength(MPa)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Direction</td>
<td>Min</td>
<td>Max</td>
<td>Ave</td>
</tr>
<tr>
<td>Gigantochloa atrovioleacea</td>
<td>Parallel</td>
<td>0.6</td>
<td>0.65</td>
<td>0.62</td>
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<tr>
<td>Dipterocarpaceae</td>
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<td>0.55</td>
<td>0.58</td>
<td>0.56</td>
</tr>
<tr>
<td></td>
<td>Perpendicular</td>
<td>0.55</td>
<td>0.58</td>
<td>0.56</td>
</tr>
<tr>
<td>Swietenia Macrophylla King</td>
<td>Parallel</td>
<td>0.74</td>
<td>0.77</td>
<td>0.75</td>
</tr>
<tr>
<td></td>
<td>Perpendicular</td>
<td>0.74</td>
<td>0.77</td>
<td>0.75</td>
</tr>
</tbody>
</table>

Fig. 11 Relationship between load and displacement obtained from tensile test of the connection

Table 5 Recapitulation of the results of testing the tensile strength of bamboo connection

<table>
<thead>
<tr>
<th>Specimen</th>
<th>Maximum load (kN)</th>
<th>5% offset load (kN)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>Max</td>
<td>Ave</td>
</tr>
<tr>
<td>K-60°</td>
<td>8.40</td>
<td>8.75</td>
</tr>
<tr>
<td>K-90°</td>
<td>11.50</td>
<td>13.40</td>
</tr>
<tr>
<td>K-120°</td>
<td>11.90</td>
<td>14.50</td>
</tr>
</tbody>
</table>

Testing of the various types of connections was conducted as shown in Fig.10. Nine joint specimens with three variations of wood clamps were tested under tension (three tests each) as shown in Fig. 9. The relationship between load and displacement obtained from the tests is shown in Fig.10. The maximum loads and the loads that correspond to the yielding of the connections were different among variation of the wooden clamps ring angles. Based on the tensile test results of the connections depicted in Figure 11 and listed in Table 5, it can be concluded that the greater the ring angle
α, which resembles contact area between the bamboo and wooden clamps, the higher the strength of the connection would be.

Although in theory the variation of wooden clamp with ring angle of 120° is higher, based on experimental results obtained, the increased of the strength of that variation is insignificant compared to the circumference of the wooden clamp with ring angle of 60° to 90°. This happens because bamboo section is not a perfect circle so that the contact area between wooden clamps and bamboo are not always optimal. Technically, an increase in the strength of the connection with clamp ring angle of 60° to 90° was around 30%, while from 90° to 120° angle was only 10%. Because of the connection system must not be damaged prior to the spliced, therefore wooden clamp with ring angle of 90° was chosen to be optimal and thus recommended to be applied to connections of bamboo truss structure.

5. Conclusions

Several studies have been conducted to devise a strong joint for assembling bamboo structural members. Various connections have been carried out in developing new joint systems for bamboo such as, PVC joint, steel gusset plate with filling mortar and wood, wood board inserts, wooden plugs and wood gusset plates. However, the existing methods are not adequate from the aspects of strength, stability of the connection, additional weight and ease of application.

A new connection system has been proposed in this paper and experimental results obtained from the tests are presented. The proposed connection system consists of bolts, wooden gusset plates and special wooden clamps that have been adjusted with the shape and dimension of the bamboos being connected. The wooden clamps were placed between the bamboo and wooden gusset plates and tightened by the bolts. The wooden clamps provide contact area that capable of mobilizing its friction capacity to transfer the applied load for stronger and reliable connection. The proposed connection system possesses higher strength, yet much lighter and cheaper than that of other methods. The connection system is easier to construct and demonstrated high potential for practical applications.

Acknowledgements

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References

The 4th International Conference on Sustainable Future for Human Security [SustaiN 2013]

CONFERENCE PROCEEDING

River Basin and Disaster Management
The Ecological Perceptions and Communities Participations on River Conservation Based on Bioindicator Odonata Knowledge in Upper Watershed Area: A Case Study in Batu District, East Java, Indonesia

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Abstract

The objective of this study was to analyze perceptions and communities participations based on Bioindicator Odonata knowledge on river conservation at upper watershed area in Batu District, East Java, Indonesia. This study was designed as analytical cross-sectional survey in upper watershed area with 70 residents living in three villages of Batu District. A daylight flying observation technique was used to count and determine Odonata (Dargonsflies and Damselflies) from March 2012 until January 2013 in dry and wet seasons, and The questionnaire was used as a tool for communities data collection twice in bahasa Indonesia and a few cases in local language, before they received information about bioindicator of Odonata and two months later after they got information about bioindicators. The result of this study showed that in upper watershed area, there were three Familia of Odonata (Aeshnidae, Chlorocyphidae, and Libellulidae) and were divided into eleven Genus (Amphaiaschiza, Libellago, Rhinocypha, Agriocnemis, Ischnura, Pseudagrion, Brachythemis, Crocothemis, Neurothemis, Orthetrum and Trithemis); they consisted of fifteen Species, namely Amphaiaschiza ampla (Rambur), Libellago lineata (Burmeister), Rhinocypha fenestrata (Burmeister), Agriocnemis femina (Brauer), Ischnura senegalensis (Rambur), Pseudagrion praunus (Burmeister), Brachythemis contaminata (Fabricius), Crocothemis servilia (Drury), Neurothemis terminata (Rambur), Orthetrum chrysis (Selys), Orthetrum glaucum (Brauer), Orthetrum praunus (Burmeister), Orthetrum sabina (Drury), Orthetrum triangulare (Selys) and Trithemis festiva (Rambur), respectively. The Questionnaire result showed that, in general, there was a change of perception and community participation based on Bioindicator of Odonata. Specifically, almost all parameters results indicated significant increase in two months after they received informations on Bioindicator of Odonata (p<0.001), Environmental ethics (p<0.001), Intention for river conservation (p<0.001), the role of the community in environmental stewardship (p,0.001), the role of the community in protection environmental damage (p<0.001), the level of community in participation environmental conservation (p<0.001) and type of community participatioin in environmental conservation (p<0.001). The relationship between the factors of research was studied using path analysis with Partial Least Square approach. The result showed that the level of accuracy model to explain the relationship of five latent constructs was 52.5% while the rest was explained by other constructs which were not included in this study.

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Keywords: Ecological Perception; Community Participation; River Conservation; Bioindicator; Odonata; Watershed

1. Introduction

Brantas watershed is the largest watershed in the East Java province, Indonesia. The river is very strategic for Brantas watershed is the largest watershed in the East Java province, Indonesia. The river is very strategic for the life of the surrounding community. Brantas river's length is 320 km with an area of 12,000 km² and it includes 26.5% area of East Java Province [15]; it has a resource potential of ± 12 billion m³ of water which is used as raw water by the community in many ways, such as power sources for power generator, irrigation, water companies, industry, tourism, etc. Upper Brantas watershed is geographically located between 7° 44' - 8° 26' N and 122° 17' - 122° 57' east longitude [20] with altitude of 690-1200 m above sea level. At the most upstream part of the Brantas river basin, there are some springs that become Brantas headwaters. Some sub-basins which are directly in contact with the upper Brantas
watershed are Sumber Brantas sub-watershed, Amprong sub-watershed, Bango sub-watershed, Lesti sub-watershed, Metro sub-watershed, and Lahor sub-watershed. Unfortunately, human activities in industry, farming, fisheries and settlements require the availability of land. On the other hand, in fact, the availability of open land which always tends to decrease both the breadth and quality in the long run can disrupt the river systems. Decline in the quality of the river is not going to happen actually if people as the main factors in the social system are involved in the management of the natural environment seriously. Environmental damage that occurs in the river is due to uncontrolled human activities. This happened when environmental issues are only addressed partially neglecting other factors. Field data showed that over the past two decades, there has been a decline in the quantity and quality of water spring in the upper Brantas watershed of Batu district, East Java, Indonesia. There were 111 springs and the number fell to only 57 springs water flow reduced by 30% [18]; that number decreased again to 46 springs in 2009 [11]. Decrease in the number of springs in the headwaters, in turn, would reduce the quantity of the aquifer.

The role of the community in the Sustainable Development philosophy has a very important position. Society cannot be separated from the natural environment, and the world cannot be seen as a collection of separate objects, but as a network of phenomena that are fundamentally interconnected and interdependent on each other. Society must grow together with the economic and environment aspects, and the mutual interaction between these three aspects. More and more people are helpless in the environmental field; they will initiate active encouragement of social participation in sustainable development which is often called the demonstration effect [16].

Even though the law has recognized the role of community level with other stakeholders, until recently, in fact, the role of society to watershed ecosystems has not been included as an important indicator in determining the quality of the river. Understanding of people’s behavior and the quality of this watershed becomes important in building awareness of environmental preservation and conservation of the river. Public apathy towards the river damage shows low participation on the environment.

The communities living in the upper watershed area are the people who maintain that area for 24/7 and can be referred as a river sentinel. Unfortunately, this condition is not well supported by the public knowledge of the environment that supports the sustainability of the river due to the lack of understanding on the biotic condition in the watershed. Only a few people who live in this conservation area have a good knowledge of Odonata Bioindicator, which will support the intent and community participation in the conservation of the river.

The objective of this study was to analyze perceptions and communities participations based on bioindicator knowledge of Odonata in the river conservation. Odonata (Dragonflies and Damselflies) as bioindicators of environmental health can be used as guidelines to see the quality of the environment and represents natural conditions as to increase the ecological perception and public participation in the river conservation at upper watershed area. Introduction of Odonata knowledge in public life would indirectly encourage public awareness of environmental conservation in the headwaters area. Odonata eggs can only develop into exuviae (the larval skins left when adults emerge) in a good water quality of the river (e.g. clear water). The water quality of the river would be better if the quality of the environment around the river has a good condition and no pollution that flows into the river. In the end, the quality of the environment will be better if there are understanding and behavior towards environmentally friendly society. Increasing public knowledge and understanding through Bioindicator of Odonata on the environment will create pressure and social mobilization to stimulate wider social participation in protecting the environment in order to the preservation and conservation of the river.

2. Method

The existing condition diversity of Odonata in the study area was seen by observing Odonata with daylight flight method observation along grass, hedgerows, bush, and tree from March 2012 until January 2013 in dry and wet season. All adults and larvae Odonata species were collected from field using insect nets and surber nets [2]; [3]; [8]; [10]. The specimens of Odonata were killed by immersing in acetone for permanent preservation [21]. Acetone could extract water and fat from adult Odonata specimens and dry with better color preservation than when merely air-dried. The abdomen was straightened and the legs were arranged in place for each specimen. Sample Odonata then put in their labeled envelopes and submerged in acetone (in a tightly closed plastic container) for 16-24 hours. Specimens Odonata were then taken to Entomology Laboratory University of Gadjah Mada, Central of Java, Indonesia for identification and determination, except for one species Amphiateleschna ampla (Rambur) that could be identified with the help of scientist Taiwan Wen-Chi Yeh. Diagnosis of each species Odonata was based on the examination of acetone-treated specimens with naked eyes or under a 10x magnifier and 45x stereomicroscope and with reference to color photos of living insects. Adult identities were confirmed according to the references of Dolny et al.[6]; Duncan [7]; Heckman [9]; Loznik et al. [13]; Proche[14]; and Subramanian [17].
The methods of data collection for community in the study area was using questionnaire [21]. Public awareness of the environment could be built by recognizing the signs of nature that could reflect the condition of the natural environment. If people were aware of the environmental degradation which in turn would affect their life quality, they would foster the active participation in protecting the environment. Active participation of the community would go well if they could accommodate the aspirations of a growing and developing in society. Socio-economic conditions were expected to affect the public's participation [1]. The Socio-economic conditions included: age, education, household size, income, land ownership, and house to live. Socio-economic conditions described the condition of the people residing in the study area in terms of income, education, and the relative dependence on the environment. Local knowledge as part of the socio-culture has a major role in conservation [12]. Socio-cultural variables included: knowledge of Odonata Bioindicators, access to information, beliefs/norms, status and role of Social, Environmental Ethic. Characteristic attitude of society was as a variable participation [4]. Understanding of the knowledge on Odonata Bioindicators (Dragonflies and Damselflies) was an important variable in the socio-cultural conditions. In eggs until exuviae phases, larvae stay and live in the aquatic environment and are sedentary at a relatively long time. Initial condition that caused Odonata larvae would be susceptible to exposure to pollutant in the water. Death of Odonata larvae would affect the absence of adult Odonata fly in terrestrial environments. Environmental ethic reflected how the wisdom of indigenous communities in the conservation of the river. Indigenous wisdom always grows and evolves in a dynamic society. Public awareness of better environmental conditions will be reflected on the ethics of the society. Parameters used in this study to reveal beliefs, public attitudes, access to watershed information, and sharing society in environmental management, including how local communities had close relationship with the government in environmental management. Engagement and Empowerment were expected to affect the success of sustainable river conservation. Initial questionnaire was given at the time when the community was still as it was, i.e. when they did not understand their knowledge on Bioindicators of the environment. The second questionnaire was given two months after the public was introduced to the knowledge on Bioindicator Odonata. The second questionnaire was also intended as an assessment on how far the community has applied their knowledge on Bioindicator Odonata.

Based on qualitative exploratory research using questionnaires to determine how perceptions of ecology and public participation in the conservation of the river, the relationship between variables were formulated using path analysis with approach of Partial Least Square [19] to create a model Ecological Communities Perceptions and participations on River Conservation Knowledge Based on Bioindicator Odonata in Upper Watershed Area.

3. Result

To determine the diversity of Odonata in the research area, a survey was carried out in the upper Brantas watershed area for community of Odonata. The results showed that there were three Familia of Odonata; those were: Aeshnidae, Chlorocyphidae, and Libellulidae which were detailed into eleven Genus: Amphiacia, Libellago, Rhinocypa, Agriocnemis, Ischnura, Pseudagiron, Brachythemis, Crocothemis, Neurothemis, Orthetrum and Trithemis, and Consisted of fifteen species, namely; Amphiacia ampla (Rambur), Libellago lineata (Burmeister), Rhinocypa fenestra (Burmeister), Agriocnemis femina (Brauer), Ischnura senegalensis (Rambur), Pseudagiron pruinose (Brauer), Brachythemis contaminata (Fabricius), Crocothemis servilla (Drury), Neurothemis terminata (Rambur), Orthetrum chrysos (Selys), Orthetrum glaucum (Brauer), Orthetrum pruinose (Burmeister), Orthetrum sabina (Drury), Orthetrum triangularis (Selys) and Trithemis festiva (Rambur), respectively. From the findings obtained in the field, it is suggested that the Odonata species were found to describe the environmental quality conditions in the study area as bioindicator. Familia of Aeshnidae could reflect the quality of a good environment, especially water quality and riparian vegetation surrounding the area. Aeshnidae larvae live in the water; the larvae are sensitive to environmental changes that occur in areas where the larvae live. Presence of pollutants into the waters will be very influential on the development of larvae and can cause death in these larvae. If it happened, people who live on terrestrial regions cannot see this familia flying in the watershed area because it is dead by the time it becomes larvae.

3.1 The Role of Odonata Knowledge to increase community perception and participation

The analysis of The Ecological Perceptions and Communities Participations on River Conservation Based on Bioindicator Odonata Knowledge in Upper Watershed Area showed that, in general, community in upper Brantas watershed area did not understand their role in environmental stewardship (14.59 ± 2.9), their role in protection environmental damage (12.41 ± 4.09) and lack of information on Bioindicator Odonata (15.83 ± 2.38). Detailed information is presented in table 1. After they get information on Bioindicator Odonata knowledge, almost all parameters results indicated significant increase in t-test analysis after two month they receive information on Bioindicator Odonata (p<0.001), Environmental ethics (p<0.001), Intention for river conservation (p<0.001), The role of the community in environmental stewardship (p<0.001), The role of the community in protection environmental
damage (p<0.001), The level of community in participation environmental conservation (p<0.001); and Type of community participation in environmental conservation (p<0.001).

Table 5. Relationship perception and participation on river conservation based on bioindicator Odonata knowledge

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Average ± std dev, Before</th>
<th>Average ± std dev, After</th>
<th>p-value of t-test before vs after</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information on Bioindicator of Odonata</td>
<td>15.83 ± 2.38</td>
<td>17.64 ± 1.54</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Environmental ethics</td>
<td>18.97 ± 3.48</td>
<td>21.57 ± 1.77</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Intention for river conservation</td>
<td>21.71 ± 2.87</td>
<td>22.60 ± 2.03</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>The role of the community in environmental stewardship</td>
<td>14.59 ± 2.9</td>
<td>17.99 ± 1.59</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>The role of the community in protection environmental damage</td>
<td>12.41 ± 4.09</td>
<td>16.74 ± 2.41</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>The level of community in participation environmental conservation</td>
<td>19.81 ± 5.01</td>
<td>25.40 ± 2.57</td>
<td>p&lt;0.001</td>
</tr>
<tr>
<td>Type of community participation in environmental conservation</td>
<td>19.94 ± 4.40</td>
<td>23.69 ± 1.91</td>
<td>p&lt;0.001</td>
</tr>
</tbody>
</table>

Note: before and after data indicated value each parameter giving information Bioindicator

Based on the table above, increased public understanding of the Odonata knowledge could support public awareness on river conservation, intentions of environmental stewardship, increasing the type and level of community participation in the conservation of the river and increasing the role of the community in maintaining the quality of the environment.

Community intention could be generated by an increase in public knowledge. Lack of information on Odonata species that could be used as Bioindicator resulted in people not understanding the signals given by nature to mankind. This could be seen at the beginning of the study when the community has not been introduced yet to the function the existence of Odonata to environmental quality. The society at the research study area simply assumed that Odonata as a complement species in the environment. Two months after receiving Bioindicator knowledge Odonata, people understand the position and function of these species in the environment and the impact can increase environmental ethics, public participation in environmental stewardship and concern for conservation significantly.

3.2 Model of the Ecological Perceptions and Communities Participations on River Conservation Based on Bioindicator Odonata Knowledge in the Upper Watershed Area at Batu District.

Further analysis showed the relationship between the factors of research which was carried out by using path analysis with Partial Least Square approach. Through this approach convergent validity and reliability in the outer composite model of ecological perceptions and communities participations on river conservation based on Bioindicator Odonata knowledge in the upper watershed area would be known. Convergent validity referred to the validity of the items making up a latent with reflective indicators. Convergent validity was examined through two size grades: Average Variance Extracted (AVE) and the value of composite reliability (CR) of latent reflective. Convergent validity was formed when the AVE values > 0.5 and composite reliability was above 0.7. On outer models, there were two latent variables that were reflective as described in Table 2.

Table 2 shows that all reflective latent variables outside the model had a composite reliability and AVE values exceeded the minimum value of 0.5 and 0.7. Thus, it can be concluded that there is no measurement error in the model outside and all latent variables can be used to predict the functions of the inner structural models. Cross loading reflexive analysis indicators on both the latent constructs explained that each construct had a suitable indicator based data supporting the results of the study. Each of these indicators had higher cross loading value than the value of the other indicators as described in Table 3.
Table 2. Value AVE and Composite Reliability (CR)

<table>
<thead>
<tr>
<th>Construct</th>
<th>AVE Value</th>
<th>Composite Reliability</th>
<th>Annotation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-Cultural</td>
<td>0.59</td>
<td>0.74</td>
<td>Valid and Reliable</td>
</tr>
<tr>
<td>Community Participation</td>
<td>0.57</td>
<td>0.70</td>
<td>Valid and Reliable</td>
</tr>
</tbody>
</table>

Table 3. Cross-Loading Results for Latent Construct The Ecological Perceptions and Communities Participations on River Conservation Knowledge Based on Bioindicator Odonata in Upper Watershed Area

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Socio-Culture</th>
<th>Participation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information</td>
<td>0.653*</td>
<td>0.651</td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.784*</td>
<td>0.578</td>
</tr>
<tr>
<td>Ecology</td>
<td>0.664*</td>
<td>0.957</td>
</tr>
<tr>
<td>Environmental Protection</td>
<td>0.201</td>
<td>0.679*</td>
</tr>
<tr>
<td>Community Role</td>
<td>0.225</td>
<td>0.674*</td>
</tr>
<tr>
<td>Level of Participation</td>
<td>0.346</td>
<td>0.584*</td>
</tr>
<tr>
<td>Type of Participation</td>
<td>0.247</td>
<td>0.469*</td>
</tr>
</tbody>
</table>

Based on the data presented in Table 3 above, the cross loading calculation results for each indicator on the socio-cultural construct and participation was appropriate because the cross loading value of the corresponding indicator was higher. This research had 9 parts of testing hypotheses relating to inner models. Causality hypothesis developed in this model was tested with the null hypothesis that the regression coefficients in every relationship were not different from zero by t-test such as the one in the regression analysis [19]. Here is a description of the test results to 9 units on the inner model hypothesis proposed in this study. In the following sections, inner and outer model (full model) in the socio-cultural structure of the variable relationships, knowledge, ethics, socio-economic, intentions and participation were presented. Relationship indicators on the latent constructs of social and cultural participation was reflexive, while the construct of knowledge, ethics, socio-economic and intentions were formative.
Inner model results shown in Table 4 explained that the entire pathway in the model was significant at $\alpha = 0.05$. Intent on endogenous constructs had four determinants, namely socio-cultural, Bioindicator, socio-economic and ethics, while the participation of endogenous constructs had five determinants of the socio-cultural, Bioindicator, ethical, socio-economic and intentions. The study of ecological perception was a complex. Research approaches could be done with measurement of the condition of socio-cultural society, socio-economic communities, knowledge of Bioindicator Odonata, and environmental ethics. The measurement of this condition would affect the intention of communities in river conservation and, in turn, would have an impact on the active participation of the community to conserve the river.

Outer models aimed to examine the relationship of each indicator of the latent constructs that existed in the structural model of The Ecological Perceptions and Communities participations on River Conservation Knowledge Based on Bioindicator Odonata in Upper Watershed Area. Indicators to construct a relationship were reflexive. Weighting factor would be taken from the value of result for outer loadings. On indicators that were reflexive, loading factor value of 0.40 or more indicated that the indicator had a good validation to measure the latent variable. While the relationship with the indicators was formative construct, weighting factors would be taken from the value of result for outer weight. Results of the analysis are described in Table 5.

![Inner Outer Model from Partial Least Square](image)

**Figure 2. Inner Outer Model from Partial Least Square**

Table 4. Inner Model test Result of The Ecological Perceptions and Communities participations on River Conservation Knowledge Based on Bioindicator Odonata in Upper Watershed Area.

<table>
<thead>
<tr>
<th></th>
<th>Original sample estimate</th>
<th>Mean of subsamples</th>
<th>Standard deviation</th>
<th>T-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-Cultural -&gt; Intention</td>
<td>0.297</td>
<td>0.300</td>
<td>0.051</td>
<td>5.836*</td>
</tr>
<tr>
<td>Bioindicator -&gt; Intention</td>
<td>0.204</td>
<td>0.200</td>
<td>0.051</td>
<td>3.981*</td>
</tr>
<tr>
<td>Ethics -&gt; Intention</td>
<td>0.193</td>
<td>0.192</td>
<td>0.057</td>
<td>3.417*</td>
</tr>
<tr>
<td>Socio-Economic -&gt; Intention</td>
<td>0.167</td>
<td>0.180</td>
<td>0.048</td>
<td>3.453*</td>
</tr>
<tr>
<td>SocioCultural -&gt; Participation</td>
<td>0.189</td>
<td>0.192</td>
<td>0.052</td>
<td>3.630*</td>
</tr>
<tr>
<td>Bioindicator -&gt; Participation</td>
<td>0.162</td>
<td>0.158</td>
<td>0.047</td>
<td>3.432*</td>
</tr>
<tr>
<td>Ethics -&gt; Participation</td>
<td>0.133</td>
<td>0.140</td>
<td>0.048</td>
<td>2.753*</td>
</tr>
<tr>
<td>SocioEconomic -&gt; Participation</td>
<td>0.150</td>
<td>0.155</td>
<td>0.061</td>
<td>2.483*</td>
</tr>
<tr>
<td>Intention -&gt; Participation</td>
<td>0.340</td>
<td>0.332</td>
<td>0.052</td>
<td>6.566*</td>
</tr>
</tbody>
</table>

Note: * = significant (t > 1.96) ; ns = not significant (t < 1.96)
### Table 5: Outer Model Test Result of The Ecological Perceptions and Communities participations on River Conservation Knowledge Based on Biindicator Odonata in Upper Watershed Area.

<table>
<thead>
<tr>
<th></th>
<th>Original sample estimate</th>
<th>Mean of subsamples</th>
<th>Standard deviation</th>
<th>T-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Socio-Cultural (R)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cooperation</td>
<td>0.784</td>
<td>0.773</td>
<td>0.054</td>
<td>14.58 *</td>
</tr>
<tr>
<td>Ecology</td>
<td>0.664</td>
<td>0.662</td>
<td>0.083</td>
<td>7.969 *</td>
</tr>
<tr>
<td>Information</td>
<td>0.653</td>
<td>0.639</td>
<td>0.087</td>
<td>7.482 *</td>
</tr>
<tr>
<td><strong>Socio-Economic (F)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Economic Value</td>
<td>0.443</td>
<td>0.399</td>
<td>0.18</td>
<td>2.468 *</td>
</tr>
<tr>
<td>Distance</td>
<td>0.569</td>
<td>0.495</td>
<td>0.216</td>
<td>2.632 *</td>
</tr>
<tr>
<td>Wide Land</td>
<td>-0.004</td>
<td>-0.02</td>
<td>0.471</td>
<td>0.008 ns</td>
</tr>
<tr>
<td>Income</td>
<td>0.394</td>
<td>0.404</td>
<td>0.484</td>
<td>0.814 ns</td>
</tr>
<tr>
<td>Education</td>
<td>0.413</td>
<td>0.352</td>
<td>0.239</td>
<td>1.728 ns</td>
</tr>
<tr>
<td><strong>Participation (R)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Community Role</td>
<td>0.674</td>
<td>0.686</td>
<td>0.056</td>
<td>12.029 *</td>
</tr>
<tr>
<td>Env. Protection</td>
<td>0.679</td>
<td>0.67</td>
<td>0.057</td>
<td>11.808 *</td>
</tr>
<tr>
<td>Level of Participation</td>
<td>0.584</td>
<td>0.571</td>
<td>0.081</td>
<td>7.199 *</td>
</tr>
<tr>
<td>Type of Participation</td>
<td>0.469</td>
<td>0.484</td>
<td>0.1</td>
<td>4.702 *</td>
</tr>
</tbody>
</table>

Note: ns = not significance (t < 1.96); * = significant (t > 1.96); R = Reflective; F = Formative

The socio-cultural latent constructs consisted of 3 indicators with reflective relations: ecology, information and cooperation. The strong social culture of the communities was represented by these three indicators, especially indicators of cooperation. Reflection to the three indicators of social culture was unidirectional. The value loading factor of the three indicator was to measure the significant socio-cultural; it is evident that the value of t was greater than the critical value of t = 1.96. Socioeconomic latent constructs consisted of 5 indicators with the formative relationship economic, residence distance to the river, land area, income and education. Five of those indicators could predict socio-economic level of the communities with the equation:

\[
Socio = Economic \cdot 0.443 \text{ economic value} + 0.569 \text{ distance} - 0.004 \text{ wide land} + 0.394 \text{ income} + 0.413 \text{ education}
\]  

Weight value to five indicators was significant on two indicators of economic society and the distance to the river; it appeared that the t value was greater than the critical value of t = 1.96. Whereas, the other three indicators, namely land ownership (wide land), income and the level of education as formative indicators of Socio-economic were not significant. This means that the ownership of land and income held by the public did not affect the level of participation in environmental conservation, as well as the parameters of education. Communities with low incomes and limited land ownership could participate actively in environmental conservation, vice versa; people with high incomes and people who had large estates did not always contribute positively to the conservation of the environment. Public education level had the same pattern of land ownership and income. Level of public participation in environmental conservation was not affected by the level of public education.

Thus, the outer models explained that high level of socio-economic explained by the high level of economic society did not always have a home that is close to the river. Latent constructs on participation consisted of 4 indicators with a reflective relationship in forms of participation, preventing damage to the environment, protecting the environment and the level of participation. The strong participation in the communities was represented by the four indicators, especially on indicators of environmental stewardship. Reflections on the participation of the four indicators...
were unidirectional. Magnitude of factor loading value to four indicators were significant to measure participation; it is evident that the value of t was greater than the critical value of t = 1.96.

The feasibility model Ecological Perceptions and Communities participations on River Conservation Knowledge Based on Bioindicator Odonata in Upper Watershed Area was indicated by the R² value of composite reliability models and specifically on variables that had a reflexive relationship with the indicators. Eligibility indicators model are described in Table 6 below.

Table 6. The feasibility model of Ecological Perceptions and Communities Participations on River Conservation Knowledge Based on Bioindicator Odonata in Upper Watershed Area.

<table>
<thead>
<tr>
<th>Construct</th>
<th>R²</th>
<th>Composite Reliability</th>
<th>Average variance extracted (AVE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Socio-Cultural</td>
<td>-</td>
<td>0.744</td>
<td>0.594</td>
</tr>
<tr>
<td>Bioindicator</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Ethics</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Socio-Economic</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Intention</td>
<td>0.248</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Participation</td>
<td>0.369</td>
<td>0.696</td>
<td>0.569</td>
</tr>
</tbody>
</table>

Feasibility model could be seen from the value of R² models, composite reliability and average variance extracted (AVE). Feasibility of the latter two could be calculated because of the nature of the relationship with the indicator construct was reflexive. The resulting construct into two composite reliability was ranged from 0.696 to 0.744 and AVE ranged from 0.569 to 0.594. Overall accuracy of the model was:

\[
Model R^2 = 1 - (1 - 0.248)(1 - 0.368) \\
= 1 - 0.475 \\
= 0.525
\]

The level of accuracy model to explain the relationship five latent constructs was 52.5% while the rest was explained by other constructs which were not included in this study. This model explained that the use of Bioindicators of Odonata to improve the understanding of the ecological perception and public participation in the upstream watershed area showed good results. Complexity of ecological Perception in the study resulted in not all of the parameters growing in community could be used as a parameter research, such as Feasibility model above. Some Reflective and formative components developed in the study, nearly all showed positive improvement. Community participation could be raised with the raising of intention at the expected conditions.

4. Conclusion

Ecological perception and public participation in the river conservation can be enhanced by increasing awareness of the people to Odonata (Dragonflies and Damselflies) in people's daily life. People cannot see the beauty of diverse of Odonata around them and will suffer losses due to a decrease in ecological diversity of Odonata if they do not conserve the river well. This study shows that by increasing awareness of the importance of Odonata in life, it will drive the intention of community to participate in river conservation at watershed area.

Acknowledgement

The author would like to thank the beneficial help and support for the completion of this paper from University of Muhammadiyah Malang, The Directorate General of Higher Education (DIKTI) Republic of Indonesia, University of Indonesia, and to the advisors for their thoughts and advice. We also appreciate the valuable technical support for identification of Odonata provided by Wen-Chi Yeh and Suputa.
References


Kukuyaan program as a form of community empowerment and river revitalization (case study Cikapundung river, Bandung, West Java, Indonesia)

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Abstract

The Kukuyaan Program is an innovative project conducted by several people in Komunitas Peduli Cikapundung (Cikapundung Care Communities) which was set up in local neighborhoods surrounding the Cikapundung River area. It aims to rebuild the connection between humans and rivers in Bandung, West Java by turning the once polluted Cikapundung River into an eco-tourism site. In this study, we attempted to identify the main motivations that drove these communities to initiate this program, what further improvements can be made for this program, and also whether or not the methods used by this community through their Kukuyaan program is able to be implemented in other communities living by rivers in Indonesia as well as around the world. The research method that we have used in this study is through qualitative methods by interviewing one of the founders of the Kukuyaan communities as well as surveys to the inhabitants of the local communities around the Cikapundung watershed area. Our results showed that the main motivation for initiating this project came from the concern of the local people themselves, but the community is still awaiting further government participation and support for further improvement of this project. This program can be implemented in other river communities as a way to maintain the motivation of the local people to keep their rivers clean.

Keywords: Community empowerment; river revitalization; eco-tourism; Cikapundung; Kukuyaan

1. Introduction

Watershed management issues are local-cumulative problems. While the effects of local-cumulative environmental problems tend to be felt most immediately within national borders, their ultimate impact is cumulative, or global, often affecting global processes, such as the climate in significant way [1]. They are also often exacerbated or transformed by processes of globalization. Research done by the Ministry of the Environment in Indonesia regarding the water quality index of Indonesian rivers has shown an increasing tendency of pollution up to 30% [2]. This pollution is mostly contributed from the increase in the population of people, which indicates a direct relationship between increased consumption and domestic waste. In order to mitigate this problem, the local government has to work together with the local communities in order to realize various river rehabilitation efforts. Small scale projects in communities or regions can contribute to achieve these goals.

We used the case study of the Kukuyaan program as an effort to revitalize the Cikapundung River located in Bandung, West Java, Indonesia. The Cikapundung River was our chosen object of study because of the success that its local communities have had in decreasing solid domestic waste pollution in the river. One of the local communities involved in the revitalization of the Cikapundung River works together in direct partnership with the local government in order to realize a rehabilitation project in the form of a river revitalization program called Kukuyaan. The Kukuyaan Program is considered as a driving force in the revitalization effort as it has been able to increase the awareness of the local communities to not throw their garbage in the river and, instead, contribute positively through a concerted effort to clean the river of its solid waste pollutants. Apart from that, the Kukuyaan program’s own uniqueness has attracted the attention of other external actors who become interested in learning more about the river.

The object of this study was to find out whether the Kukuyaan program as a river revitalization effort being carried out in the Cikapundung River can be adopted and used as reference for the rehabilitation of other rivers in Indonesia. The main research question that we would focus on in our study was: what factors affect the eligibility of other polluted

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rivers in becoming successfully revitalized using the Kukuya program. The main lesson that can be learned from this case study is that there needs to be a harmonization between the role of the local government as well as the local communities in order to reach the targeted goals.

2. Methods and Material

In this study, we use the concept of collective action and social movements in order to analyze the relationships between the main stakeholders. Collaboration, coordination, and teamwork are an integral framework linking the stakeholders to contribute towards the creation of a program that can change the behavior and social habits of the surrounding community. In other words, collective action done by the stakeholders can create the social movements that are the targets of the program. To promote such dialogue as described in the preceding paragraphs and to ensure the widest possible dissemination of the results, it would help to organize some common activities that would bring together leading scholars approaching the institutional dimensions of human-environment relations, bottom up and top down [3]. I have also adopted 3 alternative approaches to local development: decentralized sectors, local government, and community support approaches. As illustrated in Figure 1, a network of 3 categories facilitators established through partnership building was responsible for empowering the river revitalization.

Figure 1. A collective action model of three alternative approaches to local development

2.1 Stakeholder identity and analysis

The most suitable technique for identifying the interests and strategies of actors regarding river revitalization community projects is stakeholder analysis. Sustainability among stakeholders is very important; it means that the social and cultural compatibility of human intervention in the environment with the images of nature and the environment are constructed by different groups within society. It does not matter whether there is a real environmental crisis in the sense of facts proven by natural sciences [4]. Research from a bottom-up perspective applied stakeholder analysis to identify those actors who are likely to be affected by river revitalization deployment and to describe their interrelationships and interactions as in Figure 1. Although the three approaches all aim to providing public facilities and services at the local level, they organize their efforts differently. While sectoral approaches organize according to the functions to be performed or the services to be provided, local government approaches organize based on the territorial jurisdiction under a legally autonomous authority. As illustrated in Figure 1, the basis of community support approaches is the social unit through which people organize, either traditionally or voluntarily, to make and act upon collective decisions and as a result of these fundamental differences, each approach has generated a distinct body of theory and practice relevant to supporting local development [5].

2.2 Case Study

The Cikapundung River is part of the watershed of the Citarum river, which is the longest and biggest river in the province of West Java, Indonesia. The Cikapundung River is one of the 48 rivers surrounding the town of Bandung. The length of the Cikapundung River is around 15.4 km. This river weaves through densely populated residential areas, especially around the area of West Bandung. According to data from the Environmental Management Body of Bandung, there are over 750,000 residents living near the river. The width of the river at its source is 22 meters, and 26 meters at its mouth, with a minimum water debit of 6 m³/s. The Cikapundung river also serves as the main drainage point for the town of Bandung, a dumping site for domestic and industrial waste, a supply of drinking water for the local water company (PDAM) of Bandung, a supply of hydroelectric energy as has been managed by PT Indonesia Power-Unit
Saguling which has installations in PLTA Bengkok and PLTA Dago Pojok, and as a supply of water for irrigation—as the town of Bandung continues to develop, this function is not significant any more. Not only that, the Cikapundung River is also used to store water during dry season, to reduce the sedimentation of mud in the Citarum River, and also as a source of hydroelectric power for the region of West Java, as well as the electrical network from Java to Bali.

As time passes, the effectiveness of the Cikapundung River to perform its various functions has continued to decrease. This is caused by the increasing pollution and environmental destruction that has occurred in the surrounding river area. More and more people build settlements on the riverside, and, in general the condition of the Cikapundung River is already quite degraded. Almost 10.5 km of the Cikapundung riverside is lined with residential housing, where almost 90% of their domestic household wastes are thrown into the Cikapundung River and this has made Cikapundung River receiving around 2.5 million liters of waste per day [6]. The most common household waste found there are different types of food wrappings, especially in the form of paper, styrofoam and cans, as well as clothing, bottles, and other miscellaneous plastics. These objects often stick in tree roots around the river, causing the waste to build up and continue to increase the pollution levels in the river.

The Cikapundung River has been classified as a category IV in terms of its pollution. The damage done in the Cikapundung River is made worse by the high amount of waste that also comes from non-ecofriendly agricultural practices, farming, households, local markets, and industrial runoff. The location of the Cikapundung River’s source in the area of North Bandung influences the quality and quantity of the water debit. The current condition of the Northern Bandung area is increasingly filled with shopping centers, residential areas, as well as several hotels and high-rises. This cannot ensure anymore that the Cikapundung River can have its normal water debit, especially in the dry season where the water flowing from the Cikapundung River’s source is not enough at all to fulfill all the needs of various stakeholders on the riverside, causing the Cikapundung River’s water debit to gradually decrease and hard to predict.

![Fig. 2. The Importance of the Cikapundung River to the livelihoods of the riverside communities](image)

Although the effectiveness of its functions has decreased due to pollution, as shown in Figure 2, the Cikapundung River still plays a vital role in the lives of the surrounding communities despite of its condition which is getting more and more worrisome. Because of that, several programs have been realized in an effort to rehabilitate the Cikapundung River. These programs involve the roles of local community as well as the local government.

3. Result of River Revitalization Analysis

Since the Cikapundung River plays a vital role in the lives of people in the city of Bandung, several of the stakeholders mentioned beforehand have strived to implement various rehabilitation efforts for Cikapundung River. The scheme of the stakeholders in formulating the river revitalization policies in this study are shown in Figure 3 [7].
3.1 The Strategy of Community Empowerment

Local communities are key elements in the revitalization effort of the Cikapundung River. Since the Cikapundung River is so long, there are several communities that are involved; they are divided according to the Rukun Warga (RW) or neighborhood system. There are 43 Kukuyaan communities which are managed by each RW that is located on the Cikapundung riverside; among them are the Bantaran 13 community, Kuya Gaya, Zero, Katak, etc. In 2010, the Baraya Cikapundung community was formed as the main coordinating community for the 43 other communities. This Baraya Cikapundung community is headed by Mrs. Riana Dewipurnamasari. Baraya Cikapundung was made official on the same occasion as the record breaking attempt for the most participants in a Kukuyaan program, where there were over 842 participants floating down the river on inner tire tubes. This record breaking attempt was one of the revitalization programs of the Cikapundung River which has been done, called Kukuyaan.

Dozens of river community activists in the city of Bandung launched a trial of a river expedition by floating with inner tubes, popularly called Kukuyaan in a local language, along the upper stream of Citarum River. In Sundanese language, Kukuyaan means turtle, as an inner tube rafter usually takes a supine position and uses both hands to paddle mimicking a turtle in motion in an upward-facing position. Technically, the Kukuyaan program is similar to a rafting sport, such as white water rafting. However, it is different in the way of the equipment and methods used. The equipment needed to do Kukuyaan is quite simple as it only requires normal safety gear and a used inner tire as the float. The tires used usually come from cars or trucks, which have undergone various tests to ensure the quality. As for the method, one tire is used for one person as their own boat, so that the person only needs to sit on the tire and let the river current carry him/her down the river, although once in a while they may have to paddle using their hands in order to steer the tire on the designated track. Participants of Kukuyaan can float as far as 15 km downhill along the Cikapundung River. In order to minimalize accidents, participants are often accompanied by an official guide who chooses a suitable river track for them. Tourists take part in this Kukuyaan program mostly during the rainy season in months of October-March because at this time, the water debit of the Cikapundung River is much larger than in previous months. The length of the track and the equipment used, especially the used inner tires, are a fascinating attraction for the lovers of Kukuyaan.

However, the decreasing effectiveness of the Cikapundung River’s functions has had a direct impact on the Kukuyaan activity. This is because Kukuyaan is highly dependent on the conditions of the Cikapundung River, being the water debit and the level of pollution of the Cikapundung River. The increasing amount of trash, decreasing water debit and the uncertainty of natural conditions hinder the locals and tourists from being able to do the Kukuyaan program. In the beginning, in order to restore the ability to conduct the Kukuyaan program, several communities and Kukuyaan lovers came together to cleanup Cikapundung River. However, this river cleanup gradually grew into a regular activity that is done once every 3 weeks by one of the 43 Kukuyaan communities, with each community taking turns each time. Cleaning-up the Cikapundung River became even more structured after the Baraya Cikapundung community coordinated each community to contribute to the river clean-up. These communities also tried to inform and mobilize the local people in the riverside area to participate in the rehabilitation effort, as well as giving them informative sessions regarding the importance of not throwing trash into the rivers, and also inviting them to participate in the Kukuyaan program once the rivers are clean once more. This effort is done in order to create a sense of love and
common ownership of the Cikapundung River as the lifeblood of the city of Bandung.

Ever since, the Kukuyaan program has not only been a fun recreational water sport, but also an environmental awareness campaign and a regular clean up of the Cikapundung River. As of now, there is still no fixed price to use Kukuyaan in the Cikapundung River, as the program is still conducted differently by each Kukuyaan community. However, for the Bantaran 13 community, they have fixed price of Rp 50,000/person for a complete package of Kukuyaan program which includes a Kukuyaan ride with a guide, a tour guide to get to know the Cikapundung River, a river cleanup session, and one lunch menu. The price set is still not fixed yet as the original goal of the communities is not focused on economic gains; hence, the price is only fixed to attract tourists from outside of the region to try the Kukuyaan program. The river cleanup is also done not only when there are Kukuyaan activities. Since Cikapundung River flows almost throughout the entire city of Bandung and its source is located in the educational area of West Bandung where there are universities, like ITB and UNPAD, college students are among the main target audiences of the Kukuyaan program. As word of the Kukuyaan program spreads, it has attracted the interest of many college students. Many of them have conducted several programs with the Kukuyaan communities, such as the event done by Komunitas House the House in partnership with Manuel Haischel (a master student of Visual Arts in ITB) to paint the walls of the buildings on the left and right side of the Cikapundung River. There was also the production of Kabaya Nyingceut made by the visual arts community of ITB for 3 days and previewed on the local TV station of Bandung.

3.2 Local Governance

Government has emerged from evolutionary processes as a way of promoting collective welfare [8]. The effectiveness of the Kukuyaan program to rehabilitate the Cikapundung River attracted the attention of the local government of the city of Bandung. Kukuyaan was able to bring the spirit of revitalization of the Cikapundung River back to the forefront, where once it had been forgotten. Now, the local government of Bandung has included the Cikapundung River as one of the primary priorities in their development programs, both in the short term (2009-2013) and the long term (2005-2025) [9]. The rehabilitation of Cikapundung River is supported by programs like Gerakan Cikapundung Bersih (Cikapundung Rehabilitation Program/CRP), which is both endorsed by the local and central government. For the local government of Bandung, the revitalization plan of the Cikapundung River will involve 5 sub-neighborhoods in 3 neighborhoods. In these neighborhoods, the problems faced are pretty similar; among them are being waste management, water source management, and septic tank management. Because of this, the urban planning of the area will also need to include the building of a clean water pipe, drainage, septic tank, and waste management facilities [10]. Apart from those initiatives, other forms of direct support of the Kukuyaan program by the government include, among other, giving financial support and donating the used inner tires used to ride the Kukuyaan. The government’s next plan is to pass a regulation regarding a fine of up to Rp 5,000,000 ($500) for whoever throws trash into the river, as well as involving more government personnel (TNI, POLRI, etc) in the cleanup program in the Cikapundung River.

4. Discussion

4.1 Comparison of Stakeholder motivations

![Fig. 4. Survey of people regarding interest in Kukuyaan program](image)

Fig. 4. Survey of people regarding interest in Kukuyaan program

Starting with the corporate sector, many firms and trade associations have expressed a high level of dissatisfaction with the pace and extent of traditional, intergovernmental cooperation and regime formation [11]. Although each actor
has its own different priorities, each is interconnected in some way. The Kukuyaan program has had a significant effect in the river rehabilitation program (Cikapundung Rehabilitation Program) done by the local government of Bandung. This is shown in Figure 4, where our survey showed that 55% of correspondents were very interested in the Kukuyaan program.

Apart from meeting the specific river characteristics, in order to adopt the Kukuyaan program, a strong coordination mechanism between stakeholders is also needed in order to meet the goals of the program. The Kukuyaan program is made stronger through the merging of the internal sector to the external sector in a systematic pattern. This pattern starts from the local communities which target the surrounding riverside communities and the college students, followed by the local government which has the whole population of Bandung in mind. This pattern functions by strengthening the smallest of its units through decentralization, from the provincial government to the local government and then to the local communities. When this pattern has been started then the main driving force is in the local communities as the smallest unit. The success of the Kukuyaan program in achieving its goals is used by the local government as a stepping stone in realizing other Cikapundung rehabilitation efforts. So, in this study case, the Kukuyaan program is included in the Gerakan Cikapundung Bersih program (Cikapundung Rehabilitation Program/CRP) which is supported by the provincial government of West Java and the central government as well.

This Kukuyaan program is conducted by the local communities and the local government in order to attract attention and raise awareness amongst the general population. One of these was the record-breaking attempt of having the most inner tires in a river, cooperating with the Harley Davidson organization, and Students’ Association of various national/international universities, such as ITB. As for now, the success of Kukuyaan has driven the success of other river revitalization efforts; not only concerning the cleanliness of the river, but also of its surrounding terrestrial area. An example of this is Gang Wisata, where there are wall paintings covering the entire street, done by children and teenagers with art talents. Another example is Ruang Publik as a place to conserve the traditional Sundanese arts and complete with several traditional musical instruments, such as angklung, degung, etc. These terrestrial projects are done by the 43 local communities in the Cikapundung River in order to give a good impression to visitors as they reach the Cikapundung River to play Kukuyaan.

5. Conclusion

The Kukuyaan program as a river revitalization effort done in the Cikapundung River can be adopted and be used as a reference for the rehabilitation efforts of various rivers in Indonesia. The criteria that have to be met are: having a water debit of at least 6 m³/s, having a river length of at least 4 km, and the river is categorized not more than a class IV in terms of pollution. The success of the Kukuyaan program as a river revitalization effort lies in first strengthening the local communities. The local communities have to have a clear structure and able to coordinate well with the other communities. Apart from that, the government also has an important role in formulating the policies and giving financial support for the programs brought up by the local communities so that in this program the government and the local communities both contribute towards the river rehabilitation. Looking at the patterns that have been explained, apart from the river characteristics, the roles of the stakeholders are also an integral key in the success of this program. The failure of the government to do river rehabilitation efforts in many cases is caused by the low amount of response from the local communities. Because of this, this study shows that the rehabilitation of rivers has to start in the smallest sector, which is the leaders of the local community which can then persuade the surrounding residents to participate in the program being realized. The program is designed to attract the attention and response from the communities as well as the local government. Good cooperation between the communities and the local government in realizing the program can ensure success in making it a community-engaged effort to revitalize the river.

Acknowledgements

We would like to thank the Baraya Cikapundung Community, especially the Bantaran 13 Community that has been so kind and cooperative in allowing us to conduct the surveys and interviews necessary in order to obtain the data used in this study.
References

The Analysis of Community Adaptation Process in Constructing Disaster-Prone City (A Study on West Padang)

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² Lecturer Architecture Engineering Department, University of Indonesia

Abstract

Natural disaster is an event that cannot be eliminated or postponed. However, we can reduce the risk through mitigation planning, structurally or non-structurally related to the physical construction, including the spatial planning that suitable with the vulnerability of the region. With the ability to adapt within a disaster-prone city, a community has a major role in mitigation process. This adaptation is affected by the comprehension and perception of the community. The purpose of the study was to analyze the adaptation process using the variables of social, economic, cultural, and physical factors affecting the comprehension and it will affect the perception. Another factor that will affect the perception is the mitigation preparation in facilities and infrastructure.

The application of cognitive theory for society adaptation in planning disaster-prone city spatial with 455 survey respondents using the Structural Equation Modeling (SEM) is one of the multivariate analysis that analyzes the relationship between variables thoroughly, complex and simultaneously. The first step to see how far the data support the model, we used the value indicators of Goodness Of Fit Index (GOFI) latent variable on testing Confirmatory Factor Analysis (CFA); it showed a very good match, the model is saturated = perfect fit. The scope of the research is the implementation of disaster-prone mitigation with research sites in Padang, especially in the Western part.

The research shows that cognitive theory affects the perception and it influences the adaptation that is used to construct significant model in research data.

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Keyword: Disaster-prone city, mitigation, adaptation, SEM.

1. Introduction

Sumatra Island as one of the disaster-prone regions resides among the 3 (three) crustal plates of the earth: the Eurasian continent, the Indian-Australian Ocean and the Pacific Ocean plate. The interaction of these plates engenders to what is known as the line of volcanoes, earthquakes and mountain trails. The track is known as the path of geological disasters (landslides, volcanic eruptions, earthquakes and tsunami), ranging from the northwest of Aceh through Bukit Barisan up to Lampung. Padang is located in that pathway and highly vulnerable to geological natural disasters. The seismic data showed that the centers of earthquake at the coast of Padang are spread evenly. Many people lost their life in one of the consequent earthquake on 30 September 2009 in Padang.

Earthquake is difficult to predict, so the effort that can be done is to reduce the risk through mitigation. Disaster mitigation is "a series of efforts to reduce the risk of a disaster, either through physical development or building and increasing the awareness in facing the threat of disaster" (UU 24/2007). Mitigation can be divided into two categories: structural and cultural mitigations. Structural mitigation is the effort to reduce vulnerability of disaster through engineering a resistant construction. In a micro-scale, it can be done through the formulation of disaster by coding the structure and construct the resistant building; in a macro-scale, it can be done by zoning the scale of disaster and designing regulations of the buildings. Cultural mitigation is the effort to reduce the vulnerability of disaster by changing the paradigm, improving knowledge and attitudes; thereby, the society becomes tougher.
The impact of natural disaster in a region is directly felt by the society and it is important to reduce and avoid the risk by increasing their capacity [1]. This society is one that has direct experience on a disaster so their understanding of it becomes a basic knowledge in reducing the risk; it is important to understand their response [2].

There are changes in the orientation of research on disaster. It is not only on the technical and handling the victims, but also on the approach that emphasizes on society aspects including the management proposal mitigation integrally in society development [3]

There will be changes in city structure and form as the implementation of disaster-prone mitigation. The understanding from the society will be needed to create a perception so they can adapt to it. The structure and form of the city is the result of the dynamic from various factors, generally or locally, in social, economic, cultural, and physical factors. Allocating the utilization area in the structure will require a plan to sum the needs of society from all sectors, both in current needs as well as in the future.

The purpose of the study was to analyze the adaptation process with the dependability on understanding, readiness and the availability of mitigation in infrastructure and perception affecting society in disaster-prone city. The problem of this research is that the mitigation implementation cannot accommodate the needs of society in all sectors so they need to adapt to it in reducing the casualties and risk of the disaster.

2. Research Method

Figure 1. The Community Adaptation Model
This research used the survey design with quantitative and qualitative analytical approaches; it was a research that took samples from population and used questionnaires and interviews as the main data collection. The research was based on the premise that the society perception was really needed in determining plan and development guidelines as well as the provision of infrastructure facilities in a district and city in terms of earthquake disaster mitigation. It is one of the development concepts by including their participations so we can know their perception towards their living place; also, we know their understanding and mitigation (the infrastructure preparation) along with their adaptation and anticipation in facing earthquakes. The population in this study was the society from West Padang and the samples used 455 patriarch based on Slovin’s theory $n = N / 1 + Ne^2$. [4]

Table 1. Latent Variables and Observed Variables

<table>
<thead>
<tr>
<th>Latent Variable</th>
<th>The Observable Variables</th>
<th>Code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical</td>
<td>Earthquake-resistant buildings</td>
<td>Physical1</td>
</tr>
<tr>
<td></td>
<td>When disaster shelter</td>
<td>Physical 2</td>
</tr>
<tr>
<td></td>
<td>When disaster happen take cover</td>
<td>Physical 3</td>
</tr>
<tr>
<td></td>
<td>Disaster-prone areas</td>
<td>Physical 4</td>
</tr>
<tr>
<td>Social</td>
<td>The level of public awareness</td>
<td>Social 1</td>
</tr>
<tr>
<td></td>
<td>Mutual cooperation</td>
<td>Social 2</td>
</tr>
<tr>
<td></td>
<td>Decision-making</td>
<td>Social 3</td>
</tr>
<tr>
<td>Economic</td>
<td>Economic system</td>
<td>Economic 1</td>
</tr>
<tr>
<td></td>
<td>The unemployment rate</td>
<td>Economic 2</td>
</tr>
<tr>
<td></td>
<td>Criminality</td>
<td>Economic 3</td>
</tr>
<tr>
<td>Culture</td>
<td>The appropriate counseling culture</td>
<td>Culture 1</td>
</tr>
<tr>
<td></td>
<td>The level of society awareness</td>
<td>Culture 2</td>
</tr>
<tr>
<td></td>
<td>The society leaders becomes a role model</td>
<td>Culture 3</td>
</tr>
<tr>
<td></td>
<td>The society still cherish the culture</td>
<td>Culture 4</td>
</tr>
<tr>
<td>Mitigation</td>
<td>The standard of earthquake resistant building</td>
<td>Mitigation 1</td>
</tr>
<tr>
<td></td>
<td>The evacuation routes in the environment</td>
<td>Mitigation 2</td>
</tr>
<tr>
<td></td>
<td>The capacity of evacuation is adequate</td>
<td>Mitigation 3</td>
</tr>
<tr>
<td></td>
<td>The room of evacuation is adequate</td>
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</tr>
<tr>
<td></td>
<td>Community got a briefing</td>
<td>Mitigation 5</td>
</tr>
<tr>
<td>Perception</td>
<td>The spatial of Padang</td>
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</tr>
<tr>
<td></td>
<td>Uncomfortable the resident move</td>
<td>Perception 2</td>
</tr>
<tr>
<td></td>
<td>The control and usege of space</td>
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</tr>
<tr>
<td></td>
<td>The outreach for the society</td>
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</tr>
<tr>
<td>Adaptation</td>
<td>Adjustment to environment conditions</td>
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</tr>
<tr>
<td></td>
<td>Necessary precautions</td>
<td>Adaptation 2</td>
</tr>
<tr>
<td></td>
<td>Material benefits</td>
<td>Adaptation 3</td>
</tr>
</tbody>
</table>
Explanation on factors used in establishing models are as follow:

1. Comprehension Factor influences perception and perception influences adaptation based on the Cognitive And Piaget theory.
2. Comprehension is influenced by Physical, Social, Economic & Cultural factors based on the concept of environmental science.
3. An increase in mitigation factor (preparedness of facilities & infrastructure) is a concept developed by the writer to be tested in a model using SEM

Based on the concept of frameworks and outlined, the formulated hypothesis in this study were:

H1: There is a relationship / influence between comprehension variables (understanding) towards the perception (perceptual)
H2: There is a relationship / influence between comprehension variables (understanding) towards the mitigation (mitigate)
H3: There is a relationship / influence between mitigation variables (mitigate) towards the perception (perceptual)
H4: There is a relationship / influence between perception variables (perceptual) towards adaptation (adaptability)

3. Analysis and Discussion

After testing the measurement model and the simplifications of latent variable, either to the first order or to the second one, then, the Confirmatory Test Factor Analysis (CFA) was done which aimed to reconfirm latent variable that could be processed further simultaneously / in same time to the stage of structural research.[5]

The pictures of CFA test results could be seen in the figure below:

![Confirmatory Factor Analysis Test / CFA (Standardized Solution)](image)

The first step to see how the data supported the model, we used the indicator value: the Goodness of Fit Index (GOFI) latent variable on CFA test. The result showed that the latent variable on CFA test had a value of Chi-Square = 0, df = 0, P-value = 1, RMSEA = 0.00, which meant a very good match, the model is saturated = perfect fit. It can be concluded that the data strongly supported the model for the latent variables in the CFA test.

The result on the latent variable measurement model on CFA test was seemed to have Standardized Loading Factor (SLF) > 0.50 (good validity). The reliability was good where the value of CR > 0.70 and VE > 0.50. The summary of the validity and reliability of the latent variables in the CFA test could be seen in the table below:
Tabel 2. Latent Variables and Reliability on the CFA test

<table>
<thead>
<tr>
<th>Latent Variable / Observed variable</th>
<th>The value of SLF*) &gt; 0.50</th>
<th>Error value</th>
<th>The value of CR**) &gt; 0.70</th>
<th>The value of VE***) &gt; 0.50</th>
<th>The conclusion of calculation</th>
</tr>
</thead>
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<td>0.98</td>
<td>Reliability good</td>
<td></td>
</tr>
<tr>
<td>Social 1</td>
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<td>0.01</td>
<td></td>
<td>Validity good</td>
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</tr>
<tr>
<td>Perception</td>
<td></td>
<td>0.99</td>
<td>0.99</td>
<td>Reliability good</td>
<td></td>
</tr>
<tr>
<td>Perception 1</td>
<td>1.00</td>
<td>0.01</td>
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<td>Validity good</td>
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</tr>
<tr>
<td>Mitigation</td>
<td></td>
<td>0.98</td>
<td>0.98</td>
<td>Reliability good</td>
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</tr>
<tr>
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<td>0.97</td>
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</tr>
</tbody>
</table>

*) SLF = Standardized Factor Loading, wherein the value of good SLF > 0.50  
**) CR = Construct Reliability; whereby CR good value > 0.70  
***) VE = Variance Extracted, wherein the value of a good VE > 0.50

4. Result

The final stage of processing SEM was to test the structural models which tested the research model where the results was in the form of details to see which hypotheses were accepted and rejected. The hypothesis was acceptable if the value of t was (T - Value) > 1.96. The pictures of the structural model test were 2 (two):

1. Based on the value of t (T-value) to test the hypothesis
2. Based on the standard value / standardized solution, to see the size of the effect between the latent variables of research on the hypothesis

The pictures of both the structural model test results can be seen below.

![Figure 3. The Result of Structural Model Research (T-Value)](image-url)
The first step to see how the data supported the model, we used the value indicators of Goodness of Fit Index (GOFI) latent variable on structural model test research. The result showed that the value of Chi-Square = 0, df = 0, P-value = 1, RMSEA = 0.00 on latent variables in the structural model test; it meant that it was a very good match, the model is saturated = perfect fit. It can be concluded that the data strongly supported a model for the latent variables in the structural model test research. The description of the result on hypothesis research can be seen in the table below:

<table>
<thead>
<tr>
<th>Relations / Effect Between Latent Variables</th>
<th>T value</th>
<th>coefficient</th>
<th>The Conclusions of Hypothesis Significance Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>H1: There is a relationship / influence between comprehension variables (understanding) towards the perception (perceptual)</td>
<td>3.01</td>
<td>0.15</td>
<td>H1 is accepted, t value &gt; 1.96 there is a relationship / positive influence between the understanding towards the perceptual</td>
</tr>
<tr>
<td>H2: There is a relationship / influence between comprehension variables (understanding) the mitigation (mitigate)</td>
<td>1.63</td>
<td>0.10</td>
<td>H2 is rejected, t value &lt;1.96 there is no relationship / influence between comprehension towards the mitigate</td>
</tr>
<tr>
<td>H3: There is a relationship / influence between mitigation variables (mitigate) towards the perception (perceptual)</td>
<td>2.66</td>
<td>0.12</td>
<td>H3 is received, t value &gt; 1.96 there is a relationship / positive influence between mitigate towards the perceptual</td>
</tr>
<tr>
<td>H4: There is a relationship / influence between perception variables (perceptual) towards adaptation (adaptability)</td>
<td>2.09</td>
<td>0.11</td>
<td>H4 is received, t value &gt; 1.96 there is a relationship / positive influence between perceptual towards adaptability</td>
</tr>
</tbody>
</table>

Source: The Results of Research Data Processing (2012)

From the research hypotheses above, in the 4 hypotheses, there were three acceptable hypotheses and one hypothesis was rejected by forming paths / lines which were connected as follows:

1. Comprehension (understanding) ➔ Perception (Perceptual) ➔ Adaptation (Adaptability)
2. Mitigation (mitigate) ➔ Perception (Perceptual) ➔ Adaptation (Adaptability)

The influence between the dominant latent variable researches on this study was between the latent variables of comprehension (understanding) towards the perception (perceptual)
5. Discussion

Based on tests of physical latent variable, it showed that the physical 2 (the observed variable) was the one presenting the respondent in physical. The physical variable 2 was the society’s opinion about the importance of seeking a safe place when a disaster occurred; it showed that they already knew and realized the importance of a safe place to become a shelter. The availability of a safe place became an important factor and should become a concern for the government in planning a disaster-prone spatial.

Based on the social latent variable model, the test showed that social1 (the observed variable) was a latent variable presenting respondents in social. The social 1 is the society’s opinion on the importance of caring of each other when disaster occurred; it showed that people already knew and realized the importance of unity in facing and overcoming the disaster and it should be a concern for the government in planning a disaster-prone spatial.

Based on tests on the economic latent variable, it showed that all economics (the observed variables) were the variables presenting the respondents in economy. The economy1, economy2 and economy3 were the disruption of economic system, the increasing of unemployment and criminality rate were very important to confront and overcome the disaster and it should be a concern for the government in planning a disaster-prone spatial.

Based on the culture latent variable, it showed that culture3 (the observed variable) was presenting the respondent in the culture variable. The culture3 variable was their opinion on public figures that was still a role model in the society according to each culture, so it might be a consideration for the government’s preparation when disaster occurred.

The link between latent variables in the research suggested that the society’s understanding towards disaster-prone city was influenced by physical, social, economic and cultural variables. This study revealed some observed variables that presenting respondents and it was a major concern in constructing steps and strategies to improve the society’s perception of spatial disaster-prone city.

In the theory constructing this study, it stated that beside about the society's understanding of spatial planning, perception was also influenced by the preparedness of mitigation; the availability and readiness of infrastructure mitigation were established by the government. Based on tests, the observed mitigation variables (mitigation 2, mitigation 3, mitigation 4 and mitigation 5) were representing respondents in mitigation latent variable. Respondents noted that the evacuation routes, the capacity of the route, the existence of evacuation space and direction from government during disasters placement were very important.

The structural stages simultaneously showed that all latent variables used here based on J. Piaget supported the SEM model.

1. There is a relationship / influence between understanding variable understanding towards the perception.
2. There is a relationship / influence between mitigation variables mitigate towards the perception.
3. There is a relationship / influence between perceptions variable perceptions towards adaptation.

Adaptation is an adjustment behavior (behavioral adaptation) which refers to an action. Adaptation to the environment is repeated behavior; this raises two possibilities; the first is imitating the successful behavior as expected and the second is those who do not want to do it because it is not like what they are expecting. Success in this mimicking behavior leads to an individual adjustment towards their environment or an adjustment happens with the environment towards individual. [6]

The application of cognitive theory for society adaptation in planning disaster-prone city spatial with 455 survey respondents by using the Structural Equation Modeling (SEM) was one of the multivariate analysis that analyzed the relationship between variables thoroughly complex and simultaneous. The first step to see how far the data supported the model we used the value indicators of Goodness Of Fit Index (GOFI) latent variable on testing Confirmatory Factor Analysis (CFA); it showed a very good match, the model is saturated = perfect fit. Thus, it can be stated that the data strongly supported the model for the latent variables.

The result showed that the understanding towards the spatial changes affected the spatial perception and adaptation. The increasing perception through increasing knowledge will be added when the readiness of infrastructure mitigation was fit with the needs of the society and it should be fixed.

Based on the research results, to make the society in disaster-prone city can adapt well, besides the needs of increasing understanding through socialization, education is also needed related with their needs in infrastructure so they will have a good perception in mitigation. With their knowledge capacity, it is expected that they will participate in maintaining facilities and infrastructure so that when the disaster occurs, it can be used as much as possible to provide for their benefits. The good implementation is the integration of mitigation both in structural and cultural.
6. Conclusion

There are some conclusions based on the results. First, the society’s understanding is influenced by physical, social, economic and cultural factors. Second, the perception is significantly affected by the understanding and mitigation (the preparation in facilities and infrastructure). Third, perceptions are affected by the adaptation. There are differences in the observed factors in the initial model with the results of the research. The research shows that the cognitive theoretical that stated understanding affecting the perception and perception influence the adaptation used in constructing society’s adaptation in disaster-prone city is significant in the research data. With the increasing adaptability of the community in mitigation programs, society is expected to be better prepared, to take a stand and be more confident in disaster management, so as to reduce the number of fatalities and can make a sustainable city.

References

4th International Conference on Sustainable Future for Human Security, SustaiN 2013

Status of Heavy Metal Concentration in Water of Citarum River at Selected Sites in Bandung Residence

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Abstract

The pollution of aquatic ecosystem by heavy metals has been assumed as serious proportions due to their toxicity and accumulative behavior. This paper deals with the measurement of four heavy metals, i.e. Cd, Cr\textsuperscript{6+}, Cu, and Zn. Grab samples of water for one year period (March, June, and November) were collected from 6 different sites following the Standard Methods. Water samples of this river were processed and analyzed for heavy metal using AAS. The heavy metal found in the river water were in range of: Cd (0.00 to 0.01 mg/L); Cr\textsuperscript{6+} (0.03 to 0.18 mg/L); Cu (0.00 to 0.08 mg/L); and Zn (0.00 to 1.44 mg/L). Some physic-chemical parameters which were dissolved oxygen, BOD\textsubscript{5}, and COD were also estimated as they have direct or indirect influence on incidence, transport and speciation of the heavy metals. Based on the findings, the Citarum river water can be considered as polluted with respect to Cd, Cu, Cr\textsuperscript{6+}, and Zn.

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Keywords: Accumulative Heavy metals; Citarum Rivers; Pollution; toxicity;

1. Introduction

The Citarum River is one of the most utilized rivers in Indonesia. Due to the abundant availability of water throughout the year, it has played an important role in the development of West Java civilization and economy. Increased urbanization and industrialization in the basin has resulted in polluting the river, since the river has been the preferred waste disposal site for industrial and domestic effluents.

The Pollution of aquatic ecosystem by heavy metals has assumed to be serious proportions due to their toxicity and accumulative behavior. Unlike organic pollutants, natural processes of decomposition do not remove heavy metals. Metals are introduced into the aquatic system as a result of weathering soil and rocks from volcanic eruptions and from a variety of human activities involving mining, and processing use of metals or substances containing metal contaminants. Trace metals entering natural water become part of the water-sediment system and their distribution processes are controlled by a dynamic set of physicochemical equilibrium. The metal solubility is principally controlled by pH, concentration and type of ligands and chelating agents, oxidation-state of mineral components and the redox environment of the system.

Since each form may have different bioavailability and toxicity, the environmentalists are rightly concerned about the exact forms of metal present in the aquatic environment. Thus, distribution of heavy metals in water, and sediments play a key role in detecting sources of heavy metal pollution in aquatic ecosystem [5]. Almost all important rivers in West Java have been monitored in detail for heavy metal pollution in water. However, very little emphasis has been given on the heavy metals accumulation in Citarum River water, especially in the region of Bandung residences.

In this paper, we presented the heavy metals distribution in Citarum River and quantified the degree of pollution caused by them at this stretch. Metals in the Citarum River come from natural as well as artificial sources. Metal that is naturally introduced into the river is primary from sources, such as rock weathering, soil erosion, or the dissolution of water-soluble salts. Naturally occurring metal moves through aquatic environments of human activities independently. Usually, it is without any detrimental effects. However, as the valley of the Citarum River and its tributaries are settled and industrialized, the metal are essential for proper metabolism an all living organism yet toxic at high concentrations. Other metals currently thought of as non-essential are toxic even at relatively low concentrations.

Heavy metals are released to the Citarum River from numerous sources. Typical sources are municipal wastewater-treatment plants, manufacturing industries, mining, and rural agricultural cultivation and fertilization. Heavy
metals are transported as either dissolved species in water or as an integral part of suspended sediments. Heavy metals may be volatilized to the atmosphere or stored in riverbed sediments. Toxic heavy metals are taken up by organisms; the metals dissolved in water have the greatest potential of causing the most deleterious effects [7][9].

2. Material and Methods

2.1. Description of Study Area

Citarum River is the biggest river in West Java Indonesia. It has an important role in the lives of the people of West Java as it is used to support agriculture sector, water supply, fishery, industry, sewerage, electricity, etc. There are three hydroelectric power plant dams installed along this river: Saguling, Cirata, and Ir. H. Djumand (Jatiluhur) hydroelectric power plant, all supplying the electricity for Bandung and Greater Jakarta area. The Jatiluhur Dam with a 3 billion cubic meter storage capacity is the largest reservoir in Indonesia. The river is heavily polluted by human activities; about five million people live in the river’s basin, and most of them rely on its flow for their water supply [9].

Majalaya in Bandung Residential is the heartland of the textile industry in Indonesia. Out of 600 factories built along the Citarum River, 170 are located in the village. Yet, 90 percent of the factories lack efficient waste water treatment systems. Industry sector discharge at least 1,320 Liters or 280 tons of waste everyday in the river and its tributaries [9].

2.2 Water Sampling

For water sampling, six sampling points were chosen at the banks of Citarum River. The sampling points were located at Bandung resident (see Table 1). These points were chosen because they receive considerable amount of wastewater from industrial areas as well as from intensively cultivated agriculture areas and domestic wastes from 5 towns and villages (used as reference points), i.e.: Bandung, Sumedang, West Bandung Resident, Bandung and Cimahi Municipals.

<table>
<thead>
<tr>
<th>Site</th>
<th>X (meter)</th>
<th>Y (meter)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I Cisanti Lake</td>
<td>793709*</td>
<td>9202411*</td>
</tr>
<tr>
<td>II Cikapundung</td>
<td>7900729*</td>
<td>9226616*</td>
</tr>
<tr>
<td>III Cisangkuy</td>
<td>789994*</td>
<td>9226634*</td>
</tr>
<tr>
<td>IV Cibeureum</td>
<td>780601*</td>
<td>9229399*</td>
</tr>
<tr>
<td>V Cibaligo</td>
<td>780159*</td>
<td>9232216*</td>
</tr>
<tr>
<td>VI Cimahi</td>
<td>779133*</td>
<td>9232531*</td>
</tr>
</tbody>
</table>

*Universal Transverse Mercator (UTM) coordinat system, zone 48 M

Six water samples were collected once in three times, i.e. in March, June, and November 2011. Water samples were taken using Van Dorn plastics bottles (1.5 L capacity). The samples, after collection, were stored in the refrigerator at about 4°C prior to analysis. All chemicals used in the study were of analytical grade and obtained from Merck Indonesia. Double distilled water was used throughout the study. The sample bottles were soaked in 10% HNO₃ for 24 hours and rinsed several times with double distilled water prior to use. All the glassware and other samples containers were thoroughly cleaned and finally rinsed with double distilled water. The pH measurement was made using pH meter (Model-Systolic 365); the metal concentration in the samples was determined using atomic absorption spectrophotometer (AA-3600 Shimadzu North America). The physicochemical parameters samples were determined following the standard methods for the analysis of water APHA [4]. Samples were analyzed in Environmental Engineering Laboratory of ITENAS Bandung.

3. Result and Discussion

3.1. Sources of Metals in the Citarum River

Heavy metals in the Citarum River are originated from either natural processes or human activities. Natural erosion and weathering of crusted materials take place over long periods of time and the amount of heavy metals released is small. However, the potential for contamination is increasing when mining exposes metal-bearing ores.
When compared to the natural exposure of ore bodies through erosion, the exposure rate through industry is over ten times faster for lead and zinc [6]. Industrial wastewater can introduce substantial amounts of metals into the river. The largest amount of industries in the West Java is located along the Citarum River.

3.2 Physicochemical Characteristics of River Water

The pH ranged from 6.2 to 8.5 in all locations. The pH value of Citarum River water fell between slightly acidic to moderately alkaline and had relationship with the solubility and accumulation of heavy metal in river water according to Tessier et al and Warren and Zimmerman [35]. Dissolve oxygen ranged from 0.14 to 8.12 mg/L which was below as well as above the permissible limit assigned by Base International Standard (BIS). Biochemical Oxygen Demand (BOD₅) ranged from 1 to 202 mg/L which was above the WHO [34] limit of 3 mg/L, indicating that the water of all sites as polluted, which might affect the aquatic ecosystem. Chemical Oxygen Demand (COD) ranged from 2 to 492 mg/L. The values of physicochemical parameters measured in Citarum River water at different sites are given in Table 2.

Table 2. Physicochemical Characteristics of Citarum River

<table>
<thead>
<tr>
<th>No.</th>
<th>Site</th>
<th>Month</th>
<th>Q (m³/s)</th>
<th>DO (mg/L)</th>
<th>BOD₅ (mg/L)</th>
<th>COD (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Cisanti Lake</td>
<td>March</td>
<td>0.12</td>
<td>7.34</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>June</td>
<td>0.19</td>
<td>7.80</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November</td>
<td>0.20</td>
<td>8.12</td>
<td>1.00</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>0.17</td>
<td>7.75</td>
<td>1.33</td>
<td>2.00</td>
</tr>
<tr>
<td>II</td>
<td>Cikapundung</td>
<td>March</td>
<td>4.35</td>
<td>3.42</td>
<td>18.00</td>
<td>23.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>June</td>
<td>6.14</td>
<td>4.40</td>
<td>24.00</td>
<td>56.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November</td>
<td>5.90</td>
<td>0.79</td>
<td>11.00</td>
<td>12.00</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>5.46</td>
<td>2.87</td>
<td>17.67</td>
<td>30.33</td>
</tr>
<tr>
<td>III</td>
<td>Cisangkuy</td>
<td>March</td>
<td>11.25</td>
<td>5.42</td>
<td>4.00</td>
<td>19.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>June</td>
<td>7.98</td>
<td>4.04</td>
<td>3.00</td>
<td>25.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November</td>
<td>30.00</td>
<td>3.44</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>16.41</td>
<td>4.30</td>
<td>3.00</td>
<td>15.33</td>
</tr>
<tr>
<td>IV</td>
<td>Cibalgo</td>
<td>March</td>
<td>0.59</td>
<td>2.02</td>
<td>202.00</td>
<td>492.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>June</td>
<td>0.45</td>
<td>0.48</td>
<td>162.00</td>
<td>440.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November</td>
<td>0.63</td>
<td>0.10</td>
<td>69.00</td>
<td>273.00</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>0.56</td>
<td>0.87</td>
<td>144.33</td>
<td>401.67</td>
</tr>
<tr>
<td>V</td>
<td>Cimahi</td>
<td>March</td>
<td>1.56</td>
<td>2.95</td>
<td>17.00</td>
<td>39.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>June</td>
<td>0.83</td>
<td>0.97</td>
<td>17.00</td>
<td>54.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November</td>
<td>0.52</td>
<td>4.83</td>
<td>13.00</td>
<td>22.00</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>0.97</td>
<td>2.92</td>
<td>15.67</td>
<td>38.33</td>
</tr>
<tr>
<td>VI</td>
<td>Cibeureum</td>
<td>March</td>
<td>0.50</td>
<td>0.10</td>
<td>35.00</td>
<td>115.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>June</td>
<td>0.36</td>
<td>0.10</td>
<td>66.00</td>
<td>158.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>November</td>
<td>0.20</td>
<td>0.10</td>
<td>10.00</td>
<td>42.00</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td></td>
<td>0.35</td>
<td>0.10</td>
<td>37.00</td>
<td>105.00</td>
</tr>
</tbody>
</table>

3.3 Heavy Metals in the Citarum River

Cadmium in Citarum River

Cadmium has an atomic number of 48, an atomic weight of 112.40, consisting of eight stable isotopes (⁴⁸Cd, ⁴⁹Cd are most abundant), and a density of 8.65 g cm⁻³ [27]. In several aspects, Cd is similar to Zn (it is a neighbor of Zn in the
periodic table); in fact, it is almost always associated with Zn in mineral deposits and other earth materials. Cadmium is a soft, silvery white, ductile metal with a faint bluish tinge. It has a melting point of 321°C and a boiling point of 765°C. It belongs to group IIb of elements in the periodic table and in aqueous solution has the stable 2+ oxidation state. Cadmium is a rare element (67th element in order of abundance) with a concentration of ~0.1 µg/g in the lithosphere and is strongly chalcophilic, like Zn.

In nature, aerobic freshwater aquatic system with typical Cd- S-CO₃ concentrations [18], Cd²⁺ is the predominant species below pH 8, CdCO₃ which is predominant from pH 8 to 10, and Cd(OH)₂ is dominant above pH 10. The solubility of Cd is minimum at pH 9.5 [18]. The speciation of Cd is generally considered to be dominated by dissolved forms, except in cases where the concentration of suspended particulate matter is high, such as “muddy” rivers and reservoirs and near-bottom benthic boundary layers, and underlying bottom sediments in rivers and lakes [24]. The distribution coefficient between the particulate and the dissolved Cd is remarkably consistent for a wide range of riverine and lacustrine situations [25]. The sorption of Cd on particulate matter and bottom sediments is considered to be a major factor affecting its concentration in natural waters [15]. Pickering (1980) has quantitatively evaluated the role of clay minerals, humic substances, and hydrous metal oxides in Cd adsorption and concluded that some fraction of the particle-bound Cd was irreversibly held by the solid substrate[28]. The concentration of dissolved Cd in average world river water is 0.08 µg/L [14]. This concentration is identical to that of Cd in ocean water (0.079 µg/L)[10].

Cadmium was mostly absent in river water of Citarum during the study period. The concentration of heavy metals in river water of River Citarum did not show a definite seasonal behavior as well as site trend. However, overall order of concentration of these elements in river water was Zn>Cr>Cu>Ni>Cd. Thus, the higher concentration of Zinc and Chromium in river water presented an alarming picture in this area of river Citarum. Major pollution sources of River Citarum at this stretch were due to the entry of heavy load of city, sewage street washing and waste from automobile workshops and hospitals. In addition, there are several small and large dying industries, printing industries and storage battery manufacturing units in the city which directly or indirectly discharged their effluents into the river. Effluents from dying industries contained several compounds of metal, such as chromium, zinc, lead, mercury, etc. Whereas storage battery and printing effluents have high amount of lead and nickel compound which might be the possible reason for high level of metal content at this stretch. The range values of Cadmium in Citarum River are presented in Table 3.

**Table 3.Range of Concentration of Cd at Various Sites**

<table>
<thead>
<tr>
<th>Site</th>
<th>Concentration Cadmium (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>March</td>
</tr>
<tr>
<td>I</td>
<td>Cisanti Lake (Up Stream)</td>
</tr>
<tr>
<td>II</td>
<td>Cikapundung</td>
</tr>
<tr>
<td>III</td>
<td>Cisangkay</td>
</tr>
<tr>
<td>IV</td>
<td>Cibeureum</td>
</tr>
<tr>
<td>V</td>
<td>Cibaligo</td>
</tr>
<tr>
<td>VI</td>
<td>Cimahi</td>
</tr>
</tbody>
</table>

**Chromium hexavalen in Citarum River**

Chromium has an atomic number of 24, an atomic weight of 51.996, consisting of four stable isotopes (⁵²Cr = 84%), and a density of 7.14 g cm⁻³[1]. Crystalline Cr is steel-gray in color, lustrous, hard metal that has a melting point of 1,900°C and a boiling point of 2,642°C. It belongs to group VIb of the transition metals and in aqueous solution, Cr exists primarily in the trivalent (+3) and hexavalent (+6) oxidation states. Chromium, as well as Zn, is the most abundant of the “heavy metals” with a concentration of about 69 µg g⁻¹ in the lithosphere [23].

In most natural waters at near neutral pH, Cr⁶⁺ is the dominant form due to the very high redox potential for the couple Cr⁶⁺/Cr⁴⁺ [29]. Chromium (III) forms strong complexes with hydroxides. Rai et al. (1987) reported that the dominant hydroxo species were CrOH⁺, Cr(OH)₂⁺ at pH values 4-6, Cr(OH)³⁺ at pH values from 6 to 11.5, and Cr(OH)⁶⁺ at pH values above 11.5. The OH⁻ ligand was the only significant complexer of Cr⁶⁺ in natural aqueous solutions that contained environmental concentrations of carbonate, sulfate, nitrate, and phosphate ions. The only oxidant in natural aquatic systems that has the potential to oxidize Cr⁶⁺ to Cr⁴⁺ is manganese dioxide. This compound is common on Earth’s surface...
and, thus, one can expect to find some Cr\textsuperscript{VI} ions in natural waters. The predominant Cr\textsuperscript{VI} species at environmental pH is CrO\textsubscript{4}\textsuperscript{2-}[18]. The principal Cr\textsuperscript{III} solid compound that is known to control the solubility of Cr\textsuperscript{III} in nature is Cr(OH)\textsubscript{3}. However, Sass and Rai (1987) have shown that Cr/Fe(OH)\textsubscript{3} has an even lower solubility. This compound is a solid solution and, thus, its solubility is dependent on the mole fraction of Cr; the lower the mole fraction, the lower the solubility is[32]. Most Cr\textsuperscript{III} solids are expected to be relatively soluble under environmental conditions. In the absence of solubility-controlling solids, Cr\textsuperscript{VI} aqueous concentrations under neutral pH conditions will primarily be controlled by adsorption/desorption reactions [30]. Under environmental conditions, iron oxides are the predominant adsorbents of chromate (to Cr\textsuperscript{VI}) in acidic to neutral pH range and oxidizing environments. The Cr concentration in average world river water is 0.7 µg L\textsuperscript{-1}[14] and that in ocean water is 0.21 µg L\textsuperscript{-1}[10].

Chromium occurs in nature mainly in the mineral chromite; Cr also occurs in small quantities in many minerals in which it replaces Fe\textsuperscript{3+} and Al\textsuperscript{3+}[12]. The metallurgy industry uses the highest quality chromite ore whilst the lower-grade ore is used for refractory bricks in melting furnaces. Major atmospheric emissions are from the chromium alloy and metal producing industries. Smaller emissions come from coal combustion and municipal incineration. In the aquatic environment, the major sources of Cr are electroplating and metal finishing industries. Hexavalent Cr\textsuperscript{VI} is a potent carcinogen and trivalent Cr\textsuperscript{III} is an essential trace element [20]. Chromium hexavalent data for river water at different locations during the study period are shown in Figure 1. The values of Chromium hexavalent in water ranged from 0.03 to 0.18 mg/L. The concentration of Chromium hexavalent in water exceeded the maximum permissible limit assigned by WHO [34] (0.05 mg/L) at almost all of the sites which reflected its pollutional status.

![Fig. 1: Range of Concentration of Cr\textsuperscript{VI} at Various Sites](image)

**Zinc in Citarum River**

Zinc (atomic no. 30) is a bluish-white, relatively soft metal with a density of 7.133 g cm\textsuperscript{-3}. It has an atomic weight of 65.39, a melting point of 419.6°C, and a boiling point of 907°C. Zinc is divalent in all its compounds and is composed of five stable isotopes (\textsuperscript{64}Zn = 49%) and a common radioisotope, \textsuperscript{65}Zn, with a half-life of 245 days. It belongs to group IIb of the periodic table which classifies it as a heavy metal whose geochemical affinity is chalcophilic.

In freshwater, the uncomplexed Zn\textsuperscript{2+} ion dominates at an environmental pH below 8 whereas the uncharged ZnCO\textsubscript{3} ion is the main species at higher pH [18]. Complexing of Zn with SO\textsubscript{4}\textsuperscript{2-} becomes important at high sulfate concentrations or in acidic waters. Hydrolysis becomes significant at pH values greater than 7.5; hydroxy complexes of ZnOH\textsuperscript{2-} and Zn(OH)\textsubscript{2} do not exceed carbonate species at typical environmental concentrations of 15 µg/L for world stream water [14]. More recent data of [31] place the concentration of dissolved Zn in average world river water at 0.60 µg/L. Significant complexing with organic ligands may occur in stream and lake waters with highly soluble organic carbon concentrations. The concentration of Zn in ocean water is 0.39 µg/L [10], which is close to its value in world river water.

There are several factors that determine the relative abundance of dissolved and particulate Zn in natural aquatic systems. These include media pH, biogeochemical degradation processes that produce dominant complexing ligands, cation exchange and adsorption processes that control the chemical potential of solid substrates, and the presence of
occluded oxyhydroxide compounds [1], 1986). At pH values above 7, aqueous complexed Zn begins to partition to particulate Zn as a result of sorption onto iron oxyhydroxide. The clay mineral montmorillonite is particularly efficient in removing Zn from solution by adsorption [19].

The average Zn content of the lithosphere is ~80 µg/g and the most abundant sources of Zn are the ZnS minerals sphalerite and wurtzite and to a lesser extent smithsonite (ZnCO₃), willemite (Zn₂SiO₄), and zincite (ZnO) [31]. The smelting of nonferrous metals and the burning of fossil fuels and municipal wastes are the major Zn sources contributing to air pollution.

The values of zinc in river water at different locations during the study period are given in and Figure 2. Zinc was detected in most of the water samples. The values of zinc in water ranged from 0.0 to 1.44 mg/L. The result indicated higher concentration of zinc in river water. However, in case of water the concentration of zinc was within permissible limit as assigned by WHO[34] (0.05 mg/L).

Copper in Citarum River

Copper has an atomic number of 29, an atomic weight of 63.546, consists of two stable isotopes (⁶⁴Cu = 69.2%; ⁶⁵Cu = 30.8%), and has a density of 8.94 g cm⁻³[33]. Metallic Cu compounds (sulfides) are typically brassy yellow in color while the carbonates are a variety of green and yellow-colored. The metal is somewhat malleable with a melting point of 1,356°C and a boiling point of 2,868°C. It belongs to group Ib of the transition metals and in aqueous solution Cu exists primarily in the divalent oxidation state although some univalent complexes and compounds of Cu do occur in nature [21]. Copper is a moderately abundant heavy metal with a concentration in the lithosphere of about 39 µg g⁻¹[23].

Chemical models for the speciation of Cu in freshwater [26] predict that free Cu²⁺(aq) is less than 1% of the total dissolved Cu and that Cu(CO₃)₂²⁻ and CuCO₃ are equally important for the average river water. Leckie and Davis (1979) showed that the CuCO₃ complex was the most important one near the neutral pH. At pH values above 8, the dihydroxo–Copper(II) complex predominates. The chemical form of Cu is critical to the behavior of the element in geochemical and biological processes [21]. Cupric Cu forms strong complexes with many organic compounds.

In the sedimentary cycle, Cu is associated with clay mineral fractions, especially those are rich in coatings containing organic carbon and manganese oxides. In oxidizing environments (Cu–H₂O–O₂–S–CO₂ system), Cu is likely to be more soluble under acidic than under alkaline conditions [16]. The mineral malachite is favored at pH values above 7. Under reducing conditions, Cu solubility is greatly reduced and the predominant stable phase is cuprous sulfide (Cu₂S)[22]. In natural aquatic systems, some of the Cu is dissolved in freshwater streams and lakes as carbonate and organic complexes; a larger fraction is associated with the solid phases. Much of the particulate Cu is fixed in the crystalline matrix of the particles [17]. Some of the riverine reactive particulate Cu may be desorbed as the freshwater mixes with seawater. The biological cycle of Cu is superimposed on the geochemical cycle. Copper is an essential element for the growth of most of the aquatic organisms but is toxic at levels as low as 10 µg L⁻¹[21]. Copper has a greater affinity, than most of other metals, for organic matter, organisms, and solid phases [21], and the competition for
Cu between the aqueous and the solid phases is very strong. Krauskopf (1956) noted that the concentration of copper in natural waters, 0.8–3.5 µg L⁻¹[8], was far below the solubility of known solid phases. Davis et al. (1978) found that the adsorption behavior of Cu in natural systems was strongly dependent on the type and concentration of inorganic and organic ligands. Recent data of Gaillardet et al. (2003) placed the concentration of dissolved Cu in average world river water at 1.5 µg L⁻¹and that in ocean water at 0.25 µg L⁻¹[10].

The most common Cu minerals, from which the element is refined into the metal are Chalcocite (Cu₂S), Covellite (CuS), Chalcopyrite (CuFeS₂), Malachite and Azurite (carbonate compounds). It is not surprising that Cu is considered to have a chalcophillic geochemical affinity. In the past, the major source of Cu pollution was smelters that contributed vast quantities of Cu–S particulates to the atmosphere. Presently, the burning of fossil fuels and waste incineration are the major sources of Cu to the atmosphere and the application of sewage sludge, municipal composts, pig and poultry wastes are the primary sources of anthropogenic Cu contributed to the land surface [2].

The values of Copper in river water at different locations during the study period are given in and Figure 3. Copper was detected in most of the water samples. The values of Copper in water ranged from 0.0 to 0.08 mg/L. The result indicated higher concentration of Copper in river water. However, in case of water the concentration of zinc, it was within permissible limit as assigned by WHO [34] (0.02 mg/L).

Copper dissolved in the Citarum River comes mostly from industrial and municipal wastewaters. Concentrations of dissolved copper generally increase in the downriver direction, especially near urban centers. Some tributaries carry greater concentrations of copper than the main stem Citarum, but their influences on main stem concentrations seemed to be minimal. The transport of dissolved copper in the Citarum River varies directly with the water discharge. The most significant increases in the transport of dissolved copper occur at the confluences of the Citarum Rivers.

The Fate of Metals in the Citarum River

The numerous studies of the heavy-metal water quality of the Citarum River that have been conducted over the last several years have emphasized mostly the water quality in specific regions of either the lower reaches of the river. However, our study assessed the heavy metal contamination through the full length of the Citarum River from Cisanti Lake to Cimahi. The water samples were collected during the entire study using proven sampling protocols. In addition, all samples were analyzed by one group of scientists in a single laboratory using state-of-the-art instrumentation and methodology. Heavy metals released into the Citarum River, both by natural processes and human activities, can be distributed among several different forms within the water environment. Metals can be either transported with the water and suspended sediment or stored within the riverbed bottom sediments. Heavy metals are transported as (1) dissolved species in the water, (2) suspended insoluble chemical solids, or (3) components of the suspended natural sediments. Metals dissolved in the water can exist as hydrated metal ions or as aqueous metal complexes with other organic or inorganic constituents. Water-insoluble inorganic (non-carbon-containing, except for carbonates) chemical solids, such as metal hydroxides, may be formed, as may organic (carbon-containing) chemical solids, such as those associated with compounds derived from the decay of living organisms. Both inorganic and organic solids can be transported with the water as individual entities or as chemical coatings on suspended sediments. In addition, mineral components of
suspended sediments themselves can contain heavy metals. Heavy-metal solids can also be stored in river-bottom sediments. Suspended sediments and metallic chemical solids are stored in riverbed sediment after they aggregate to form large, denser-than-water particles that settle from the water when the river's flow is not sufficient to keep them in suspension.

4. Conclusion

The study revealed that there was a considerable variation in the concentration of heavy metals in water samples at various sites. The variations might be due to the change in the volume of industrial and sewage being added to river at different sampling stations. In general, among different metals found in the river water were in range of: Cd (0.0 to 0.01 mg/L); Cr (0.03 to 0.18 mg/L); Cu (0.0 to 0.08 mg/L); and Zn (0.0 to 1.44 mg/L). Some physico-chemical parameters which are dissolved oxygen, BOD₅, and COD were also estimated as they have direct or indirect influence on incidence, transport and speciation of the heavy metals. pH ranged from 6.2 to 8.5 at all locations. Dissolve oxygen ranged from 0.14 to 8.12 mg/L, Biochemical Oxygen Demand (BOD₅) ranged from 1 to 202 mg/L and Chemical Oxygen Demand (COD) ranged from 2 to 492 mg/L.

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References

Difference of response hydrology using mock model and integrated NRCS with base flow at Krueng Peusangan Watershed, Aceh, Indonesia

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Abstract

Watershed management is land use regulation or optimization land use for the various interests in a rational as well as other eco-friendly practices that can be assessed by key indicators of quantity, quality and continuity of the flow of the river at the point of expenditure (outlet). Therefore, this study needed to know firstly the availability of water resources that can be utilized for a variety of multi-sector, through land use regulation so that the carrying capacity of water resources in awake through watershed rehabilitation Krueng Peusangan. Thus, damage or critical natural resources in the watershed can be minimized and repaired in order to maintain sustainable watershed conditions as the water supply for the need of its population. This study was hydrology Mock Model and Integration Model NRCS (Natural Resources Conservation Service) with base flow. NRCS can provide an overview of the model hydrograph flow through production estimate only water; this model was used to calculate the direct run-off, so after base flow integrated with this model, it would be more effective to predict the production of water in a watershed. One of determinant was the value of Curve Number (CN), which was used as the basis for determining the portion of rainfall into runoff. CN value was determined by the condition of the soil and watershed land cover conditions that present soil hydrologic group, land management and hydrological conditions. NRCS method can also provide the accuracy of information on the process of land use runoff, evaporation and infiltration. The model is one of the Mock rain flow models that calculate the value of the monthly direct runoff from precipitation, evapotranspiration, soil moisture and soil water storage. Validation of the model was tested with Nash-Sucliffe Efficiency (NSE), Correlation coefficient (R\(^2\)) and RSR. The results of the model validation test were Mock model that has better value than the NRCS integration with Base flow model.

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Key words: response hydrology, Mock model, Curve Number, Integrated NRCS with base flow

1. Introduction

The development land is related to the volume of surface water and ground water. In addition to land use, the behavior of water in a heavily area is influenced by local factors of climate, geology, watershed shape, type of river networks and drainage density [1]. Watershed physical condition is associated with water production [2]. The conversion of the land use has the impact on hydrological process for big and small scales of Watershed [3] and causes the change in the correlation between water supply and demand so that it has significant impact on Watershed ecosystem, environment, and economic development [4]. Through rain hydrologic flow models, it can describe the response of a watershed hydrologic processes which occur when there is a given certain input. In the preparation of a simple model of the flow of rain, the focus was centered on the analysis of rainfall over a range of discharge through a watershed system.

To assess water management and comprehensive land conservation, it needs a suitable approach, firstly by knowing the availability of water. Thus, the water availability in the future can be maintained. The availability of water in the future is very difficult to understand because of climate change and an increasing population [5] and water management planning is not easy, especially related to national policies, society and the condition of an unstable region [6].
Many programs have been carried out to know the land-use changes associated with soil and water. The experiments were conducted to estimate the magnitude of consequences caused by land degradation and efforts should be made to reduce the impact on society and the environment. If the damage partially anticipated, this will lead to problems of natural disasters (floods) as if it could not be resolved. So, in order that these problems can be overcome or at least reduced for the impact, we should do watershed management to the water production modeling. In this research, development model was integrated with NRCS base flow to get the availability of water in the watershed of Krueng Peusangan Aceh, Indonesia. Availability of water based on the model would be compared with Mock models based on water balance calculations that have been developed by FJ Mock in Indonesia.

2. Materials and Methods

The study was conducted in the watershed of Krueng Peusangan which had 12 sub watersheds. Part of the area is situated within the administrative area of Central Aceh District on the upstream, in the middle of Bener Meuriah District, and Bireuen District downstream. Geographically, the watershed of Krueng Peusangan is in the top position (Upper) 5°16'34" NL - 96°27'12 "E, and the bottom (Lower) 4°30'38"N-97°02'40"L, with an area of 2557.80 km² (Fig. 1).
Precipitation data for the upstream and downstream areas were derived from Stations of Meteorology and Climatology of Lhokseumawe and Bebesan Takengon. Although Krueng Peusangan watershed consists of 12 sub watersheds, they are available and operated only at (two) river water monitoring stations called Teumbo (04°59'6.9" NL and 96°4’46.6” EL) and Nareh Stations (04°34’34.8” NL and 96°48’52.8” EL), for the period of 2008-2012. Whereas, three other stations are now no longer functioned so that the available data were only from the year of 1987-1996.9 (Kr. Seumpo (5°04’04” North Longitude (NL) and 96°42’46” East Longitude (EL), (B) Kp. Simpang Jaya (05°07’04” NL and 96°40’54” EL), (C) Ds. Beukah (05°10’ NL and 96°48’04” EL).

River flow was a sensitive parameter to the changes of watershed components. In this research, daily flow data were necessary to establish river flow hydrograph. The data were obtained from the equation that described the relationship between discharge with the water level. The data as used in this study were stream flow data issued by the Office of Water Resources and Headquarter of Krueng Aceh Watershed, Aceh Province (NAD).

2.1. Water Yield based Mock Model

Mock models transformed the rain-flow follows the principle of water balance to estimate the discharge a river. This method assumes the rain that fell in the watershed will be partially lost as evapotranspiration; some will direct run-off and some will go into the ground as infiltration. If the capacity of soil moisture is exceeded, the water will flow downward due to the force of gravity as percolation to the saturated aquifer as ground water which is going out to the river as base flow. Precipitation will be transformed by the watershed system. Discharge in the river is the number of streams directly and low base flow [7]. The basic equation used in the model equations Mock was the water balance in the soil and ground water storage equation. The total structure of the Model Mock is shown in fig. 2 [8]. Mock Model that the rate of water production at a watershed was found through the equation of
\[ BF = I - \Delta S \]  
\[ DRO = WS - I \]  
\[ WS = P - Ea \]  
\[ I = WS \cdot I_f \]  
\[ IGWS = GWS_{i-1} \]  
\[ GWS = K(IGWS) + 0.5(1 + K)I \]  
\[ \Delta S = GWS - IGWS \]  
\[ Q = (DRO + B)A \]  

2.2. Water Yield based Integrated NRCS and Base flow Model

NRCS could calculate runoff by introducing procedures with the curve number technique [9]. The determination of curve number value was based on the characteristics of land (kind of vegetation, land management, soil types (texture and infiltration rate). In addition to it, the value of CN (curve number) was also related to the condition of rainfall in which normal rainfall condition (condition II); if the rainfall was below normal condition, the...
factor of conversion for Condition I and if the rainfall condition was, the factor of condition III was used. The value of CN presented the condition of soil hydrology group, land cover, land management and hydrologic condition [10]. The determination of surface runoff based on SCS (Soil Conservation Service) method [11].

[12] … has calculated that groundwater recharge by presenting the procedure to estimate groundwater recharge based on the modified soil moisture balance approach. A large number of streams and rivers that have base flow hydrograph were modeled by an exponential relation [13], [14] was as follow Fig. 3.

2.3. Validation Test

The accuracy/validation of measured discharge and simulated discharge the model formed was tested through the formula : [15], [16]

\[
R = \frac{\sum_{i=1}^{n}(q_i^{obs} - q_i^{mean})(q_i^{sim} - q_i^{mean})}{\sqrt{\sum_{i=1}^{n}(q_i^{obs} - q_i^{mean})^2}(q_i^{sim} - q_i^{mean})^2}}
\]  (9)

\[
RSR = \frac{RMSE}{STDEV_{obs}} = \sqrt{\frac{\sum_{i=1}^{n}(q_i^{obs} - q_i^{sim})^2}{\sum_{i=1}^{n}(q_i^{obs} - q_i^{mean})^2}}
\]  (10)

\[
NSE = 1 - \frac{\sum_{i=1}^{n}(q_i^{obs} - q_i^{sim})^2}{\sum_{i=1}^{n}(q_i^{obs} - q_i^{mean})^2}
\]  (11)

3. Results and discussion

![Comparison of Observed and Simulated discharge with Mock Model](image.png)

Fig. 4 Comparison of Observed and Simulated discharge with Mock Model
Land use with diverse vegetation and the amount of evaporation that differ between vegetation with the other watershed. Based on the method of Penman, potential evapotranspiration was influenced by the magnitude of the reflection coefficient. This coefficient depends on the existing vegetation in an area and has very close relation to land use in a watershed; all land use gives different reflection coefficient. In addition, discharge stimulated with Mock Model was also calculated based on evapotranspiration due to the difference in height (topography).

Simulated of discharge using Mock Model has been done to get parameters of model that was suitable with discharge observed. Discharge simulated at watershed of Krueng Peusangan was Krueng Beukah because this location was at downstream position. Comparison of discharge measurement values can be seen in fig. 4.

NRCS and base flow Integration Model is a model of daily discharge based on the application of simplified water balance model. Discharge is the volume of water generated in a watershed over time. Daily runoff calculations generated using the NRCS based on the condition of the area. This calculation was based on the retention parameter, initial abstraction, surface storage, interception, and infiltration prior to runoff, and daily rainfall (mm). Parameters are variables due to changes in soil type, land use, and soil moisture. [17] … showed that the 0.2 was a retention parameter which was not always the most suitable for the initial abstraction. However, for the location of this study, Curve number taken on the condition II that showed normal conditions.

In 1993, the annual rainfall at Krueng Peusangan watershed was 853.48 mm. After being measured, this 1993 rainfall provided the average daily river debit of 99.7 m$^3$/second. The value of potential maximum retention (S) was 103.7 mm. The simulated debit obtained after the input data of rainfall, direct runoff, percolation, groundwater reserves, base flow was 130.41 m$^3$/s. The result of simulation of estimating the debit of Krueng Peusangan watershed using the NRCS and Baseflow Integrated Model for 1993 is seen in Fig. 5.

The simulated debit was taken at the measurement point of Kp. Beukah which is downstream of Krueng Peusangan watershed. The value of CN taken was belonged to the normal condition (II) for the simulation of its debit estimation. In 1993, The CN value was 71. This value was obtained in accordance with the condition of land use at Krueng Peusangan watershed. The increase of CN value showed that land conversion has occurred. Therefore, it is necessary to make an effort to prepare a spatial concept emphasizing the integration of eco-hydrology, conservation of forest area in the upstream of Krueng Peusangan watershed, and conservation of water catchments areas in the centre and downstream of Krueng Peusangan watershed. This concept is useful as a synthesis review to support the sustainable watershed management planning beside the ability of this model to perform simulations based on mathematical approaches and physical assumptions.
Model validation test has been done using (NSE) Nash-Sutcliffe efficiency, R (correlation coefficient), and RSR for point discharge measurements in Kp Beukah. Model validation results are shown in Table 2. NSE measures goodness of fit and close to unity if the simulations represent satisfactory observation. NSE clarified the picture of the difference of the observed values from time to time are counted for by the model [18]. If the efficiency was negative, the model predictions were worse than predictions made using the average of all observations. If close to one (1), then, the model was perfectly formed. Correlation the coefficient of variation values of the model was evaluated. It could reveal the strength and direction of a linear relationship between simulation and observation.

The square of the correlation coefficient (R) obtained coefficient of determination (r²). Difference between NSE and r² was that the NSE could interpret the model in replicating the performance of the individual against the value generated models, while r² did not explain it [17]. High values of r² indicated less error variance, and typically values greater than 0.5 were considered acceptable [19], [20]. It was considered good if the validation criteria or limit the suitability of the result set has been reached. Overall, the result of validation test of the model showed that its performance was very good and satisfactory.

<table>
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<th>Model</th>
<th>Year</th>
<th>NSE</th>
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<th>RSR</th>
<th>performance</th>
<th>R</th>
<th>r²</th>
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<td>0.670</td>
<td>good</td>
<td>0.210</td>
<td>very good</td>
<td>0.950</td>
<td>0.903</td>
</tr>
</tbody>
</table>

4. Conclusions

The results obtained for the availability of water by using a mock model evapotranspiration from the Penman formula was 804,192,989.26 m³/year. While the availability of water using NRCS integration model and base flow was 2,559,231,717.61 m³/year. Water availability of measurements is 911,510,715.74 m³/year. NRCS method can provide the accuracy of information on the process of land use runoff, evaporation and infiltration. While Mock models can calculate the value of the monthly direct runoff from precipitation, evapotranspiration, soil moisture and soil water storage. The result of validation test of the model showed that its performance was very good and satisfactory. But the results of the model validation test were Mock model that has better value than the NRCS integration with Base flow model.
Acknowledgement

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PILKADA: Clans, Ethnic Revivalism, and Local Democracy in Indonesia
(A Lesson from Lampung)

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Abstract
Democratization in Indonesia began in 1998, when the Soeharto regime was overthrown by a student movement. Law 22/1999 was implemented for a short period, from January 2000 to 2003. In 2003, the Central Government once again revised the relationship between the central and local government by implementing Law No.32/2004. The mode of election changed from indirect to direct election, which is known as Pilkada. According to the central government evaluation, out of more than 500 local elections, only a few (for instance, Musi Banyuasin and Jembrana) had positive impacts on the development of good bureaucracy. Ethnicity and political clans are currently the main issues in local politics. Lampung Province is one of the key areas for local democracy development in Indonesia. Despite its ethnic and tribal heterogeneity, there is no fundamental political conflict among the elites. In Lampung, an area dominated by the Governor and the Sjahroedin family, some Lampungese attempted to form a political coalition with Javanese people to win Pilkada. This paper looks at the issues above, and their implications for local democracy.

1. Introduction

The transitional government under caretaker President B.J Habibie from 1998 to 1999 revised some rules and regulations. The first revision was the law regarding the relationship between central and local government. The old Law number 5/1974 was replaced by Law Number 22/1999; a fundamental change from a very centralized system to very decentralized one. From the political point of view, the most important change was the fact that the new law was more democratic than the old one.

In 2003, the Central Government once again revised the Law on central and local government relationship, and implemented the new Law No.32/2004. According to this new law, local official leaders such as mayor, regent and governor who were previously elected indirectly by representatives or local house members became elected directly by the people—a process officially known as Pemilihan Kepala Daerah or Pilkada. In addition, as well as the provinces, between 2004 and 2010 more than 500 regencies and cities used Pilkada to elect a official leader in local government. However, the elections did not have any impact on public welfare and services.

Lampung Province, located in the southern part of Sumatra Island, is divided into thirteen regencies and two cities. Political scientists often call Lampung “mini Indonesia” because several ethnic groups are found in Lampung, including, among others, Javanese, Lampungese, Palembangese, and Bugis. The heterogeneous ethnicity of Lampung affects how the local elites gain and share power. Many of the political elites, particularly in Lampung, believe that a coalition between Lampungese and Javanese in Pilkada is needed to ensure the election of a truly local leader through Pilkada and, indeed, to win election at all, because Javanese people are the majority ethnic group in Lampung.

Brian Smith in Hidayat (2009) says that the direct election of local government heads and of the members of local representative councils is one of the most important preconditions for an accountable and responsive local government, and for building up what he calls political equality at the local level. Pilkada is instrumental in selecting the best leaders in local government. A Central Government evaluation finds that only a few of the many elections have helped to

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Two elections, in Musi Banyuasin and Jembrana, did have positive results: free education at elementary and high schools, health insurance for poor people, and good access to public services.

2. Clans and Politics in Lampung

Ethnicity and political clans are the main issues affecting current local politics and the development of local democracy in Lampung. The use of the term revivalism in this study indicates that ethnicity and political clans are not a new concept; it has been rooted in the history of politics in Indonesia. Heather Sutherland (1983), for instance, argued that clans had been the main vehicle for certain families to aspire and struggle for positions in the elite of bureaucracy in Indonesia. Burhan Magenda (1991), on the other hand, stated that in the past East Kalimantan experienced the rise of commercial aristocracy in which certain families, in this case Kutai aristocracy, gained wealth and power by using their connection with colonial power. However, timber boom and centralization of power under New Order Era caused the decline of commercial aristocracy. Power and wealth of this aristocracy then, accordingly, declined.

To begin with, the clan is an informal organization built on an extensive network of kinship and of fictive, or perceived and imagined, kinship. Two principles mark clan relations and identity: Kinship is the core foundation of clan relations, and a network is the organizing principle of this unit. Multiple individuals are connected by kin-based bonds (sometimes distant and sometimes immediate), and have concomitant responsibilities for the members of that identity network (Collins: 2006, p. 35).

For instance, local politics in South Sulawesi is dominated by the Limpo family. Syahrul Yasin Limpo is a Governor and Iksan Yasin Limpo is Regent of Gowa. Tenrie Olle Yasin Limpo, the older sister of Syahrul and Iksan, is the head of the Golkar party in Gowa Regency and a member of the local parliament. Their younger sister, Dewie Yasin Limpo, ran for the regency government head in Takalar in 2008. Irman Yasin Limpo, the eldest brother, is a member of the Provincial Development and Planning Board (Bappeda), which is said to be a ‘wet’ position (an Indonesian euphemism for a job which generates a lot of income for the office holder). Haris Yasin Limpo, the youngest brother, is a Golkar cadre in the city of Makassar. Finally, their mother, Nurhayati Yasin Limpo, won a seat in the national parliament for Golkar (DPR-RI) in the 2004 legislative elections (Buehler, 2007).

This phenomenon also occurs in Central Kalimantan. Agustin Teras Narang is Governor, and Narang’s son, Asdy Narang, has been appointed as a member of DPR-RI. Moreover, according to a Manado Post survey in 2009, in North Sulawesi the result of 2009 general election was that 13 persons from influential and rich families in North Sulawesi were elected as legislative members. From the perspective of democracy (Migdal, 1988), the emergence of local strongmen in Indonesia indicates a weak state. Since the fall of the New Order, the state has weakened and lost control. Local organizations compete to re-establish hegemony. Local strongmen implement their own rules, which are often contrary to the will of the State.

Lampung politics is dominated by the family of Sjahroedin, Governor of Lampung. The eldest son is the regent of South Lampung Regency and the youngest son is the vice regent of Pringsewu Regency. The second son is a member of the Senate, representing Lampung Province, and his sister is a local MP. This indicates how political clans and kinship play an important role in managing local power. Other than Sjahroedin family, the family of Abdurrahman Sarbini is also part of this new trend of political clan. Abdurrahman Sarbini was the Bupati (Regent) of Tulangbawang Regency; and while he was in his position, he used his power to put his second son, Aris Sandi Dharma Putra, to be the Regent of Pesawaran Regency. While he was in his post, he made his eldest son, Frans Agung Mula Putra, run for candidacy of Regent of Tulang Bawang Barat Regency, even though he failed. Other family that shows strong political clans in Lampung is Tamanuri (Regent of Way Kanan from 2005-2010) and his son, Agung Ilmu Mangkunegara (recently elected to be the Regent of Lampung Utara Regency). Furthermore, other families also show the same trend in which family members are promoted for political posts due to a connection with other strong political figures.

In Lampung, Banten, and South Sulawesi, the local direct elections were affected by political conspiracies among party elites, the bureaucracy, and businessmen. It is therefore not surprising that most candidates have family (clan) funds or finance from business or crime (Haris, 2006:6). On this phenomenon, Sidel (2005:51) said:

Over the course of the past several years, increasing academic, journalistic, governmental, and NGO attention has been devoted to the problems of local ‘money politics’ (politik uang) and ‘gangsterism’ (premanisme) in regencies, municipalities, and provinces around the Indonesian archipelago. The election of regents (bupati), mayors (walikota), and governors (gubernur) during this period is said to have been heavily swayed by monetary inducements on the one hand, and threats of violence on the other, with local businessmen and leaders of criminal rackets playing a prominent role on and off stage.
The Pilkada and General Election results in 2009 show that the Sjahroedin family dominated the local ballot and still influences local political activities and policies day by day in Lampung. Furthermore, the leader of the Indonesian Democratic Struggle Party (PDI-P) is Sjahroedin with local leaders under his control. Out of fifteen regencies and cities in Lampung, nine local leaders belong to the PDI-P coalition. The Sjahroedin influence in local government is shown in the table below. According to Migdal (1988:9) local strongmen’s success in capturing state agencies and resources impedes or compromises the efforts of state leaders to implement various policies. Local strongmen, overall, limit state autonomy and capacity, affecting goal-oriented social change and contributing to ungovernability and disorder. Throughout Lampung, by using Sjahroedin’s men in several regencies and cities, his family has managed to take over many infrastructure projects such as roads, hospitals and schools. This kind of activity changes the style of bureaucracy from public service to private corruption.

According to a Central Statistics Bureau survey in 2012, the poor people in Lampung make up fifteen percent (1,141,260) of the total population (7,608,405). To overcome poverty, Lampung has many incentive programs. It can be done if there is a good leadership of an honest Public Service bureaucracy. Table (a) shows that the Indonesian Democratic Struggle Party (PDI-P) and its coalitions currently govern nine of the total fifteen regencies or major cities in Lampung.

Table (a). PDI-P Coalition in the Local Government

<table>
<thead>
<tr>
<th>Regency/City</th>
<th>Coalition of PDI-P</th>
<th>Coalition of Golkar PAN</th>
<th>Coalition of PAN</th>
<th>Coalition of Demokrat</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bandar Lampung</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metro</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tanggamus</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central Lampung</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Lampung</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tulang Bawang</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Lampung</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>West Tualang</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bawang</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>North Lampung</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Way Kanan</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pringsewu</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mesuji</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>South Pesisir(*)</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pesawaran</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>East Lampung</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*New Regency, the official leader are appointed directly by governor

However, in only a few cases do local governments seem to perform well in serving the people. Lampung lacks public service and government accountability to the people. Tomquist (2002) calls the present form of democracy in Indonesia a “bad guys democracy”—benefiting local bosses, thugs and corruptors. A weak state is just what the old forces and hardliners want. They have been innovative in capturing the new democratic spaces provided by the dismantling of the Soeharto Empire and the centralized state. The bureaucracy remains dominated by people trained under the authoritarian regime, so riddled with corruption that it has grown incapable of serving the public interest (Antlov 2003, p.72 in Aspinal &Fealy 2003).

3. Ethnic Revivalism: A Strategy for Grassroots Political Culture

Hutchinson and Smith (1996:6-7) in Baumann (2004) explain that ethnicity is defined in terms of six main features:
- a common proper name to identify and express the essence of the community,
- the idea of common ancestry that includes the idea of common origin,
- shared historical memories,
- one or more elements of common culture,
- a link to a homeland, and
- a sense of solidarity on the part of at least some sections of the ethnic population.

Regrettably, ethnicity, political clans and vote-buying in Pilkada lead to a deterioration in the quality of local democracy throughout Indonesia. My research in Lampung shows that it is impossible to be elected as Major or Regent without spending a lot of money during the campaign. People whom I have interviewed confirm that it costs more than 10 billion rupiah for each candidate if they want to be elected as Major or Regent. As a result, Pilkada tends to be more a contest of popularity than a contest of electing a capable major, regent or governor.

The roles of money in any Pilkada are unavoidable. Every candidate needs a lot of capital for the campaign and for employing political machinery of success team and witnesses in voting booths. He/she even needs money for legal process, should there be any one preceding or following election day once even when she/he elected. The difference with stable democracy is that money in stable democracy was collected and disbursed in legally legitimate way, while in the case of Pilkada in Indonesia, money was usually collected and disbursed in illegal and illegitimate way. The roles of money in Pilkada are therefore unavoidable yet disturbing. The case will be worse when only limited families have the access to power and money; formal democracy (in this case Pilkada) will not lead to substantive democracy (in the form of people’s welfare) but to poverty since leaders will concern more on paying back the debt than concentrating in promoting public welfare.

According to the Central Statistic Bureau in 2012, Lampung population is 7,608,405. Based on the latest survey which was also conducted by Central Statistic Bureau, the ethnic people of Lampung constitute only 16% of the total population. Native Lampungese are a minority in their own land because Lampung has attracted many migrants for centuries. In the Soeharto era, no single Lampungese was ever appointed as governor; the central government had their own candidate. The relations between local and central government made it possible for Soeharto to strengthen his power by exploiting ethnic sentiment. As a result, the ethnicity and daily local politics in Lampung reflect migration activities in the Dutch Colonial and in the New Order era.

According to Benoit (1989) in Yuhki Tajima (2008), migration was a policy to relieve poverty on the overcrowded island of Java by subsidizing the move from Java to less populated islands. It began in the early twentieth century through the Dutch Kolonisatie program, which continued after independence through the Transmigrasi program. Recently, Lampungese have formed political coalitions with Javanese people to win Pilkada. The popular terminology in Indonesian politics is Jawa and Non Jawa. It seems hard to believe, but it is a fact— in the Pilkada in Lampung, coalition politics work!

Table (b) below shows the statistical data of coalition between candidates who won the Pilkada from 2005 to 2012.

Table (b). City Majors and Regents Elected in 2005

<table>
<thead>
<tr>
<th>No.</th>
<th>The Couple</th>
<th>Region</th>
<th>Ethnicity of Major/Regent Elected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Tamanuri-Bustami</td>
<td>Way Kanan</td>
<td>Lampungese-Lampungese</td>
</tr>
<tr>
<td>2</td>
<td>Edy Sutrisno-Kherlani</td>
<td>City of Bandar Lampung</td>
<td>Javanese-Lampungese</td>
</tr>
<tr>
<td>3</td>
<td>Zulkifli Anwar-Wendy Melfa</td>
<td>South Lampung</td>
<td>Palembangnese-Lampungese</td>
</tr>
<tr>
<td>4</td>
<td>Lukman Hakim-Djohan</td>
<td>City of Metro</td>
<td>Javanese-Lampungese</td>
</tr>
<tr>
<td>5</td>
<td>Satono-Noverisman Subing</td>
<td>East Lampung</td>
<td>Javanese-Lampungese</td>
</tr>
<tr>
<td>6</td>
<td>Andi Achmad-Mudyanto</td>
<td>Central Lampung</td>
<td>Lampungese-Javanese</td>
</tr>
</tbody>
</table>

In the East Lampung Regency, and in the cities of Bandar Lampung and Metro, the Javanese candidates obtained the Regent and City Major positions while the Lampungese candidate took the vice-regency and Deputy City Major positions. In the South Lampung Regency, the coalition between Palembangnese and Lampungese won. In short, Lampungese and Javanese coalitions attracted support from other voters and won the majority of Pilkada in 2005. Overall, in Pilkada in 2005, the political coalition between Lampungese and Javanese dominated the polls. Table (c) below shows data from two years later in 2007.
Table (c). City Majors and Regents Elected in 2007

<table>
<thead>
<tr>
<th>No</th>
<th>The Couple</th>
<th>Region</th>
<th>Ethnicity of Major/Regent Elected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Abdurahman Sarbini-Aagus Martowojo</td>
<td>Tulang Bawang</td>
<td>Lampungese-Javanese</td>
</tr>
<tr>
<td>2</td>
<td>Bambang Kurniawan-Sujadi Sadat</td>
<td>Tanggamus</td>
<td>Lampungese-Javanese</td>
</tr>
<tr>
<td>3</td>
<td>Zainal Abidin-Rohimat</td>
<td>North Lampung</td>
<td>Lampungese-Lampungese</td>
</tr>
<tr>
<td>4</td>
<td>Mukhlis Basri-Dimyati</td>
<td>West Lampung</td>
<td>Lampungese-Javanese</td>
</tr>
</tbody>
</table>

In 2007, Abdurahman Sarbini (Lampungese) and Agus Martowojo (Javanese) together won the Pilkada in Tulang Bawang. In Tanggamus, a similar Lampungese and Javanese coalition (Bambang Kurniawan and Sujadi Sadat) won the Pilkada, and in West Lampung, Mukhlis Basri and Dimyati did the same. In North Lampung the whole Lampungese coalition of Zainal Abidin and Rohimat won the Pilkada.

Moving on to 2008, look at Table (d), and compare it with Table (e) two years later in 2012.

Table (d). Governor Elected in 2008

<table>
<thead>
<tr>
<th>No</th>
<th>The Couple</th>
<th>Region</th>
<th>Ethnicity of Major/Regent Elected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sjahroedin ZP-Djoko Umar Said</td>
<td>Lampung Province</td>
<td>Lampungese-Javanese</td>
</tr>
</tbody>
</table>

The Lampungese-Javanese coalition (Sjahroeddin and Djoko Umar Said) won the Governorship in 2008. Furthermore, nearly all the candidates represented a Lampungese and Javanese coalition. The partnerships seemed to act fairly in 2008. Andy Achmad who is Lampungese obtained the vice-regency from the Javanese H.M Supardjo. Muhajir Utomo who is Javanese installed the Lampungese Andi Arif as his vice governor.

The pattern repeated itself in 2010 (Table (e))

Table (e). City Majors and Regents Elected in 2010

<table>
<thead>
<tr>
<th>No</th>
<th>The Couple</th>
<th>Region</th>
<th>Ethnicity of Major/Regent Elected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Rycko Menoza-Eki Setyanto</td>
<td>South Lampung</td>
<td>Lampungese-Javanese</td>
</tr>
<tr>
<td>2</td>
<td>Lukman Hakim-Saleh Candra</td>
<td>City of Metro</td>
<td>Javanese-Lampungese</td>
</tr>
<tr>
<td>3</td>
<td>Herman HN-Tohroni</td>
<td>City of Bandar Lampung</td>
<td>Lampungese-Palembangnese</td>
</tr>
<tr>
<td>4</td>
<td>Bustami Zainuddin-Raden Nasution</td>
<td>Way Kanan</td>
<td>Lampungese-Lampungese</td>
</tr>
<tr>
<td>5</td>
<td>Satono-Erwin Arifin</td>
<td>East Lampung</td>
<td>Javanese-Lampungese</td>
</tr>
<tr>
<td>6</td>
<td>Arisandi-Musiran</td>
<td>Pesawaran</td>
<td>Lampungese-Javanese</td>
</tr>
<tr>
<td>7</td>
<td>Pairin-Mustafa</td>
<td>Central Lampung</td>
<td>Javanese-Lampungese</td>
</tr>
</tbody>
</table>

Table (e) shows the result of Pilkada in 2010. Overall, from a total of seven, a Lampungese-Javanese coalition won five, and the other two went to a wholly Lampungese coalition (Bustami Zainuddin and Raden Nasution) and to a Lampungese-Palembangnese team in Bandar. It is fair to say that Lampungese and Javanese coalitions again dominated the Pilkada in 2010.

Now see Table (f), for 2011.

Table (f). City Majors and Regents Elected in 2011

<table>
<thead>
<tr>
<th>No</th>
<th>The Couple</th>
<th>Region</th>
<th>Ethnicity of Major/Regent Elected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Sujadi-Handitya</td>
<td>Pringsewu</td>
<td>Javanese-Lampungese</td>
</tr>
<tr>
<td>2</td>
<td>Bachtiar-U mar</td>
<td>West Tulang Bawang</td>
<td>Lampungese-Lampungese</td>
</tr>
<tr>
<td>3</td>
<td>Khamamik-Ismail Ishak</td>
<td>Mesuji</td>
<td>Javanese-Palembangese</td>
</tr>
</tbody>
</table>
In 2011 two out of three pilkada were won by coalitions between Lampungese and Javanese, and the third by a Javanese-Palembangese team.

The most up-to-date results at the time of writing appear in Table (g) – 2012

<table>
<thead>
<tr>
<th>No.</th>
<th>The Couple</th>
<th>Region</th>
<th>Ethnicity of Major/Regent Elected</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Hanan Rozak-Heri Wardoyo</td>
<td>Tulang Bawang</td>
<td>Lampungese-Javanese</td>
</tr>
<tr>
<td>2</td>
<td>Bambang Kurniawan-Syamsul Hadi</td>
<td>Tanggamus</td>
<td>Lampungese-Javanese</td>
</tr>
<tr>
<td>3</td>
<td>Mukhlis Basri- Azhari Mahmur</td>
<td>West Lampung</td>
<td>Lampungese-Lampungnese</td>
</tr>
</tbody>
</table>

Table (g) shows a clean sweep by the Lampungese-Javanese and/or Lampungnese partners in three regions (Tulang Bawang Regency, Tanggamus Regency and West Lampung Regency).

Although Lampungese are a minority in their homeland, they control the power. Overall, Lampungese-Javanese candidates dominate the Pilkada from 2005 to 2012. The candidates believe that ethnic symbols, puppets and so on will attract Javanese votes. Our research in Bandar Lampung in 2011 suggests that ethnic sentiment is not really significant in influencing voters. It’s the money. Pilkada applies the concept of majority rule. The candidate who wants to win the election must obtain support from the majority of voters. The Javanese outnumber others in Lampung, so non-Javanese must get support from ethnic Javanese to win the Pilkada. Candidates may adopt symbols such as blankon (the traditional hat), or quote Javanese proverbs or sentences such as Piye-Piye Wonge Dewe (“Somewhere he is our own people”) to attract support. Even traditional Javanese puppets may be pressed into service to woo the Javanese.

According to Hidayat (2009) the pattern of money politics varies, but in general it can be grouped into two main categories: “direct” and “indirect”. Direct money is generally in the form of cash payments given by candidates to individuals or institutions. Indirect money involves gifts, particularly those possessing high use value as well as high exchange value; familiarly known as the “nine basic needs” such as rice, sugar, cooking oil, salt, flour, salted fish, kerosene, cassava and corn (or local interpretations). Lampung is not unique: generally in other parts of Indonesia, money politics trumps ethnic sentiment.

4. Conclusions

Obviously in the current local politics in Indonesia particularly in Lampung, Ethnicity and clan ties play an important role in attracting support for politicians, particularly in Lampung. Moreover, The Candidates use ethnic sentiment and symbols as part of their campaigns. The Ethnic coalitions between Lampungese and Javanese are only a strategy for winning in Pilkada—it is not a grass-roots political culture. Finally, The clan and ethnic sentiment strategies in local politics prevents development of a robust democracy.

Acknowledgements

We thank our institution, The Faculty of Social and Political Science at the University of Lampung, as well as the Directorate General of Higher Education, for supporting our journey to the 4th Sustain Conference at Kyoto University. We also thank the many people in our faculty for their assistance and for productive discussion on the topics of clans and ethnicity and their influence on local democracy in Lampung.

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**Regulations**

Law NO.22/1999 (First Local Government Regulation)
Law NO.32/2004 (Second Local Government Regulation)
The Conservation of Temuan Indigenous Cultural Heritage at Kampong Charik, Johol, Kuala Pilah, Negeri Sembilan, Malaysia.

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Abstract
The purpose of this study is to explore the conservation of cultural heritage among the Temuan indigenous tribe that inhabits the southern part of peninsula Malaysia since 2,500 BC. According to a statistical survey, most indigenous tribe communities are one of the poor income group populations in the country. To reduce this disparity, community base tourism and cultural tourism product development is considered as one of the means to upgrade the living standard of these communities. Developing cultural tourism product development is part of our Tenth Malaysian Plan (2010-2015). A primary research is done among the Temuan tribe of Kuala Pilah, Negeri Sembilan. Exploratory and qualitative research study was conducted in Kampong Charik, Johol through in situ baseline observation fieldwork for two weeks. The research finding shows that the community is still strongly upholding their cultural heritage tradition even though there is an onslaught of media modernization and rural project development.

Keywords: Conservation; Indigenous; Cultural Heritage and Community.

1. Introduction
Cultural Heritage tourism is fast becoming one of the leading tourism sub-sectors in South East Asia especially Malaysia. In 2012 Malaysia received 25.3 million tourists and fifty six percent (56%) was from cultural tourist visitors that contributed to sixty (60.6) million Ringgit in Malaysian GDP (www.tourismmalaysia.gov.my). It was also revealed in many research studies that foreign tourist visited Malaysia for its culture and tradition of its local people. [1] According to People and Bailey cited by Brumann, culture is the socially transmitted knowledge and behaviour shared by some group of people. The culture of any society consist of the sum total of ideas, conditioned emotional responses, and patterns of habitual behaviour which the members of the society have acquired through instruction or imitation and which they share to a greater or less degree[2]. Cultures include the art and literatures as well as lifestyles, value systems, creativity, knowledge systems, traditions and belief [3].

In West Malaysia there are 178,197 indigenous populations comprising three dominant tribes of Negrito, Senoi and Proto Malays. Senoi tribe is having the largest populations of 55% followed by proto Malays at 42.3% and Negrito at 0.03%. According to survey statistic done in 2011 the poor income group among these communities are at 7% of the total indigenous population. These data is high compared to other ethnic group such as Malay, Chinese and Indian communities in Malaysia. The issue of indigenous communities having poor income group is because of illiteracy and poor education background among their adults population. Beside these issues the indigenous tribe received little skilled training since independence in 1956. To reduce these variance in income group the tenth government plan is developing cultural tourism product development among poor country villages and indigenous tribe as part of their community income.

Kuala Pilah district is a sub district of Negeri Sembilan located on the South of Selangor and North of Melaka state. The district is situated between Bahau and Seremban the capital of Negeri Sembilan with land area of 109,039.58 hectares. The district consisted of Terachi, Langkap, Seri Menanti, Juasseh, Johol, Ampang Tinggi, Bandar Pilah, Pilah, Kepis and Ulu Muar. Negeri Sembilan state is the only state that practise “Matrilineal kinship” societal system, where the mother lineage is rightful owner of property inheritance or community title called “Adat Pepatih” for Malays or “Mepatih” for indigenous tribes. This “Adat Pepatih” societal system tradition has been practised since 1700 AD when the state is proclaimed. The state adopted this societal system through the Minang kabau tribe in Indonesia. The “Minangkabau” tribe was named after a fight of a buffalo (Malay word “kabau”) that won the chieftain fight.
According to Jabatan Hal Orang Asli (Department of indigenous affairs) the district has twenty (20) indigenous villages community recorded around Kuala Pilah and Johol area. The Johol sub district has the highest numbers of indigenous Temuan villages. The village consisted of Kampong Tering, Kampong Senibai, Kampong Ayer Pulasan, Kampong Air Lerek, Kampong Air Runtuh, Kampong Simpang Tering, Kampong Bari, Kampong Kelapi and Kampong Carik. Kampong Charik Johol was chosen for the research area because they are from the Proto Malays group descendant and its accessibility in location.

1.1 Study Area

Negeri Sembilan is one of the 13 states that constitute Malaysia as a nation; it is situated between Selangor, Johor and Melaka state. Seremban city is the capital of the state that can be easily accessible by road or rail from Kuala Lumpur and Johor Baru or city of Singapore. It is 50 kilometers or about an hour drive by car from Kuala Lumpur. The research study conducted is focusing on Kampong Charik, Johol a sub district of Kuala Pilah. Kampong Charik is one of the ten Temuan tribe villages of Johol district that is approximately 25 kilometers away from Kuala Pilah town.

1.2 Research Issues

Conservation is an important issue in Cultural Heritage preservation of a community or tribe. This is because the Temuan tribe is one of oldest communities living in southern part of peninsula Malaysia or Malaya during the British colonial occupation from 1784 till 1955. Significant uniqueness of this research is that Temuan tribe practices “Adat Mematih” or “Mematih” tradition that is similar to the practices of Minangkabau clan of Negeri Sembilan that practice matrilineal kinship in their daily community lives.

1.3 Research Objective

This study was conducted to explore the possibilities of conserving the culture heritage and tradition among the older and younger generation of Temuan in their daily lives. The objective is:
1) To explore Temuan cultural heritage assets and traditional practice among the community
2) To explore the community lifestyle of Kampong Charik Johol.

1.4 Research Framework

Research Process is illustrated into four phases as below in Figure 1

The research framework is divided as follows:
1) Situational Analysis
2) Resource Analysis
3) Summary of resource analysis
4) Identification of cultural heritage tourism conservation
2. Literature Review

2.1 Understanding Cultural Heritage

Culture is defined broadly as quoted in Meethan as a set of practices, based on forms of knowledge, which encapsulate common values and act as general guiding principles [4]. It is through this form of knowledge that distinctions are created and maintained, for example one culture is marked off as different from another. Prentis defined the term “heritage” as not only landscapes, natural history, building, artefacts cultural tradition and the like that are literally or metaphorically passed on from one generation to the other, but those among these which can be promoted as tourism product he also suggested that heritage sites should be differentiated in terms of types of heritage; built, natural and cultural heritage [5].

Furthermore, United Nation Education Scientific and Cultural Organization (UNESCO) has emphasized heritage in two categories: tangible and intangible cultures. Tangible heritage culture includes buildings and historic places, monuments, artefacts which are considered worthy of preservation for the future. These include objects significant to the archaeology, architecture, science or technology of certain culture (www.unesco.org). UNESCO cultural committee ICOMOS defines intangible heritage as the practices, representations, expressions, knowledge, skills as well as the instruments, object, artefacts and cultural spaces associated there with that communities, group and in some cases, individuals recognize as part of their cultural heritage[6].

2.2 Conservation of Indigenous Cultural Heritage

Conservation of indigenous cultural heritage is clearly described in article 9 (Nara document of authenticity 1994) stating that all conservation of cultural heritage in all its forms and historical period rooted in the values attributed to the heritage. It further stated that that it is our ability to understand these values depends in part, on the degree to which information sources about these values may be understood as credible or truthful. Knowledge and understanding of these sources of information in relation to original and subsequent characteristics of the culture heritage, and their meaning, is a requisite basis for assessing all aspect of authenticity.

According to Butler and Hinch indigenous cultures have become a powerful attraction for tourist and as such they have drawn the attention of tourism entrepreneur, government agencies and academic. Indigenous tourism represents an opportunity for indigenous people to gain economic independence and cultural rejuvenation [7]. The integration of indigenous people into a global culture on one hand while encouraging indigenous communities to protect and enhance local advantages on the other may give them a competitive advantage in this global economy .[8]

3. Research methodology and data collection process

This study was conducted through exploratory and qualitative methods. Exploratory design was used to explore the dimension which was unknown to researcher and to seek in depth findings. Descriptive design interviews were used to describe the behaviour of the research subject for period of two weeks of field study. The data collection method primarily were gathered through semi structured interview and observation with the tribe headman and village community of the area. Observation was made by open ended questions and photograph was taken on the real surroundings area of the community. Secondary data was also obtained through reviewing of journals, books and articles related to research topic. The checklist research instruments comprises of site analysis, community resource analysis and cultural resource analysis comprising of historical building or sites, folklores and tradition, handicraft, performing arts and food of the community.

4. Findings and Discussions

4.1 History of the tribe

According to Nicolas, Temuan tribe can be found mostly in every state in peninsular Malaysia and most of them still live in rural and sub-urban village in Negeri Sembilan and Selangor state. The Temuan tribe is of olive skin, straight hair and mongol physical features. They are from the Proto Malays or Austronesian group that migrated down to the Malay peninsula since 300BC from Yunnan, Southern China.

The tribe gets its tribal name from the word “temu”, a malay word for meeting. According to “tok batin” (Headman) of Kampong Charik, Temuan was born in Gunung Raya, a hill that is located in the borders of Selangor and Pahang. The temuan tribe is well known to be good hunters and forest dwellers. Local legend depicts that the tribe has
been always attacked by the cannibals “Batak” tribes from Indonesia who cross over from the strait of Melaka.

According to stories of elder named Pak ayub the tribe was attacked by the Bataks tribe centuries ago and many of them were killed and captured during the raid. During the conflict a villager suggested setting a trap to lure against the attacker. The Bataks was invited to have a meal with the villagers serving local fruit dish called “perah” which is widely found in tropical forest. The “perah” fruit has exotic nutty flavour when it is well cooked and preserved. But If the “perah” nuts is not well cooked it became poisonous that can cause giddiness and death. The Bataks invaders were then served with half cooked “perah” dish and all of them died after consuming it. Finally the Temuan village is safe from their attackers and they are proud of their glory.

4.2. History of the Village

The temuan tribe is known to be peace loving tribe that dislike violence and fighting but their tribe peace was disrupted with British colonialism and Japanese occupation during World War II in 1939 to 1945. During these years the tribe had a hard time living their lives due to lack of food from the war and living conditions. Some of them are forced to live in the forest which they dislike and through this hardship a group manage to escape the forest and find this place and a solution of their conflict. This group managed to solve the hardship conflict and give solution to their tribal matters. This place is called now called Kampong Charik from the word “cari”, a Malay word for find.

4.3 Cultural Analysis

4.3.1 Religion and Belief

The Temuan tribe practises animism similar to other indigenous group in Malaysia also known as ancestor belief. A basic traditional Temuan belief is that their God and ancestors are always present with them, guarding their safety. At the end of every year, the Temuans celebrate “Aik Gayak Muyang” (Ancestor Day in English). This celebration is to thank their God and ancestors for the crops they grow and for the peaceful life they have had. The Temuans believe they were placed on the seven earths by “Muyang” (God) to be guardians of the rain forest and that if they fail in their sacred duty, the whole world will turn upside down and humanity will perish. Each river, hill, stream, rock, tree and shrub is animated by a guardian spirit. Rivers are guarded by dragons (naga) and snakes (ular) which often cause mayhem if their homes are desecrated.

The Temuan’s culture reflects their belief in nature spirits. Their animism takes the form of taboos, herbal remedies, ritual ceremonies and magic. They have healers (dukun) and a village shaman who, when in a trance state, communicates with the nature spirits. It is the shaman who leads the tribe in the annual “sawai” an ancient earth healing ritual to honour their ancestors and appease the guardian spirits. Temuan people believe in dreams as dreams brings warning or sign in their life. Among Temuan tribe there are people with supernatural powers or magic. However, currently most black magic is used for medication, education and life purpose. This supernatural power is taught from the ancestor of the family and then handed down from generation to generation. Items used in healing are usually water, ginger and turmeric.

The tribe practise “adat mematih” which practice matrilineal kinship societal system that women is the guardian of family wealth or honour in which the men has no right to property or honour because they belief men are physically stronger and train to be self reliance.

4.3.2 Life Styles

The traditional house of the Temuan tribe is made of bamboo or wood with roofing of “Langkap” or “Bertam” palm leaves. They are of vernacular shape to let fresh air flow through the roof and beams because of the hot tropical climate. The vernacular house architecture is one of the oldest designs for domestic dwelling. The latin word “vernaculus” means domestic or indigenous. Vernacular houses are common type of indigenous dwelling that use local material that is found abundant in Malaysian tropical forest. The earlier houses of Temuan have partitions for male and female family member sleeping separately. Now they build modern housing made of wood and concrete that are more durable and permanent. The smaller hut are now used to entertain guests or for relaxation after working hard in the farm or rubber plantation.

4.3.3 Wedding and Engagement

The Temuan wedding ritual begins with “adat merisik” or asking ceremony which the male groom family member visits the potential bride home with an engagement ring. The ring was given to the bride to signify that the bride is
engaged to be married. During this ceremony they have to bring the “bujam” or palate of betel nuts with betel leaves to the bride family. After discussion on the dowry both side will eat the “sirih” or betel leaves from the “bujam”. The bride dowry depends on the wealth of the family and in earlier times a buffalo is the exchange for dowry given by the groom. Now money is use as dowry gifts it ranges between six (6) thousand to ten (10) thousand Malaysian ringgits on average. The dowry is mostly use for wedding celebration.

A night before the wedding there is “berkhenak” ceremony where the bride is put on a dias and family members put henna (inai) on her palm and fingers. This premarital event is held in front of the clan chief or “lembaga adat”. The marriage contract is then solemnize on the day of the wedding and later the couple held the “bersanding” (enthronement) ceremony for guest and families. After the “bersanding” ceremony “Tuak” or rice wine is served and “Joget lambak” (Malay dance) is celebrated.

4.3.4 Birth and Death

In event of birth and death the tradition of the Temuan people do not differ much from the Malays. They have the celebration of birth by having family feast to celebrate the baby. During the celebration the baby is presented to ritual done by the shaman or “bomoh”. He will say his rites to bless the baby to have good life. Death ritual for the Temuan people is similar to Muslim burial rites where the corpse is wash with mud water and cleaned in direction of sunset. The corpse is then wrapped with white cloth to present the holiness of the deceased. During the burial ceremony, the families of the deceased should made a vow and greet the spirit of the soil as sign of respect. The body of the corpse is buried six feet in depth and the head of the deceased should face the sunrise.

Most of the Temuan burial grounds are located in cool shady part of the village. This is believed that if the body is buried in a cooling place the deceased will have a better life after death. The tomb stone are usually made of wood or stone. The tomb of Temuan people is place differently according to gender difference where male tomb should be place to the left and female tomb is place on the right side.

4.3.5 Languages

Basically, Temuan language is similar to Malay language however the respondent informed that the word of Temuan is emphasizing the alphabet “K” for example:

<table>
<thead>
<tr>
<th>Temuan language</th>
<th>Malay language</th>
<th>English Language</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kok</td>
<td>Saya</td>
<td>I</td>
</tr>
<tr>
<td>Awak/kamu/Ong</td>
<td>Awak</td>
<td>You</td>
</tr>
<tr>
<td>Nyap</td>
<td>Tak</td>
<td>No</td>
</tr>
<tr>
<td>Hap</td>
<td>Tiada</td>
<td>Don’t have</td>
</tr>
<tr>
<td>Terimak Kasih</td>
<td>Terima Kasih</td>
<td>Thank you</td>
</tr>
<tr>
<td>Samak –samak</td>
<td>Sama –sama</td>
<td>You are Welcome</td>
</tr>
</tbody>
</table>

The respondent also noted that the Temuan languages has great similarities with Iban language the indigenous people of Sarawak (formerly known as Borneo).

4.4 Community Analysis

4.4.1 Population

According to head of village there are 99 people living in Kampong Charik. The majority are elderly people of retirement age. This variance of high elderly population is because of the young migrating to town and other places for better job opportunity and livelihood. In Kampong Charik the population are mostly rubber tappers, farmers and livestock farming. They start their day by 6a.m to work in their rubber plantation or vegetable farming for local market. Some of the villagers are active sellers of forest product such as “petal” and wild fruits. As for livestock farming they rear chicken, goose, buffalos and sheep. Buffalos are common livestock among village families here because a buffalo can fetch as high as two thousand ringgit for a cattle. Averagely one family has four to six healthy buffalos. In this state most people eat buffalo meat instead of beef.

Temuan women in olden days are very good in weaving of baskets, mats and crafts. These baskets, mats and
crafts are made of “Mengkuan” Leaves (pandanus actrocarpus) which are found easily in the villages. Now weaving is not a source of income because the younger generation do not have to patience and interest in doing weaving.

4.5 Site Analysis

There are total of 35 houses in the village. The residential patent is lined and arranged neatly of 3 to 4 houses in each row. The village is free of pollution as there are no factories nearby or open burning on the site. The village is clean from litter and rubbish around the place. The grass is well grazed eaten by the buffalo herd around the villages. In terms of public transport the village is easily accessible by public transport, buses, taxi and van and road are well tar. The tar road is build right up to the houses door steps. The only drawback of the village is that the road is narrow that only allow only one vehicle to pass at any one time.

The village telecommunication connection is bad because of its topography. Mobile network and internet are not available therefore younger generation prefer to migrate to urban areas. As for channel television only certain houses has the connection and fishing activity is a favourite activity since the Charik river is very near.

5. Conclusion

Conservation of Cultural Heritage of Temuan tribe is crucial to legacy of past bestowed for the benefit of future generation. These legacies are in the forms of tangible and intangible culture asset that can be forgotten through time. The tangible asset that can still be seen and conserve are the making of Temuan huts and weaving of baskets, mats and crafts among the women community. To conserve these assets the community leaders and stakeholders have to promote them by teaching and training the younger generation on the art of making these cultural assets through education, workshops and festival. These can be done through school and community activities in Kampong Charik, Johol district or state of Negeri Sembilan.

As for the intangible cultural assets, they are found in the form of tradition and belief; these can only be disseminated through community activities or festival celebration performance at state level or district with participation from stakeholders in Kuala Pilah. By having these organised activities, cultural tourist will definitely participate in reviving these intangible assets by bringing economic benefit to the Temuan community.

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Introduction

Many rural people in developing countries still make a lot of travels characterized by long travel time and consume much energy for daily activities [1]. This condition is triggered by limited transport infrastructures and services in rural areas, resulting in poor access to various activities and service centers, also cause problems in socio-economic development of society. The accessibility issues greatly contributed to the increase of rural poverty. Therefore, according to Starkey, et.al [2] efforts in rural mobility improvement are necessary through transport infrastructure and services development by considering to the location, quality and cost of public facility service.

Concerning to the low motorized vehicle ownership in rural areas, mobility improvement of rural people and goods must be tackled not only by road betterment but also by transport service provision [3]. Very few programs have been made to improve rural mobility, but there is still big potential for enhancing road network utilization by motor vehicles or by public transport services improvement. According to Dewanti [4], significant challenge in rural mobility improvement is the model development of sustainable transport service, including private and public transportation. Until now, rural public transport service still exists in certain rural areas crossed by regency road network or rural main roads, but its routes designated by local government are not served optimally. Transport subsidy from government to offset the high vehicle operating cost is also failed to promote it. As a result, transport service is not affordable by rural people and many public transport operators stop their bus operations due to high vehicle operating cost. Provision of rural public transport services has not also been able to reach the community at large area, even to the remote ones. Decline in rural public transport performance has lasted nearly for the last 10 years and followed by the rapid increase of the use of motorcycles and mobile phones [5].

Meanwhile, private transport service depends on the economic ability of individual to have various kinds of vehicle. The better a person's economic level, more vehicles owned and the more transportation service options can be taken (including the choice of public transport), thus his or her mobility will increase. Reverse condition would be experienced by individual with low economic level. Provision of rural transport services by utilizing a variety of existing transport potentials in the society will offer a lot of choices and conveniences for the people in conducting movement. Therefore, this research was conducted with the objectives of:

Abstract

One of rural transport problems in Indonesia is the lack of transportation service. This study aimed to analyse a variety of transportation service existed in flat and hilly rural areas, in Indonesia, and to identify appropriate model and strategies of transportation services provision by considering socio-economic character, topography and trip undertaken. Qualitative research method was adopted and in-depth interview was conducted for 56 informants of rural society, government, public transport operators, entrepreneurs and drivers. A schematic diagram model of transport service was developed covering public and private transport services, motorized and un-motorized vehicles, as well as other types of vehicle/service developed in the study area. SWOT analysis was utilized in formulating strategies of rural transport service provision. In addition to the provision of private and affordable public transport, it is recommended to place public facilities closer to rural settlement to increase rural public services accessibility.

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Keywords: strategy; rural transport; service; Indonesia

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Meanwhile, private transport service depends on the economic ability of individual to have various kinds of vehicle. The better a person's economic level, more vehicles owned and the more transportation service options can be taken (including the choice of public transport), thus his or her mobility will increase. Reverse condition would be experienced by individual with low economic level. Provision of rural transport services by utilizing a variety of existing transport potentials in the society will offer a lot of choices and conveniences for the people in conducting movement. Therefore, this research was conducted with the objectives of:
1. To develop a model of rural transport services,
2. To formulate strategies of sustainable rural transport services.

The study was conducted in two districts with different topography, namely: Jogonalan (flat area) and Kemalang (hilly area) in Klaten Regency, Central Java Province. Selecting both locations with different topography enable to observe diverse travel patterns and rural transport services. Transport services are closely related to people’s behavior in selecting and using those services so that social aspects in the research will be very dominant. To understand the overall social behavior, it is required research strategy which able to capture the trending problems completely and active researcher involvement in any process of social change. It is qualitative research strategy [6]. Qualitative approach allows researchers observe the existing facts that inseparable from the context and tries to understand the meaning of the events occurred and their relation to the people involved in a certain situation. This method emphasizes the subjective aspect of people behaviour. It is also able to present directly the substantial relationship of researcher and respondent. In addition, this method is considered to be more sensitive and capable in self adjustment with the presence of value pattern.

The data were analyzed by inductive method since it enabled to find multiple realities, to make an explicit, identifiable and accountable relationship between researcher and respondent. It could also elaborate the full background, find influences which sharpening relationship and take into account the values explicitly as part of analytic structure.

2. Problems of Rural Transport Service.

Poor accessibility is a common transportation problem in rural area, although it is not only related to the ease of getting transportation services but also to the social and economic services [7]. In the context of transportation, poor rural accessibility is represented by bad performance of road network (non-standard pavement condition, impassable pavement in wet season) and by unreachable public facilities. Poor access is also indicated by low rural mobility. Many rural people make trips with long travel time, thereby reducing effective time for productive activities. An overview of rural mobility is presented by rural travel characters in several Asia and Africa countries, as shown in Table 1.

Table 1. Travel Characters in Rural Area

<table>
<thead>
<tr>
<th>No</th>
<th>Area/ Country</th>
<th>Number of trips</th>
<th>Time used</th>
<th>Transported Load</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Internal (%)</td>
<td>External</td>
<td>Internal (%)</td>
</tr>
<tr>
<td>1</td>
<td>Majalengka (Indonesia)</td>
<td>84%</td>
<td>16%</td>
<td>44%</td>
</tr>
<tr>
<td>2</td>
<td>Aurora (Philipin)</td>
<td>93%</td>
<td>7%</td>
<td>56%</td>
</tr>
<tr>
<td>3</td>
<td>Ghana</td>
<td>93%</td>
<td>7%</td>
<td>73%</td>
</tr>
<tr>
<td>4</td>
<td>Zambia</td>
<td>91%</td>
<td>9%</td>
<td>80%</td>
</tr>
</tbody>
</table>

Source: Dewanti [4]

The largest number of rural trips is internal ones, which cover internal daily trip with the purpose of obtaining basic needs, such as water, firewood and food. Thus the rural communities in Asia and Africa spend considerable time for daily travel to meet basic needs. This condition indicates that the rural areas do not served by public transport and motorized vehicles that capable in shortening travel time. Long travel time would reduce effective time of family members that can be used for productive activities. While, based on the aspect of transported load, rural people in Africa must transports heavier load in internal trips. This situation shows that the problems of rural accessibility and mobility in Africa are more severe.

3. Model of Rural Transport Service Provision

Different topographic condition in Kemalang and Jogonalan affects the types of operating vehicle, presented in Table 2. Those types of vehicle indicate vehicles that are often used for travel. Ownership of bicycles, motorcycles and cars in Jogonalan is 62%, 76% and 12% while in Kemalang, those are 11%, 100%, 11%. Although bike ownership in Kemalang is recorded at 11%, but it is not written in table as a private transport, because, in fact, bike is rarely used for daily trip due to topography restriction of hilly terrain.

It can be concluded that more types of public transport operate in flat region (Jogonalan), those arerickshaw, horse drawn cart and social vehicle that do not exist in hilly areas, but private transport, such as: bike is well developed. There is significant different on goods transport in Kemalang (hilly region) which has dump trucks and tank truck as sand/rock and water carrier. This area has many sand/rock quarries as a result of Merapi mountain eruption which is transported by dump trucks. Tank trucks are used to transport clean water during the dry season, sold to residents who lack of water in their reservoir. In both areas, there is a special practice of borrowing vehicle to the neighbours for social purposes,
such as dropping off and visiting sick people, religious meeting, attending funeral ceremony and others.

Developing a model of rural transport services not only pays attention to the existing condition of transportation services, but also needs to understand the character of various types of vehicle that can be developed in the future. Table 2 shows the character of those types of vehicle.

Table 2. Vehicle Types Exist in Research Study Locations

<table>
<thead>
<tr>
<th>Location</th>
<th>Passenger Transport</th>
<th>Goods Transport</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Public Transport</td>
<td>Private Transport</td>
</tr>
<tr>
<td></td>
<td>Private Transport</td>
<td>Hired Transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Private Transport</td>
</tr>
<tr>
<td>Jogonalan</td>
<td>Bus, minivan (F)</td>
<td>Walking, bicycle, motor cycle,</td>
</tr>
<tr>
<td></td>
<td>Motorcycle taxi and</td>
<td>car, borrowed motorcycle</td>
</tr>
<tr>
<td></td>
<td>minivan (NF)</td>
<td>and car.</td>
</tr>
<tr>
<td></td>
<td><strong>Rickshaw (NF)</strong></td>
<td>Truck, Pick-up, horse drawn cart</td>
</tr>
<tr>
<td></td>
<td><strong>Horse drawn cart</strong> (NF)</td>
<td>Walking, 2 or 3 wheels motorcycle,</td>
</tr>
<tr>
<td></td>
<td><strong>Mini train</strong> (NF)</td>
<td>horse drawn cart,</td>
</tr>
<tr>
<td></td>
<td><strong>Hired car</strong> (NF)</td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Social vehicle</strong></td>
<td></td>
</tr>
<tr>
<td>Kemalang</td>
<td>Bus (F)</td>
<td>Walking, borrowed</td>
</tr>
<tr>
<td></td>
<td>Motorcycle taxi (NF)</td>
<td>motor cycle and car.</td>
</tr>
<tr>
<td></td>
<td>Minivan (NF)</td>
<td>Truck, <strong>Dump Truck</strong>, pick-up,</td>
</tr>
<tr>
<td></td>
<td><strong>Mini train</strong> (NF)</td>
<td>Tank truck,</td>
</tr>
<tr>
<td></td>
<td><strong>Hired car</strong> (NF)</td>
<td>pick-up, cow drawn cart</td>
</tr>
<tr>
<td></td>
<td><strong>Social vehicle</strong></td>
<td></td>
</tr>
</tbody>
</table>

F= Formal  NF = Non Formal
Source: Analysis result

Table 3. Characters of Rural Vehicle

<table>
<thead>
<tr>
<th>Vehicle</th>
<th>Max load (kg)</th>
<th>Max speed (km/hour)</th>
<th>Max Range (km)</th>
<th>Terrain/route requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle</td>
<td>75</td>
<td>20</td>
<td>20</td>
<td>Flat, narrow path,</td>
</tr>
<tr>
<td>Bicycle with trailer</td>
<td>200</td>
<td>10 – 15</td>
<td>15 – 20</td>
<td>Flat, wide track,</td>
</tr>
<tr>
<td>Bicycle and side car</td>
<td>150</td>
<td>10 – 15</td>
<td>15 – 20</td>
<td>Flat, wide track,</td>
</tr>
<tr>
<td>Motorcycle</td>
<td>100</td>
<td>40 – 90</td>
<td>100</td>
<td>Motorable path</td>
</tr>
<tr>
<td>Motorcycle and trailer</td>
<td>250</td>
<td>30 – 60</td>
<td>60</td>
<td>Unsuitable for steep hills</td>
</tr>
<tr>
<td>Motorcycle and sidecar</td>
<td>250-500</td>
<td>30 – 60</td>
<td>60</td>
<td>Unsuitable for steep hills</td>
</tr>
</tbody>
</table>

Source: Riverson and Carapetis [8]

Giving an additional vehicle or a side trailer on a bicycle and a motorcycle will enable in increasing load capacity despite there is decline speed. Such vehicles are only appropriate on flat area. Transport service modelling is developed by considering factors of topographic, availability of vehicles, trip types and the public perception towards that service. It is created as a diagrammatic chart related to all factors mentioned. Topography character is divided into flat and hilly area. Topography affects vehicle performance passing hill-climb roads and higher vehicle operating costs. Trip type is divided into internal and external trip. Internal trip is undertaken within a village area with a maximum range of 2 km distance and it is usually for the travel purpose of water fetching, firewood collecting, working in the farm, going to school (kindergarten/primary school), to the small shop and to banking facility. External trip is done at a distance greater than 2 km, and it is usually for working outside the village, going to health facilities, to school (Junior/senior high school), to the market, to banking facilities. For the type of vehicle used includes all types, both motorized and non-motorized vehicles and public transport services (formal, non-formal), freight transport, private and social transport. The model of rural transport service is presented in Figure 1.

4. Social Behaviour in Transport Service Provision

In Kemalang (hilly area), people demonstrate higher tolerance level than Jogonalan (flat area). It is indicated by the real difference in transport behaviours, such as: ride sharing practices, motorcycle riding and sitting on the moving
bus roof by children. Having hilly character and more distant from the regency capital, some Kemalang people face so limited access to transport services that make them restricted to obtain public services. Practices of ride sharing with either local or non-local people grow well. A great number of pupils (primary school students) ride motorcycles on primary rural road without any strict law forces of polices. Many rural parents are able to provide motorcycles for their children to facilitate their school activities. Motorcycle ownership in Kemalang is high (more than 90% households have motorcycle) and people assume that motorcycle is as a primary need of rural households. They are so dependent on motorcycle for supporting their daily activities, but they often break traffic regulations by riding motorcycle without wearing helmet or riding on very old and bad motorcycle in indiscipline manner. Polices do not response it legally since those disobediences can be tolerated. High tolerance is also showed in bus operation. Many pupils sit on a moving bus roof, even on the empty bus. It is definitely very dangerous behaviour.

Figure 1. Model of Rural Transport Service
olicies do not care about it and such practice still occurs until now. In this area, it is also found non-formal public transportation using private car (minivan) that serves areas where formal public transportation does not operate. Those cases are not found in Jogonalan, but in this area, there is social vehicle service. It is a vehicle owned by individual or a non-profit foundation which is used for transporting rural people without any charges. This social vehicle is usually operated for visiting patient at hospital, attending funeral ceremony or religious special meeting. The variety of social behaviours in both locations produces different transportation services or practices and will impact on formulating strategies of rural transport service provision.

5. Implementation Strategies.

Transport services should be sustainable, so people can be guaranteed to have good accessibility to various services and public facilities. A variety of strategies to implement the model is analyzed by SWOT analysis (Strength, Weakness, Opportunity and Threat). Starting with in-depth examination of factors of Strength (S), Weakness (W), Opportunity (O) and Threat (T) from the model, then strategies are formulated in order to make the model applicable and sustainable. Some factors that indicate strength, weakness, opportunity and threat of the model are as follows:

Strength factors:
1. Consider community expectation and terrain condition
2. Using existing and emerging vehicles in study area
3. The existence of local wisdom, which is the nature of mutual help
4. Potential of public transport demand still exist

Weakness factors:
1. The extensively use of motorcycles create high risk of accident
2. Lack of traffic safety awareness
3. There is no standard of rural transport service performance
4. Limited number and competence of human resources
5. Inadequate legal regulations in the field of rural road transport
6. Unprofessionally public transport management
7. Limited rural people economic

Opportunity factors:
1. Emerging business opportunity in transportation field
2. Development of mobile phone technology facilitates information and communication
3. Ease of having a motorcycle
4. Increased rural development programs that prevents urbanization

Threat factors:
1. Accident rate increase
2. Vehicle operating costs continue to rise
3. Low population density and scattered settlement location
4. Local nature of mutual help decrease
5. Limited government finances to manage transport

Those Strategic factors above are grouped into Internal Strategic Factors (Strength and Weakness) and External Strategic Factors (Opportunity and Threat). Based on these two strategic factors (internal and external), as well as taking into account the linkage between both of them, then, all strategies that strengthen rural transport service model are formulated as shown in Figure 2.
<table>
<thead>
<tr>
<th>External Strategic</th>
<th>Internal Strategic Factor</th>
<th>Internal Strength</th>
<th>Internal Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>1. Consider community expectation and terrain condition</td>
<td>1. The extensively use of motorcycles create high risk of accident</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2. Using existing and emerging vehicle in the study area</td>
<td>2. Lack of traffic safety awareness</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3. The existence of local wisdom, which is the nature of mutual help</td>
<td>3. There is no standard of rural transport service performance</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4. Potential of public transport demand still exist</td>
<td>4. Limited number and competence of human resource</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. Inadequate legal regulations in the field of rural road transport</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>6. Unprofessionally public transport management</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7. Limited rural people economic</td>
</tr>
<tr>
<td></td>
<td>External Opportunity</td>
<td>Strategy S-O</td>
<td>Strategy W-O</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(1) Improve infrastructure and rural transport service</td>
<td>(5) Develop a standard of public transport service with users orientation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(2) Promote cross-sector cooperation and institutional performance in handling transportation problems</td>
<td>(6) Increase human resources professionalism through education and training</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(3) Enhance public participation in the planning and provision of transport services</td>
<td>(7) Improve public awareness on the importance of traffic safety.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(4) Develop various forms of social transportation service to people whose very low accessibility</td>
<td>(8) Enhance understanding of transportation regulations and laws through utilization of information and telecommunications technology</td>
</tr>
<tr>
<td></td>
<td>External Threat</td>
<td>Strategy S-T</td>
<td>Strategy W-T</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(9) Increase consistent law enforcement in traffic practices</td>
<td>(14) Increase the use of non-motorized vehicles and other types of low-operating cost vehicle for short trip distance.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(10) Promote the use of public transport</td>
<td>(15) Revise the substance of local legislation related to rural transport service.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(11) Raise the professionalism of transport management</td>
<td>(16) Optimize the system of social transport provision that can be achieved safely, easily and cheaply.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(12) Improve the provision of supporting facilities of traffic movement (signs, markings, signals, bridges, etc.)</td>
<td>(17) The involvement of big public transport operator in the provision of rural transport service</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(13) Increase community involvement in transport management</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. SWOT Analysis of the Model of Rural Transport Service

Strategy related to Internal Strength and External Opportunity (Strength - Opportunity):
1) Improve infrastructure and rural transport service
2) Promote cross-sector cooperation and institutional performance in handling transportation problems
3) Enhance public participation in the planning and provision of transport services
4) Develop various forms of social transportation service to people whose very low accessibility
Strategies related to Internal Weakness and External Opportunities (Weakness - Opportunity):

1. Develop a standard of public transport service with users orientation
2. Increase human resources professionalism through education and training
3. Improve public awareness on the importance of traffic safety.
4. Enhance understanding of transportation regulations and laws through utilization of information and Telecommunication technology

Strategies related to Internal Strength and External Threats (Strength - Threat):

1. Increase consistent law enforcement in traffic practices
2. Promote the use of public transport
3. Raise the professionalism of transport management
4. Improve the provision of supporting facilities of traffic movement (signs, markings, signals, bridges, etc.)
5. Increase community involvement in transport management

Strategies related to the Internal Weakness and External Threats (Weakness - Threat):

1. Increase the use of non-motorized vehicles and other types of low-operating cost vehicle for short trip distance.
2. Revise the substance of local legislation related to rural transport service.
3. Optimize the system of social transport provision that can be achieved safely, easily and cheaply.
4. The involvement of big public transport operator in the provision of rural transport service.

Rural transport service model can be implemented properly when it is supported by the availability of transport infrastructures, like good road network, the presence of gasoline station, vehicle–repairing facilities, telecommunication network that will improve the performance of vehicle movement, service delivery and communication in rural areas. Problem which still often appears in public transport operation is the presence of illegal payment required by unscrupulous people. Even though it looks small, but if it is done every day, it will be a burden for transport operators. Therefore practices of 'extortion' must be eradicated wherever such practices thrive. Efforts to increase revenue of transport operators should always be developed either by Transport Operators Association (ORGANDA) or government as a regulator. Special course or training on public transport management would enhance public transport operator’s knowledge of their business efficiency. Continuous promotion of public transport enables the increase of transport services demand. All efforts will not work properly without community involvement in rural transport management at various levels of planning, implementation and controlling.

6. Conclusions and Recommendations.

In general, flat and hilly rural areas have similarities of transport service characters, both of them are served not only by private transport but also formal/non-formal public transport and social transport services. Differences are found in flat area that has more types of vehicle in operation, it can be seen from the presence of rickshaw and horse drawn cart, while in hilly area, those two vehicles do not exist at all. Even some people in hilly area have bikes, but their use is very limited, unlike in the flat area, many people are biking for daily activities. Social transport gives significant role in supporting movement for people who have no vehicle or who live in remote, hilly area which lack of transport services.

In both study areas showed a considerable decrease in the performance of public transport services, both formal and non-formal. However, this decrease is followed by a sharp increase in motorcycle use. In other words, there has been a shift in the use of public transport to the use of motorcycles. It includes the reduction of non-formal public transport users, such as motorcycle taxis (called ‘ojek’), horse-drawn cart and rickshaw. Problem of reduction of public transport performance is much more triggered by internal and external factor of public transport. Internal factor is indicated by poor service, such as: unreliable schedules, long waiting time, long walking distance and depleted routes. Meanwhile, external factor is the facilitation of having a motor cycle and a cellular phone. Those makes rural people easy to travel, so, they who were dependent on public transport previously, then leave it, choose motorcycle as their means of transport. On the other hand, government policies towards rural transport have not considered the improvement efforts of public transport performance.

Rural transport service model is developed by adopting a diagrammatic model that represent types of transportation services with a variety of vehicles used for internal and external trips on flat and hilly areas. In order to make this model sustainable implemented, SWOT analysis is employed to obtain various implementation strategies. The proposed implementation strategies have considered four factors of SWOT so that the developed model can be
realized in a sustainable manner with emphasis on increasing rural mobility by using various types of vehicles and services available in a variety of regional conditions.

The most important thing in the success of implementing strategies of rural transport service provision is the availability of means of transport and transport services. Therefore, it is recommended:

1. Increase private vehicle ownership.

   Mobility improvement in rural area is an effort that should be prioritized, therefore the ownership of various types of vehicles, from non-motorized to motorized, conventional and non-conventional vehicles (example: Intermediate means of Transport) have to be increased. Thus, the demand of transport service for internal trip that most often done within a short distance can be met individually so that mobility can be improved, at least for internal trips. If private vehicle ownership increase, it will be easier to access better transport service or other public services in a longer distance, then external trip can be performed more frequent. People will have better mobility and accessibility

2. Improve transport service.

   Public transport service has to receive great attention from the government. Subsidies for continue operations of public transport should be provided, particularly for the routes with very little demand but has good potential to be developed either as their presence of natural resources or human resources. Support to the existence of transport services standard will further ensure transport users get adequate service. Besides, non-formal public transport and social transportation services are allowed to have more chance to be promoted for completing the provision of rural transport service which cannot be totally served by government.

3. Encourage, pursue and enhance public participation in transportation management since the start of planning to the implementation of the monitoring program. Community participation involvement will facilitate development process, especially in identifying service demand, willingness to support development process directly/indirectly, exploring initiatives from bottom and ensuring the success of an activity.

4. Increasing rural accessibility by putting public facilities closer to the settlement and by providing mobile services. In some cases facilities may be fixed by the physical environment, for instance natural sources of water such as springs and rivers or natural sources of fire woods. In these cases, access improvement can be implemented by constructing access paths or tracks to the natural sources. As non-fixed facilities, rural markets, local medical centres, schools, wells and sources of firewood may be located in effective locations near rural settlement in order to reduce distance and travel time to access those facilities. Mobile rural services such as mobile health services, mobile greengrocer, postal and mobile libraries also limit the demand of travel to access such services.

This research is still focused on land transport services in Klaten, future research should develop similar research on different transport field (e.g. air/sea transport) in different areas. However, Indonesian area as an archipelago demands the availability of air and water transport services as connectors of rural areas in various existing islands.

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The Effect of Infrastructure on Food Security

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Abstract

Food price in Malang Regency is unstable. There is a different price between one market and another market. Besides, there is an issue about road condition in Malang Regency. It is damaged (about 335 km) and it obstructs the vehicle. The food distribution finally gets an impact. It supposes to be an effect of infrastructure condition on food price.

The purpose of this research is to find the effect of infrastructure condition on food price. After that, this research will analyze the food purchasing power of people in Malang Regency. Food purchasing power will be assumed as the indicator of food security. Based on Government Regulation No. 68/2002 on Food Security, food security is a condition where the household has been fulfilled enough by food, which reflects in adequate supply of food, either quantity or quality, safely, evenly, and at reasonable price. This research will be done by interview the related person to analyze the correlation between infrastructure condition and food price. And then the second analysis is ability to pay (ATP) analysis to count the purchasing power of people in Malang Regency.

This research provides a cause of failed distribution that leads to the rising rice price. The main output of this research is to find the infrastructure’s characteristic that minimizes the food price, so that the food security will be reached. The role of infrastructure is important, not only in food distribution, but also in many other fields. Consider on it, this finding should encourage government to pay more attention to infrastructure sector.

Keywords: infrastructure; food price, ability to pay, food security

Background

Infrastructure has an important role in distributing product to consumer. But there are many damaged infrastructures. Three hundred and thirty three kilometres road in Malang Regency are in damaged condition, while road is important to distribute the food product. The condition of infrastructure can affect food price. Related to this problem, Kodoatie (2005) says that access to infrastructure is important to:

1. Increase the supply of import product with lower price
2. Develop agricultural sector with higher revenue
3. Increase the use of the more modern farming tools
4. Increase product to be distributed

Food price in Malang Regency is different from one market with another. The research will be conducted in five main traditional markets in Malang Regency: Bululawang, Karangploso, Jabung, Sumberpucung, and Bantur. Every market is located in a district that has the same name of the market. The chart of rice price in Malang Regency can be seen at Figure 1.

The horizontal axis is the name of market, the vertical axis is the price of rice in thousand rupiahs, and the blue, red, and green line are the varieties of rice (bengawan, mentari, and IR 64). The research took those five markets based on some criteria, how it represents its area, and how different the price with another markets. Each market represents its area. Bululawang represents the price in central area, Karangploso represents the price in northern area, Jabung represents the price in eastern area, Sumberpucung represents the price in western area, and Bantur represents the price in southern area. The map of Malang Regency with location of the five markets can be seen at Figure 2. Markets are signed with the blue dots.

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Figure 1. Food price at five markets in Malang Regency

Figure 2. Map of Malang Regency and Location of Markets
This research will take rice as a commodity to be analyzed. Rice is a prime food and contains carbohydrate. Based on BPS, carbohydrate is a most consumed compound by people in Malang Regency. Based on the problems, this research will identify the correlation between infrastructure condition and rice price. After that, this research will identify whether the rice price is affordable for the customer or not, it will be associated with food security issue. The hypothesis of this research is there is an effect of infrastructure condition on the rice price, rice price on people’s ability to pay, and those are also has an effect on food security. The illustration of the research hypothesis can be seen at Figure 3.

2. Research Methods

Research entitled The Effect of Infrastructure on Food Security has a concept as shown at Figure 4.

The detail of variables that used in goal 1 can be seen at Table 1.
Table 1. Variables of Goal 1

<table>
<thead>
<tr>
<th>Indicator</th>
<th>Variables</th>
<th>Decision Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rice price</td>
<td>Price of bengawan rice</td>
<td>Rupiahs</td>
</tr>
<tr>
<td></td>
<td>Price of mentari rice</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Price of IR 64 rice</td>
<td></td>
</tr>
<tr>
<td>Condition of road</td>
<td>Type of vehicle used on rice distribution</td>
<td>• Un-motorized</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Motor cycle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Light vehicle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Medium heavy vehicle</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Large truck</td>
</tr>
<tr>
<td>Length of road</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Level of service</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Condition of rice warehouse</td>
<td>Number of warehouse every distribution</td>
<td></td>
</tr>
<tr>
<td>Size of warehouse</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Sample will be taken with purposive sampling method, one of non-probability sampling. Purposive sampling is a method which takes a subject that fits with the set characteristic, and ignores another which is unfit the set characteristic (Morissan, 2012: 117). Sample size will be 30, but according to Kumar (2005), if the sample has represented the real condition, survey could be stopped.

The second goal is analyzed using ATP, the approach is by focusing on how much is the percentage of household’s consumption for food and rice. In developing countries like Indonesia, it is easier to measure expenditure than income. Income is hard to measure because much of it comes from self-employment, while expenditure is more straightforward (World Bank Institute, 2005: 36). This research use percentage of household’s consumption for food and rice based on Engel’s Law. Based on Holcomb, Park, & Capps (1995:1), Ernst Engel stated that poorer households devote a higher share of income to food than richer households. There is no standard of the best percentage of expenditure for food, but Engel said the lower the percentage, the better.

This research will compare the existing percentage of expenditure in Malang Regency with the percentage of expenditure in Indonesia as the standard. In Indonesia, on September 2012 as the last survey of people’s consumption, percentage of expenditure for food per capita per month is 47.71, and percentage of expenditure for rice per capita per month is 9.7 (BPS, 2012). Household expenditure for food and rice will be surveyed on 30 respondents. Roscoe (1975) said that sample is representative if the size 30 or more. Sample will be taken with simple random sampling method. Kumar (2005: 174) said that simple random sampling enable the whole population to get the same chance to be surveyed.

The result of ability to pay analysis will be used as indicator of food security, but not the only indicator, because the scope of this research is just rice. Assumption is based on Government Regulation No. 68/2002 about Food Security, food security is a very important factor in the framework of national development to form a qualified, independent, and prosperous Indonesian people through the manifestation of adequate, safe, qualified, nutritional, and various food evenly across Indonesia, which price is reasonable to the people. This research just takes the reasonable price as one of food security indicator. If the food is reasonable for people, food security will be reached as shown in Government Regulation No. 68/2002 about Food Security.

3. Discussion

a. Goal 1

According to the distributor as the related person, infrastructure like road and warehouse, does not give too much effect to the rice price. Even in two markets located at the different area (Jabung in the eastern area and Sumberpucung in the western area), the price is the same. The effects on infrastructure are the length of the route. If there is an obstacle
on the way delivering the goods, vehicle should turn to another route and maybe it will be longer route or rougher road. It will take more fuel, but not too much. The size and the number of warehouse also not give a significant effect to rice price.

b. Goal 2
Survey of ability to pay has done to 30 respondents, and the result can be seen at Table 2.

Table 2. Household Expenditure for Food and Rice

<table>
<thead>
<tr>
<th>Respondent</th>
<th>Total Expenditure</th>
<th>Expenditure for Food</th>
<th>Expenditure for Rice</th>
<th>Percentage Expenditure for Food</th>
<th>Percentage Expenditure for Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000</td>
<td>1500</td>
<td>800</td>
<td>75.00</td>
<td>40.00</td>
</tr>
<tr>
<td>2</td>
<td>3500</td>
<td>1500</td>
<td>250</td>
<td>42.86</td>
<td>7.14</td>
</tr>
<tr>
<td>3</td>
<td>1500</td>
<td>600</td>
<td>85</td>
<td>40.00</td>
<td>5.67</td>
</tr>
<tr>
<td>4</td>
<td>1000</td>
<td>700</td>
<td>256</td>
<td>70.00</td>
<td>25.60</td>
</tr>
<tr>
<td>5</td>
<td>2500</td>
<td>1000</td>
<td>170</td>
<td>40.00</td>
<td>6.80</td>
</tr>
<tr>
<td>6</td>
<td>2500</td>
<td>2000</td>
<td>170</td>
<td>80.00</td>
<td>6.80</td>
</tr>
<tr>
<td>7</td>
<td>1500</td>
<td>1000</td>
<td>240</td>
<td>66.67</td>
<td>16.00</td>
</tr>
<tr>
<td>8</td>
<td>1400</td>
<td>900</td>
<td>153</td>
<td>64.29</td>
<td>10.93</td>
</tr>
<tr>
<td>9</td>
<td>600</td>
<td>450</td>
<td>135</td>
<td>75.00</td>
<td>22.50</td>
</tr>
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Based on the survey to 30 respondents, 20 are higher than the standard of percentage expenditure for food (47.71%) and 15 are higher than the standard of percentage expenditure for rice (7.9 %). We can assume that if the rice price were rising, percentage expenditure for rice would be rising too.

4. Result

The result of this research suggests that infrastructure does not affect food price too much. Rising price could be led by failed distribution. Failed distribution is not only about infrastructure thing, but also the other thing:

a. Inefficient route of distribution, goods (in this case the goods is rice) not well distributed, they could pass the same route because there is no management for route distribution from the upper level such a government or organization. This is just the waste of fuel time to distribute.

b. There is a speculator, a person or body which invests in stocks the goods in the hope of gain. They save the rice when the quantity of supply is high, and then sell it when the supply is low. Because when the supply is low, the price will rise.

c. Some area has rice as its commodity, but the farmers sell it to the market which located out of that area. If farmers sell their product in local market, the price should be lower.

5. Conclusion

Based on the analysis, it is concluded that infrastructure affects the food price, but not that significant, and the rice price could affect people’s ability to pay. The most important part that makes the price is distribution. Failed distribution can lead to the rising price.

References

Impact of AEC Connectivity on Local Communities: Comparative Studies of Dawei Deep Sea Port in Myanmar, the Eastern Seaboard in Thailand and the Strait of Malacca in Malaysia after the Implementation of the ASEAN Economic Community in 2015: Challenges and Opportunities

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Abstract

In the implementation of ASEAN Economic Community (AEC) in 2015, there have been many efforts to establish the new AEC connectivity. The AEC connectivity denotes the capabilities of transborder transportation that increases the rapidity with which goods, information, capital and technology move between the region and the world. For centuries, the Strait of Malacca in Malaysia, the Sunda Strait and the Lombok Strait in Indonesia have been the center of AEC’s connectivity. Ninety percent of the world’s transportation has to pass those straits to transport both commercial and secure products from the United States of America and Europe to East Asia. The countries in Southeast Asia especially coastal states have the significant roles to initiate and manage the AEC’s connectivity because of the mutual interest since the Declaration of Independence of each country, for example, ASEAN’s coastal states cooperated to achieve the Regional Maritime Security Initiatives (RMSI) which was initiated by the United States of America in 2004 to operate the maritime security in Southeast Asian sea especially in the Strait of Malacca in Malaysia, the Sunda Strait and the Lombok Strait in Indonesia.

However, in the implementation of ASEAN Economic Community in 2015, the new ASEAN connectivity will be changed from the Deep Sea Port at the Strait of Malacca in Malaysia, the Victoria Point in Myanmar, the Eastern Seaboard in Thailand to Dawei Deep Sea Port in Myanmar. From AEC’s plan in 2015, Dawei Deep Sea Port will be the most significant transborder corridor of the ASEAN connectivity. The port is located in the frontier between Myanmar and Thailand which is connected to Thailand, Greater Mekong Sub-region, China and South China Sea. It will be the center of ASEAN connectivity after 2015. If comparing to the Deep Sea Port at the Strait of Malacca in Malaysia in term of transportation, Dawei Deep Sea Port in Myanmar can decrease the cost of transportation and to increase the high maritime security. The port will encourage many investors to transport their products to Dawei Deep Sea Port. The rise of interconnectedness like the port after the implementation of ASEAN Economic Community in 2015, not only affects to almost every sphere of society from economic term to human security term on local communities of the Strait of Malacca in Malaysia but also local communities near Victoria Point in Myanmar, the Eastern Seaboard in Thailand because the Strait of Malacca in Malaysia is the center of ASEAN’s Connectivity nowadays and Victoria Point is the center of crossing the border between Ranong in Thailand and Myanmar which serves as trading center for local Thai-Burmese commerce. Moreover, the Eastern Seaboard is located in Rayong and Chonburi province which is also the commercial and industrial center with the Deep Sea Ports. Those are the Connectivity of ASEAN nowadays. However, Dawei Deep Sea Port in Myanmar will be the new AEC Connectivity after the implementation of ASEAN Economic Community in 2015. Therefore, local communities of the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar, the Victoria Point in Myanmar and the Eastern Seaboard in Thailand will be affected significantly in political, economic and social terms. The AEC Connectivity will make the advantages and the disadvantages to local communities of the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar, the Victoria Point in Myanmar and the Eastern Seaboard in Thailand in the future. It is very significant to study the impact of AEC Connectivity to those local communities of the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar, the Victoria Point in Myanmar, the Eastern Seaboard in Thailand on political, economic, ecological and social terms that will affect to local people in each area after the implementation of ASEAN Economic Community in 2015 by using the Linkage theory. The Linkage theory mentioned that policy is made by the internal and external factors. This research will focus on the challenges and opportunities of the impact to local communities on the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar and the Eastern Seaboard in Thailand in social, economic, ecological and political terms after the implementation of the ASEAN Economic Community in 2015. There are three parts of the research below:

(i) The principles and history of the ASEAN Economic Community

(ii) Analyzing the politics and political economy of the ASEAN Economic Community (including problems in the way of movements of skilled people and the availability of particular skills in different parts of the Community, and access by the little people to the benefits of integration - and thus the broader question of the distribution of the benefits of the formation of the AEC)

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1. Background

This paper examines the political impact of Dawei Deep Sea Port on local Thai communities in Sustainable development in case of social, political environmental and economic terms after the implementation of the ASEAN Economic Community in 2015: challenges and opportunities. While there have been multitudinous studies which focused on the consequence of ASEAN Connectivity in 2015, only a few attempts have been made to analyze the challenges and opportunities of the impact to local communities on the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar, the Victoria Point in Myanmar and the Eastern Seaboard in Thailand in social, economic, ecological and political terms after the implementation of the ASEAN Economic Community in 2015. Base on materials collected through interviews with local people and local governmental officer at Ranong province, Chonburi province and Tak province, the focal point of this article is to consider the challenge and opportunity of the impact of Dawei Deep Sea Port to local community in Ranong province, Chonburi province and Tak province in term of politics, economic, society and environment. Particularly history of the ASEAN Economic Community, this article discusses the politics and political economy of the ASEAN Economic Community including problems in the way of movements of skilled people and the availability of particular skills in different parts of the Community, and access by the little people to the benefits of integration - and thus the broader question of the distribution of the benefits of the formation of the AEC, including case studies of the likely impact of the AEC on particular industries in particular countries on local communities of the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar, the Victoria Point in Myanmar and the Eastern Seaboard in Thailand in social, economic, ecological and political terms will be discussed. This article explores whether ASEAN approach toward ASEAN Connectivity in case of Dawei Deep Sea Port. It also shows that the Declaration of ASEAN connectivity and related to ASEAN development underscore the collective commitment among ASEAN States to pursue a limited refinement of ASEAN connectivity towards local community in 2020.

2. The principles and history of the ASEAN Economic Community

As prevailing situation of multi-history background of the Association of Southeast Asian Nations (ASEAN), ASEAN Economic Community (AEC) is the focal point of ASEAN including the world community in the 20th century. This article will provide the fashionable multilateralism of ASEAN in the 1990s and the plan of ASEAN Economic Community in 2015 as the economic parable via the convenient economic benefits among states. Dawei Deep Sea Port in Myanmar is a case study of ASEAN Connectivity which is a project under ASEAN Economic Community in 2015. The implication of ASEAN connectivity towards local areas will be described in this topic below.

The emergence of the Association of Southeast Asian Nations (ASEAN) was on August 8, 1967.(Keling, 2011: 172) ASEAN as a regionalism in Southeast Asia began inauspiciously in the 1950s with the Bandung Conference and the disastrous Association of Southeast Asia (ASA) including Malaysia-Philippines-Indonesia (Maphilindo), Maphilindo separated efforts to organize mainland and insular Southeast Asia. The Member States of the Association comprised of Cambodia, Indonesia, Brunei Darussalam, Thailand, Lao PDR, Philippines, Malaysia, Singapore, Vietnam and Myanmar. The ASEAN Secretariat is based in Jakarta, Indonesia, Vietnam, Lao People’s Democratic Republic (PDR), Myanmar, and Cambodia also joined the Association of Southeast Asian Nations (ASEAN) in the 1990s in the event of jeopardize regime of ASEAN in the term of the integration with the inequality background and without the purpose of intervention among member. ASEAN Economic Community will be completed in 2015 without considering the different context in each country of ASEAN.

In term of ASEAN Economic Community, according to the structure of the ASEAN economy, and its trade with the rest of the world, is changing expeditiously from that of a relatively backward exporter of agricultural product to that of economically progressive state with exports dominated by manufactured goods and services. The influx of impact of Dawei Deep Sea Port is not a new phenomenon in ASEAN because the growth of ASEAN Connectivity has been started before 1967 from previous ASEAN connectivity such as the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar, the Victoria Point in Myanmar and the Eastern Seaboard in Thailand. In the context of international trade, ninety percent of product’s transportation is by maritime transportation (Methee Keawnil, 2549: 1).
Half of all products are transported to the straits in Southeast Asia. For example, product are transported though Malacca Strait to South China Sea. One-Third of oil transportation of the world, eighty percent of oil transportation from Japan and sixty percent of transportation of Australia must travel though the Straits of Malacca in Malaysia, Sunda Straits and Lombok Strait in Indonesia. Both countries have been the most strategic location in this region.

Nowadays, after the ASEAN Leaders adopted the ASEAN Economic Blueprint at the 13th ASEAN Summit on 20 November 2007 in Singapore to serve as a master plan guiding the establishment of the ASEAN Economic Community 2015. ASEAN Economic Community (AEC) should be the goal of regional economic integration by 2015. AEC comprised of the following key principles: (a) a single market and production base, (b) a highly competitive economic region, (c) a region of equitable economic development, and (d) a region fully integrated into the global economy. The AEC areas of cooperation include human resources development and capacity building; recognition of professional qualifications; closer consultation on macroeconomic and financial policies; trade financing measures; enhanced infrastructure and communications connectivity; development of electronic transactions through e-ASEAN; integrating industries across the region to promote regional sourcing; and enhancing private sector involvement for the building of the AEC(ASEAN, 2008: 16). In conclusion, the AEC will transform ASEAN into a region with free movement of goods, services, investment, skilled labor, and free flow of capital. Overwhelming majority of ASEAN countries and super powers outside the regions agree with the ASEAN connectivity’s proposal in Dawei Deep Sea Port in 15th ASEAN Summit on October, 2009. According to the Master Plan of ASEAN Connectivity, the purpose of ASEAN Connectivity is to increase connectivity within region and outside the region to promote economic growth, narrows the development gaps by sharing the benefits of growth with poorer groups and communities, enhances the competitiveness of ASEAN, and connects its Member States within the region and with the rest of the world.

ASEAN will complete the potential multimodal transport corridors to empower parts of ASEAN to function as land bridges in global supply routes, the East-West Economic Corridor (EWEC), Constructing the missing link in Myanmar, Developing terminal ports: Yangon, Da Nang, Promoting the Mekong-India Economic Corridor (MIEC) as a land bridge, constructing the Mekong Bridge in Neak Loung (National road No.1 in Cambodia), Developing the Dawei deep sea port (by 2020), building the highway between Kanchanaburi and Dawei (by 2020), conducting a feasibility study and preliminary design for the railway spur line between Kanchanaburi and Dawei and developing a network of ASEAN dry ports in accordance with existing ASEAN initiatives such as the ASEAN Highway Network and the SKRL. This decision reflected the realization of ASEAN decision-makers that they ultimately could not prevent each other from commenting on the ASEAN Connectivity especially the construction of Dawei Deep Sea Port. The Port had perceived detrimental social, economic or political impact on the local community as well as the former connectivity such as the Straits of Malacca in Malaysia, Victoria Point and Eastern Seaboard in Thailand. This ASEAN Connectivity also affect the local communities of the previous connectivities such as the Strait of Malacca, Victoria point and Eastern Seaboard. Once those connectivity earn the income to ASEAN. It is not difficult to understand why the principle of ASEAN Connectivity especially Dawei Deep Sea Port was attractive to ASEAN member when it was established in 2009. But the Deep Sea Port as a result of multilateralism and the economic development of ASEAN, should make the policy concern to the impact to the local community in those area.

3. Analyzing the politics and political economy of the ASEAN Economic Community (including problems in the way of movements of skilled people and the availability of particular skills in different parts of the Community, and access by the little people to the benefits of integration - and thus the broader question of the distribution of the benefits of the formation of the AEC)

ASEAN continues to develop more about the Dawei Deep-Sea Port project which is used for import and export of goods. The project would reduce logistical and labor costs and increase the movements of skilled people including foreign investment as well as creating job opportunities for people in Dawei province in Myanmar and Tak province in Thailand. However, it may decrease the job opportunities for local people in those areas as well. For economical analysis, there are three countries; Thailand, Myanmar and Malaysia which take the benefits of Dawei Deep Sea Port in 2015. The politics and political economy among those countries in Dawei Deep Sea Port can be analyzed as the strategy to move skilled people availability of particular skills in different parts of the Community.

Since the concentration ratios of labour in the previous ASEAN connectivity, such as, the Straits of Malacca in Malaysia, Victoria Point in Myanmar and Eastern Seaboard in Thailand explain the movement of labour across ASEAN to ASEAN Connectivity, the Dawei Deep Sea Port will encounter with the concentration ratios of labour as well. For political economy, the support of former prime minister of Thailand Thaksin Shinawat and his sister, Yickluck Shinawat, the current prime minister of Thailand, including the support from China toward Myanmar, those political relationships make the power of economy increase the efforts to implement the Dawei Deep Sea Port without the consideration of impact toward local community in Dawei province in Myanmar and Tak province in Thailand. However, the new prime minister
Najib Razak of Malaysia, Malaysia is not the Economic leader of ASEAN anymore because the implementation of ASEAN Connectivity in 2015 may compel all concentration ratios of labour and economy to Myanmar, Thailand and Greater Mekong Subregion. It is not the same as the administration of former primister Mahathir bin Mohamad with the Malaysian Development Plan titled “Plan 2020”. This is the reason why Dawei Deep Sea Port grows very fast in ASEAN. However, in case of the movement of labour, the consequence of Dawei Deep Sea Port currently instigates all migrant workers in Malaysia and other countries in ASEAN moving to Myanmar and Thailand including six countries in Greater Mekong Subregion. The GMS countries are Cambodia, the People's Republic of China (PRC, specifically Yunnan Province and Guangxi Zhuang Autonomous Region), Lao People's Democratic Republic (Lao PDR), Myanmar, Thailand, and Viet Nam. There are two topics; the development of Dawei Deep Sea Port and the situation of the movements of skilled people to Dawei Deep Sea Port that indicate the political economy about concentration ratios of labour of skilled people and the availability of particular skills in different parts of the community, and access by the little people to the benefits of integration - and thus the broader question of the distribution of the benefits of the formation of the AEC.

After the implementation of Dawei Deep Sea Port, the investment in Malaysia will be decreased. Thailand and Myanmar including six countries of Greater Mekong Subregion can foster the economical growth. Thailand, Myanmar and Six countries of the Mekong basin initiated many conferences to foster economical growth, narrow development gaps, strengthen regional links and integrate cooperation schemes. All economical efforts have the enormous impact to concentration ratios of labour of skilled people and the availability of particular skills in different parts of the community. According to the purpose of ASEAN Connectivity and a new decade of Greater Mekong Subregion (GMS) strategic development partnership, leaders from China, Myanmar, Laos, Thailand, Cambodia and Vietnam will find the cooperation adapting to ASEAN Connectivity in Dawei Deep Sea Port.

The ASEAN Connectivity and GMS currently implement 55 investment projects for a total project cost of $14 billion, more than 1 million of skilled labours will move to the areas of construction (Asian Development Bank, 2011, 2011:6). These included subregional roads, airports and railway improvements, plus hydropower projects for crossborder power supply and tourism. A Dawei Deep Sea Port economic development master plan will be implemented together with the ASEAN Economic Community plan, as part of an integrated Economic community by 2015. Thai private sector also wants to see a new model for border economies that links Thai border towns with neighbouring countries. Paired bordertown economies, such as Chiang Khong, Huay Xai, Nakhon Phanom-Khammuan, Mukdahan, Savannakhet, Kanchanaburi Dawei and Mae Sot and Myawaddy should be made into special economic zones with unique characteristics for special purposes. Kanchanaburi and Dawei, for example, should be model border towns for the seafood industry, rubber plantations, logistics for international sea transshipment. Thailand could link to all neighbours and become a regional hub for rail links. Prime Minister Yingluck would emphasis the mega project at Dawei special economic zone under bilateral cooperation. Prime Minister Yingluck will also address issues related to the East-West Economic Corridor to enhance economic activities along road links across the mekong basin from Burma to Thailand, Laos and Vietnam. Thai government will initiate an environmentally friendly investment projects in the context of weather change, which drastically affected Thailand and other countries in the region this year. With the Mekong region now getting attention from various parts of the world, notably East Asia, leaders will assign the ADB, as GMS secretariat, to coordinate with countries with joint development schemes, such as the Mekong, Japan and Mekong-South Korea arrangements, to avoid any overlap and efficient utilisation of resources. The GMS has regional powerhouse China as a member. Other economic powers such as Japan and South Korea, which are not in the mekong basin, used to have and wanted more roles in the region. The development partners, notably from western countries, also wanted to deal with the region. Leaders of the mekong hope to facilitate business with all of them.

However, the Burmese government and the Myanmar Port Authority (MPA) have signed an MOU. The total project, estimated at 350 billion baht, was revealed during a conference between business operators and government sectors under the project Westgate Landbridge, organised by the JSICIB. The four investors are PTT, Nippon Steel, Egat and Petroleum National Berhad (Petronas). The Landbridge is in two phases: the first commencing early next year to construct a four-lane road; and the second, the building of eight-lane roads. These two phases are expected to be finished by 2015. Italian-Thai Development project manager Surin Vichian said the highway route would begin from Phu Nam Ron in Kanchanaburi province to Dawei in the Tanintharyi region of Burma - a distance of 160km. Currently 100km have been cleared to mark the road's unsealed route from Dewei and Phu Nam Ron. Working on the forestry area is to be left to the last as there are problems negotiating with the Burmese military, but the road planned by the Thai and Burmese governments does not cut through any village or community. Within the Dawei project, plans are for deep-sea ports and industrial estates. Its area is much bigger than Laem Chabang and Map Ta Phut put together. In January next year, the deep-sea port will begin construction, together with roads for industry and public utility as the first phase. Completion is expected in five years. The cost of the deep-sea port is estimated at 100 billion baht. Eighty percent of population in those communities will be the migrant workers from other areas. According to the development of Dawei Deep Sea Port, more...
than 1 million of labour will move to the areas of construction and Dawei Deep Sea Port. In conclusion, Thailand and Myanmar will take the advantage of the project in large-scale development projects but little local people in Dawei Deep Sea Port, the Straits of Malacca in Malaysia, Victoria Point and Eastern Seaboard in Thailand will access to the benefits of integration.

4. Impact of the AEC on particular industries in particular countries on local communities of the Straits of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar and the Eastern Seaboard

The lessons learned from the evaluation of the Strait of Malacca in Malaysia, the Dawei Deep Sea Port in Myanmar and the Eastern Seaboard in Thailand that include (1) Pollution; (2) Local society; and (3) Water consumption will induce inflows of population in the region, thereby increasing demand for public sector services in the urban areas. It is therefore important to see to it that the government has adequate fiscal resources and strengthens its administrative capacity in parallel with the development.

4.1 The Straits of Malacca

For centuries, there has been much focal influence of the Straits of Malacca to local communities in several ways. The Straits of Malacca or the “Sea of Melayu” is 500 Nautical Miles (nm) long with the width that varies between 200 nm at its widest point and only 11 Nautical Miles (nm) at its narrowest point, and runs northwest-southwest between Peninsular Malaysia and Indonesian Island of Sumatra. It is the longest straits in the world. The Straits is located in the international waterways system, which has enormously shaped the everyday life in the ports and of the people living in towns along the coastal areas.

In case of pollution, the hinterland of this area is very rich in agricultural, mineral and forest products that are due to be exploited and exported to other regions during ASEAN Connectivity’s process. Malacca Straits is also rich with marine lives and it is the important maritime route. Local people and industry catch of the fishing industry in Malaysia, local community earn an average of 500,000 tons or more than RM 1 billion worth of fish from the Straits (Dato’ Hamdan Kurish,(2009A). There are 90,000 vessels passing these straits annually. The numbers of ships are expected to hit 120,000 in 2015(HM Ibrahim, 2008). There still exists a risk of an accident and spill of cargo that include crude oil, toxic chemicals and radioactive substances- Japan reprocesses 90% of its nuclear material in Europe, and those shipment travel through the Straits after the implementation of Dawei Deep Sea Port. The mammal was diminishing fast in Malaysian waters due to the depletion of sea grass by human activities such as fishing and pollution. The mangrove forests which line the coasts are also threaten by further loss with the increase pollution. University of Malaya estimated that fisheries derive from mangrove alone worth RM1.36 billion from Malaysia while from Sumatra, the figure is RM 631 million. As such they put the average value of the coastal area at RM11.8 million per km length, with the Malaysian shoreline having a higher value of RM14.1 million per km length. The total value of marine resources in the Strait of Malacca is estimated at RM2.7 billion. (Gunalan, 1999) Local community in Malacca will be affected after the implementation of Dawei Deep Sea Port because of the demise of the environment in local community. The pollution and environmental exploitation still be the problem without the income of local community in the Straits of Malacca.

In case of local economic impact, the Straits of Malacca or a golden heritage to the littoral states, The Dawei Deep Sea Port will destroy this waterway which serves as the primary conduct for the movement of oil, cargo, and trade which encourage the growth of economies of the world. Hence, securing safety of free navigation within the Straits is an important issue concerning the international community. Malacca Straits is an important waterway that is crucial to the world’s economic and security interests. The sea lines of communication (SLOC) that passes through Malacca Straits are the shortest route linking the oil-rich Gulf Countries and the oil-consumer countries such as China, Japan, South Korea and Taiwan. Ship travelling between Middle East to Northeast Asia could save about 1000 nm compared to ships transiting Lombok Straits in Indonesia. The emergence of Dawei Deep Sea Port would destroy the local economic growth in the Straits of Malacca about 30 percent of the world trade and 50 percent of world energy that need to pass through Malacca Straits each year. Moreover, People will move to work in other areas especially in Dawei Deep Sea Port. The Straits is bordered by the 4 littoral states namely Malaysia, Singapore, Indonesia and Thailand.

However, in term of local society, the Straits has not only contributed to the economic growth of the littoral states but has also contributed to rapid development of maritime crimes and TNC such as smuggling of cigarettes in local community and the trafficking of consumer goods and small arms within Malacca Straits are other major problems to Malaysia’s maritime security which penetrated the Malaysian border almost on daily basis (John Bradford, 2005). One of the possible factors which facilitate the smooth and rampant penetration of criminalities into Malaysian Maritime Zone(MMZ) is its “loose border security and ineffective Maritime Enforcement within the Straits”. If ASEAN
Connectivity move to Dawei Deep Sea Port, it has caused Malaysian government save almost 2 billion Ringgit Malaysia (RM) annually (Ramli&Sumathy,2008) to protect crime in local community. Illicit drug trafficking is another major crime activity within the Straits, which has posed a great deal of social and security problems to Malaysian internal affairs. Human trafficking is another major setback to Malaysian security.

4.2 Eastern Seaboard in Thailand

In 1980s, Thailand initiated the Eastern Seaboard Development Program. The goal of the program was to develop the eastern seaboard in the southeast of Bangkok, reducing the exclusive concentration of industries in the metropolitan Bangkok region including building a new industrial infrastructure in Thailand. It had two core components, heavy and chemical industries that exploit natural gas produced in the Bay of Siam, and export-oriented industries located in the vicinity of the newly-built international container port.

In term of economic impact, as mentioned before, the Eastern Seaboard Area has developed mainly around two areas; the one is the Map Ta Phut area whose development has been achieved as a petrochemical center and the other is the Laem Chabang and its inland area along National Road No. 331, developing as a core center receiving industries designed to substitute or supplement the metropolitan area. The industrial development in these areas was enabled by increase of private sector’s investments (installation of plants) including foreign investments in the area. This project was initiated in the framework of the Fifth Five-Year Plan(1982 to 1986). Also in the Sixth Five-Year Plan, it was one of the main program for development planning both economic and social term of Thailand. At the present, Eastern Seaboard has been the concentration of economic center in eastern Thailand. Most of local people who encounter with the poverty work in the factories in Eastern Seaboard. ASEAN Connectivity will link Eastern Seaboard and the Dawei Deep Sea Port. The product will be transported from Europe and America to South China Sea by Dawei Deep Sea Port and Eastern Seaboard.

In case of the labor movement from other areas to Eastern Seaboard, during the development of Eastern Seaboard, the population has been increased 2.5% (1986-1991) to 1.9% (1991-1996), which is higher than the nationwide average annual rate is 1.5% (1986 to 1991) to 1.4% (1991-1996), and also higher compared with other districts. In the case of Chon Buri province, in particular, which led the way toward the industrialization of the Eastern Seaboard Area, the annual population increase ratio is 2.5% (1986-1991) to 2.6% (1991-1996) (Kenichi Ariga, 2000; 107 ), which is much higher than the nationwide average and that of the other districts, demonstrating the considerable flow-in of labor from other districts along with the industrialization. After the implementation of Dawei Deep Sea Port and the logistic conveniently link between the port and Eastern Seaboard, local people will lose their works to migrant workers and tend to sell their own land because of the high offer from investors. Local people will be dependent to Multinational Cooperation and the economical stake holders of labor are the labor outside Eastern Seaboard.

In case of Pollution, even if the three parties, administration, habitants and factories, are requested to find solution by forming a agreement. Especially, the authority in charge of anti-pollution is required to disclose the information to affected habitant (or possible to be affected) and to ask understanding of the people on the current situation of pollution and its countermeasures through repeated dialogs. In the case of Map Ta Phut Industrial Complex, the first large petrochemical complex in Thailand, a problem of offensive odor occurred. For this matter, there have been no sufficient experience and no legal regulations. In term of water consumption, Water Resource Development and Water Pipeline Project, such as Nong Pla Lai Reservoir Project, Eastern Seaboard (Dok Krai - Map Ta Phut), Water Pipeline Project, Map Ta Phut - Sattahip Water Pipeline Project, Nong Kho - Laem Chabang Water Pipeline Project, and Nong Pla Lai - Nong Kho Water Pipeline Project. These projects involve the development of water resources for coping with the water demand resulting from the large-scale industrial development of the Eastern Seaboard Area, to avoid water shortage which may impede normal economic activities and social life. According to Dawei Deep Sea Port, the demand of water production will be increased because of the concentration of labor and Industrial Complex more than before.

4.3 Dawei Deep Sea Port

The effect of Dawei Deep Sea Port in term of pollution, Dawei Deep Sea Port is eight in the large scale of Eastern Seaboard. Health and Ecology are the most affected part from Dawei Deep Sea Port because the pollution from industrial areas affect to environment and people in local community without choice and legal enforcement. After the implementation of Dawei Deep Sea Port and Industrial Area by Italian Thai Company, the increasing substance that caused acid rain is approximately 1 million tons per year. The small dust would be increased about 100,000 tons per year. Air Pollution will increase under the mountain of Dawei. Industrial area will spread the metal such as Mercury from coal-fired power plant. The amount of Mercury is around 10,000 kilogram per year. The rain will inflow those pollution to river and food chain that affect to people who consume the local agricultural products, such as, a symptom of neurologic development in children and infant. (Dechrat, 2555: 35)
In term of local society, local people faced with the expropiation from the governmental enforcement. The burmese government expropriates the land of local people. People lost their house and land and most agricultural products from people’s garden. They have to change themselves and turn to be the employee of Multinational Cooperation. The fisheries are a way of life of those Dawei and Thai local people. When the government forces people to settle to other area, it affect to local people’s ways of life. The migrant workers who are affected from Dawei Deep Sea Port can be divided into 2 groups(Southern Society Development Network, 2012: 28):

1. 32,274 People in Dawei Deep Sea Port and The Rung Tha Industrial Area about 21 villages and 3977 families.
2. 1,000 People in 1 village who live near the dam construction area.
3. 5 villages with 1,500 people who live in the road construction area that link Dawei Deep Sea Port to Thai and Myanmar frontier.

Moreover, Dawei Industrial area will consume water quantity more than 2,000 million cubic meters each year. It brought the water conflict of public water resource consumption and affects to local ecological system especially in dry season. More than 1 million cubic meters of sewage will affect to ecological system and water consumption in Tenasserim Range.

5. Summary

For the first in almost a decade, the simultaneous growth of trade, capital flows and foreign investment among ASEAN in the implementation of ASEAN Economic Community turned significantly; there have been many efforts to establish the ASEAN connectivity. The ASEAN connectivity denotes the capabilities of transborder transportation that increase the rapidity with which goods, information, capital and technology move between the region and the world. Dawei Deep Sea Port is the most significant transborder corridor of the ASEAN connectivity. The port is located in the frontier between Myanmar and Thailand which connect to Thailand, Greater Mekong Subregion and China. It will be a center of ASEAN connectivity. Since the port has had a significant influence on both advantages and disadvantages to local Thai communities near the port, there exists the impact of Dawei Deep Sea Port on local Thai communities in case of 1) Pollution; (2) Local society; and (3) Water consumption will induce inflows of population in the region, thereby increasing demand for public sector services in the urban areas. Dawei Deep Sea Port is the most influence project to local community in Dawei Province, Eastern Seaboard and the Strait of Malacca without the public awareness from ASEAN member states.

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Contributing Factor of Military Assistance Toward Police In Handling Social Conflict In Indonesia

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Abstract

Nowadays, social conflict has become a massive threat that tends to increase continuously. Theoretically, social conflict is part of a dynamic chance. Social conflict is associated with socio-cultural changes that are frequently destructive. This is because the actor cannot minimize the impact of conflict. The police have authority in social conflict to enforce the law, discipline the society, and guarantee safety. However, field conditions often require a larger role; this is because social conflict can have an impact on the stability of nation. Military reinforcement to assist the police in social conflict often be considered as a military intervention into police authority. Despite, according to the law in Indonesia, the military is bounded by operation liabilities besides disaster management. The military reinforcement for the police in dealing with social conflict need a strong and binding legal and institution instruments to minimize the abuse of authority. Therefore, the principle of military reinforcement must be based on human rights and democratic civil-military relations. With purposive sampling technique, there have been 68 middle level officers involved in handling conflict. Aside from obedience to procedure and equipment in handling social conflict, humanity is the factor which makes military want to cooperate with police officer.

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Keywords: Military; Police; Democratization; Human Rights; Social Conflict

1. Introduction

Indonesia is the world's most diverse country. The diversity and richness of ethnicity, religion, race, culture, population, and natural resources are the potential resources in realizing a prosperous Indonesia. Nevertheless, this condition may be able to potentially cause adverse impacts if upraise social imbalance, economic disparity, inequality of development, and disharmony among individuals, group, and societies [1]. Negative potential and effect from diversity and richness of Indonesia could be social and natural resources conflict [2].

Social conflict has become increasingly massive trend associated with potential conflicts of increasingly diverse forms. Social conflict became a real threat because the consequences thereof. Socio-anthropologically, social conflict is a part of a dynamic chance because it is associated with socio-cultural changes taking place in society that are often destructive and disintegrative [3]. But social conflict may be positive if a conflict situation increases the internal cohesion of the concerned group, able to create associations and new coalitions and awakened the power balance between the involved groups. The social-conflict paradigm is a theoretical framework based on the view of society as a system characterized by social inequality and social conflict that generate social change [4]. Social conflict is species of social opposition (q.v.) in which (a) the immediate objective consists of the capture of or damage to part or all of one or more of the opposed personalities or groups, or of their property or culture complexes, or of something for which they have developed n attachment, so that they struggle takes the form of attack and defence; or in which (b) the activities of one personality or group unintentionally block the functioning or damage the structure of another personality or group [5].

Coser [6] stated that the conflict is a struggle over values and demands for rare status, power, and resource which intended to neutralize opponents in order to injure or eliminate their opponents. Conflict is seen as a form of prosecution rights, status, power and economic resources. Conflict is intended to restore those elements.

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In the view of radical or reformist, conflicts occur due to changes in the system and the social structure of the community as a result of new entrants seeking to enter the hierarchy, position and existing social systems. The functionalist view that the conflict is not due to the presence of migrants, but because of the complex changes in social institutions devices are no longer able to provide for the basic needs of the society [7]. These changes have consequences struggle for limited resources and the need for open conflict. Functionalist has much in common with Marxist sociological circles which expressly states that the primary function of social institutions is the fulfillment of the basic needs of all human beings. Marx advocated that human activities, including its conflict, are based on economic interests.

Theoretically, the conflict rises essentially based on the levels or hierarchy of needs. These needs can be distinguish in three categories. The first is physiological needs, such as hunger, thirst, rest and sex; the second is safety needs, not only in the physical sense, but also the mental, psychological and intellectual. The third is esteem needs, which is generally reflected in a variety of symbols and status self-actualization needs, in terms of availability of opportunity for someone to develop the potential that contained within himself turned into a real capacity [8]. These needs can be met if people make an effort to meet them.

Eventually, the motivation consists of two factors: hygiene and motivator. There are two parts of needs that are low-level needs (physical, safety, and social) and high-level needs (prestige and self-actualization). The best way to motivate people is to meet the needs of high level. Factors such as policy, corporate administration, and adequate wages in a job will appease employees. If these factors are not sufficient then people will not be satisfied [9]. Relative deprivation theory predicts when a person/ or group has the shortcomings compared with other groups, it will cause negative psychological and behavioral condition. Perceived relative deprivation group has a close relationship with intergroup prejudice. Sometimes other forms of protest against the unfair treatment can be either destructive or instructive [10].

After 1950, military plays a role toward whole security and order. In military perspective, citizens are the subjects to watched. In the new order era there have been many violations against human rights. In entering reformation era, a democratic transition after the new order there have been a major progress in democratic dan human rights value. Army and police force, which before under the same institution, now it’s been separated. The successful in defence and security reformation is basically by properly regulating military institution as the actor in state defence and police as the actor in protecting people (security). As the matter of fact, the involvement of military in social-political life (dwig fungsi) is for the use of authoritarian political system in order to strengthening the ruling government not for the state function. It can be concluded that the two military functions (dwig fungsi) are based on political interest of the ruling government.

Reformation is not only separating the military and police function, but also regulating the relation and authority between the two institutions as their nature. The change of this paradigm needs time to adjust as each institution is still under shades of military-political and militaristic police in the past.

Human rights has become a subject in military and police training curriculum. It is also become a standard operational procedure. Even nowadays, the competition between both side still exist, more over, the division of job in handling conflict has not been arranged clearly. The difference in culture and doctrine between both side considered as the trigger. Indonesia National Army feel more competent in serving security and order. It is important to figure out factors which contribute the military cooperation assistance toward police. Some of the influencing factors to be measured are how military consider humanity value, obedience to procedure, dan equipment readiness.

Humanity values including conflict escalation, how much collateral damage as the result of aggressiveness. In serving human rights, it is important to make a standard of procedure so that they can responsible for the act in handling conflict. The readiness in equipment means whether they have suffice equipment and arms to reduce conflict.

Research question in this study is what factors can affect the strength of the military support, in the management of social conflict by the police?

2. Method

In this study 68 male respondents and field officers were obtained by purposive sampling technique based on the criteria: (1) the respondent should have the experience had helped police in solving social conflicts that occur in the community; (2) the respondent level of education have completed undergraduate education; and (3) capability of in charge as a commander in military command chains.

Hofstede set a minimum number of samples in research on cultural values were 50 respondents (in the official website www.geerthofstede.nl). In addition, Cohen [11] says that the representativeness of the sample is more important than the sample size. This study to explore the context of military organizational culture in
working closely with the Police. The respondents reside in Jakarta and Bandung. Selection of respondents sites in Jakarta and Bandung determined based on the assumption that the study site was the center of military activities and military training centers.

The dependent variable of this research is the capability in handling conflict. Indonesia National Military with their preternary spirit feel having responsibility and ability to provide security for society. The suspected variable which contribute the ability in handling conflict is humanity value (the items are: the number of ongoing victim), the obedience to procedure (as the example in handling conflict as the order from commanding officer), and the assurance of sufficient equipment and gear.

### Table 1. Comparison of methods of handling social conflicts by TNI and Police

<table>
<thead>
<tr>
<th>No.</th>
<th>Dimension</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Military and police methods of dealing with conflict is essentially the same</td>
<td>21,9%</td>
<td>6,5%</td>
<td>71,1%</td>
</tr>
<tr>
<td>2.</td>
<td>TNI has a better method of dealing with conflict than of Police</td>
<td>33,9%</td>
<td>16,1%</td>
<td>49%</td>
</tr>
</tbody>
</table>

### Figure 1. Model analysis of the relationship

In this study, based on the analysis model, formulated the following hypotheses:

- **H0**: There are no influence of the variables X1, X2, and X3 to variable Y
- **H1**: There are influence of variables X1, X2, and X3 to variable Y

### 3. Result and discussion

#### 3.1 Result

Before conducting the analysis, the validity of the test results that showed the Kaiser-Meyer-Olkin Measure (KMO) and Bartlett's Test of Sphericity was 0.614. This shows the data can be considered valid (with results greater than 0.5) and reliability test results of Cronbach's Alpha 0.747 which shows the data can be considered reliable. Though, can be seen in Table 1 (below), many respondents have the perception that the military and police methods are not the same in dealing with conflict, with 71.1% of respondents chose "disagree" in response to the dimensions of the similarity of the military and police methods to resolve conflict.

### 3.2 Multivariate analysis

This study used bivariate correlation analysis with Pearson correlation techniques to determine the relationship between the variables, and multiple regression techniques to determine the influence of variables X1, X2, and X3 to variable Y.

To determine the connectivity of the model analysis, the results of the correlation test showed a relationship between variables X1 with Y variable is 0.445 with a p-value of 0.000, the relationship between the variables X2 with Y
variable is 0.39 with a p-value of 0.009, and the relationship between variable X3 with variable Y is 0.305 with p value of 0.001. This indicates that the variables X1, X2, and X3 have a strong enough relationship to variable Y. Variables greater correlation with the variable Y is the variable X1, which can be assumed to be more influence than the variables X2 and X3 to variable Y.

Statistical analysis using multiple regression analysis showed that coefficient of $R$ of 0.5, which means that there is strong enough influence of of the variables X1, X2, and X3 to variable Y. The coefficient of determination R-square of 0.25, meaning only 25% of the variation that occurs in the variable Y is caused by variables X1, X2, and X3 together as independent variables. While the remaining 75% are caused by other variables not examined. Furthermore, ANOVA test results showed, a large value of the F statistic test results showed the amount of 6.225 and F value from the table (with $1 df = 3$, $df 2 = nk-1 = 62-3-1 = 58$) with a value of 2.78 This shows the value of F count more greater than F table, and with a p value of 0.001, which is smaller than the limit of significance level (0.05), then H0 is rejected and H1 accepted, it can be concluded that: "There are influence of variables X1, X2, and X3 to variable Y". The regression equation based on the value of the coefficient B (the results of the ANOVA test with SPSS software) was $0.864 + 0.293 + 0.172 X1 + 0.162 X2 + X3$.

The analysis showed, the strongest of the military capacity to manage conflict is largely determined by the values held by human resources. The analytical model, shows that the variable X1 has the greatest relationship to variable Y than X2 and X3. However the variables X1, X2, and X3 basically has an influence on the variable Y. This suggests that the ability to resolve social conflicts will be better by emphasizing the value of humanity in conflict resolution. Thus the solution of the conflict may be perceived as a benefit to all parties involved in the conflict. This condition is necessary in achieving human security on conflict situations, in particular for the almost protection of society. In addition, cooperation between the military and police to be important in the resolution of social conflict, where military intervention can be carried out in the presence of joint coordination.

3.3 Discussion

Professionalism of the military and police forces is not only proficient in the use of weapons and trained in their duties, but also must be able to use analytical skills, broad vision, imagination, and judgment [12]. The professionalism of the military can be high if they have special knowledge based on objective standards and professional compensation, relating to the control of all military tasks such as the use of weapons, war tactics strategy; conducted only by the state, standing above all the group, responsible for all society and mainly protect them from physical threats; has a strong sense of unity against corps; own professional ideology; hierarchical institution, cohesive, organism, collective, subordinating and automatic; members recruitment is very limited nature; tendency to interfere in the lives of non-military field is very low [13].

Some theorists say that the professionalism of the organization is one of the conflict resolver. Jackson in Dhakidae [14] states that the conflict among the bottom can be solved by bureaucratic political decisions, the decision was made from the highest echelons of the elite in the center. This consensus rests on the legal authority, with the support of the government, bureaucratic and technocratic. While the society in conflict implement this decision.

In the past, in the New Order era (1967-1998) military’s involvement in socio-political life (dual function) was used to strengthen the government as an authoritarian political system rather than to support the state function. Therefore, it can be said that the dual function essentially is the political interest of the authority. Indonesian defense reform agenda is among others consists of [15]:

- To ensure loyalty of Indonesia military/TNI to follow the state’s political decisions that adhere to the principles of democracy, civil supremacy, human rights and law obedience;
- re-organization the function of defence in the framework of a democratic state, based on legal norms, and prioritizing transparency and accountability;
- the separation of the Indonesia military/TNI and the National Police;
- to improve professionalism of Indonesia military/TNI;
- prohibition of Indonesia military/TNI’s involvement in day-to-day politics;
- elimination of Indonesia military/TNI from business activity;
- judiciary reform; and
- re-arrangement of the institutional relations between the Indonesia military/TNI and the National Police.

Military reform in Indonesia is intended to create a professional military by changing the face of military praetorian army into a professional army that can carry out the functions of the military defense which is quick-respons and reliable against emerging threats [16]. Emerging threats are not only external but also internal, so the military is also legally required to engage in an operation other than war such as disaster management (civic mission), even in assistance to police forces in the context of civil order and security duties [17].
These military operations beside armed forces is done by request and based on the legislation. Conceptually, the theory of military involvement in civil matter is based on respect for human rights, since the threat spectrum that disrupt the country's stability is not only from a military threat but also non-military threats that disrupt public order and security. The human rights as the foundation of social and political entity in military operations other than war became a reference of military operations in conducting assistance task other than war [18].

The consideration to involve the military to help in social conflict resolution of the police often considered as a military intervention in the areas that are not their responsibility. Moreover, the legal basis for the formal internal security duties were the responsibility of Police (Police Act No. 2 of 2002), while the defense is the obligation of military affairs (Millitary Act No. 34 of 2004 and the Defence Act No. 3 of 2002). Two dichotomous separation of duties and powers of the military and the police seemed to make a clear demarcation of functions and responsibilities of the military and police. When in fact, the military and the National Police, according to the 1945 constitution, as a part of state instrument have the right and duty to be involved in the security and defense of the country. Similarly, operationally the military operations is bounded in a duty other than war such as disaster management, etc. (Act No. 34 of 2004 on the TNI Act 10, paragraph 2 of the operations other than war and Act No. 3 of 2002 on Defense Article 10, paragraph 3 ) [19].

Criticism of the military assisting in the resolution of social conflicts over many issues based on fears and traumatic experiences of military involvement in all aspects of life in the past. As an arm of the military instrument of the power makes the military has an absolute power and control for the sake of power and is considered to violate the principle of military [20].

Assisting the military in operations other than war does require strong and binding institutional legal instruments. This is to minimize the abuse of power. Thus assisting the military in operations other than war in principle should be based on democracy, respect for human rights, civil - military relations and democratic. Operationally and legally (Millitary Law No. 34 of 2004 ) the involvement of the military in operations other than war requires a political decision, which is proposed by the President, approved by the House and operationalized by the Military. However, based on Law no. 23 PRP/1959 about the State of Emergency, the authority of the government (central and local) may request military assistance in dealing with problems that are considered dangerous. In the eyes of the law, Act 23 PRP/1959 About the State of Emergency is to be used as justification for the use of military operations other than war, but the legal principle of lex posterior derogat legi priori / principles of interpretation of the law which states that the law that ruling the old law, from the law point of view, ideally placed the TNI law as a juridical foundation in the use of the military other than war [21]. Huntington [22] mentions that the civil-military relationship is characterized by two conditions, namely: subjective civilian control and objective civilian control. Objective civilian control is done by enlarging the civil power compared to military rule. Subjective civilian control is done by increasing the professionalism of the military, but his power is minimized and not eliminate military power. So, it will continue to provide his power, but limited in accordance with the profession.

In the handling of social conflicts, the model of democratic civil-military relations can be run operationally when the approach puts police (part of a civilian) as the main actors, and the military as a supporting actor. Dialectical cooperation in handling these conflicts are not mutually overstep their authority and this is a form of objective civilian control without reducing the role and responsibilities of the actors [23].

4. Conclusion

In social conflict handling, the model of democratic civil-military relations can be run operationally when the approach places police (part of a civilian) as the main actors, and the military as a supporting actor. Dialectical cooperation in handling these conflicts are not mutually overstep their authority and this is a form of objective civilian control without reducing the role and responsibilities [24]. Based on the result of analysis conducted, Aside obedience to procedure and equipment in handling social conflict, humanity is the factor which make military want to cooperate with police officer.

For Indonesian military, the cooperation between Indonesian military and police is focused on military operations other than war. So, there is a clear demarcation of what the responsibilities and duties of Indonesian military and police without interfering each other authority under the Act. Social conflicts that require Indonesia military reinforcement depend on escalation, potential impacts, and the level of the main actors (police) in resolving social conflict. By assigning Military role in handling conflict under the coordination of police officer showing that military work under democracy term. There are rule and the executive power as the control. The factor which motivate military in keeping human security and social conflict is humanity values itself. It means that Indonesian military reinforcement in conflict...
resolution will be examined in this study related to the field condition which necessitates a role of Indonesian military to assist the police in the handling of social conflicts.

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Weaving the future: do we want to witness the end of our civilization?
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Abstract
Societies are evolving from hunter gatherer to post informational societies. Yet, the speed of transformation is getting faster and the duration of development is becoming shorter. For instance, society 1.x, which last for thousand years, evolves from simple group or clan into more structured society with distinct vertical hierarchy. In society 2.x and 3.x, ordered societies are transformed into more complexes, even chaotic, and more globalized in less than 100 years. In society 2.x, the roles of states are questioned since the hierarchy in societies are flattened and replaced with more extensive holarchy. Therefore, anarchisms are becoming more common. Further, in society 3.x, causality cannot be defined clearly. Only future goals can be set up. Holarchy and many worlds theory, originated from the quantum physics, are closely related. Many worlds theory is associated to the path of the society evolution, whether it will go to the right or wrong directions. Based on this relation, this paper discusses the role of holarchy from the many worlds perspective in shaping our futures. In many worlds theory, our future directions will depend on our current choices and on what will be attained in the future. Since societies are now becoming more globalized, flaw in senior holons will be transferred into junior holons. Oppositely, all systems may deteriorate more easily by minor or bad decision in lower (junior) holons. It is also explained that society should follow ecological holarchy rather than developmental holarchy since its senior holon may over-dominate or even repress and alienate the lower level one.

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Keywords: holarchy; holon; many worlds

1. The developmental stage of society
Society 1.x consists of hunter-gatherer, agrarian society, industrial and post industrial society, which last for thousand years. In this society, the network structures are hierarchical and tend to be mechanistic. With the advancement of information technology, society evolved further and becoming knowledge based society (Society 2.x). Horizontal networks (heterarchy) are becoming more complex. In society 3.x, although this society has yet been materialized fully, new knowledge is created but it will obsolete in a very short term [1]. Yet, in the real life, these three societies may coexist, creating superposition situation which may lead to disorder situation [2]. Further, causal thinking and reductionism will no longer effective in society 3.x.

2. Many worlds
The concept of many worlds was originated from the quantum theory. However, its basic idea can be inferred in management and social sciences. Quantum theory began to emerge in the first decade of twentieth century, which affect our perception in physics in particular, and cosmos in general. In the early day of quantum theory, it was considered to reside in the microscopic domain only. The difficulties of merging quantum mechanics into the macroscopic world due to the way we handle our macroscopic systems or classical world where the system are treated as local and isolated from their environment. Although quantum mechanics is still local theory, yet the states that can be generated by local interactions are nonlocal. These states are also known as quantum entanglement, where two systems (which may be separated in space) cannot be broken down into two separated quantum states. Entangled states encapsulated quantum correlation between two systems which often embody entirely new physical properties. Here the subsystem has lost their individuality. In short, quantum entanglement represents a condition where the quantum wholeness is different from the sum of its part [3]. It was also recognized that the prediction of quantum theory for the macroscopic system

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should be transferred into the classical object. It is not possible for the Newton law of motion to describe a quantum interference of macroscopically distinguishable quantum states [4].

![Quantum Entanglement Diagram](image)

Fig. 1. quantum entanglement

Given any initial condition, the universe described by $|\psi\rangle$ evolves into a state that simultaneously contains many alternatives never seen to coexist in our world [5]. In the early day of the quantum physics, the widely accepted explanation of how a single outcome may emerge from the many possible outcomes was the Copenhagen interpretation proposed by Niels Bohr [5]. The key feature for this interpretation is carried out by constructing the dividing line between quantum microscopic world and classical macroscopic world. According to the Copenhagen interpretation, when the world split, one world that the observer are not staying inside will vanished after decoherent process takes place [6]. The most well known example was the Schrodinger’s cat. In this illustration (gedanken experiment), a cat was confined to a box, and inside the box there was a decay unstable atom served as a trigger for the hammer to break a vial containing poison. When the poison was released, it will kill the cat. Here, atom represents microscopic system and it is in two situations, decayed or not decayed, or technically it was in superposition state [3]. Based on the quantum entanglement, it implies that this superposition spreads to the total system containing the vial, hammer, poison and cat, which all are macroscopic in nature. Therefore, we will see two states of superposition, of which one state corresponds to the atom undecayed, the hammer untriggered, vial not hammered, and the cat is alive whilst the other represents the opposites situation, ie. the atom decayed, the hammer triggered, the vial broken, poison released and the cat killed. As long as the box is closed, the state of the cat is in superposition for the observer. When the observer open the box, the superposition will collapse into one of the two component states, the first is the state where the observer stayed in and the other state vanished. The observer here is not considered as the part of macroscopic system interacting with the cat. The role of observer is simply derived from the collapsed [3]. The Copenhagen interpretation demands a priori classical domain by letting just one potential outcome. Yet, it has been recognized recently that macroscopic quantum systems are never been isolated from their environment. Therefore, it should not be expected to follow Schrodinger’s equation which is applicable only for the closed system (reduced systems), such as in classical systems [5].

Many worlds, also known as many universes [5], many histories or meta theory of quantum theory [6] were introduced by Everett in 1957 [7]. Unlike Copenhagen interpretation, many worlds theory treats the process of measurement entirely within the wave mechanics of quantum theory. Everett considered the wave function as a real object, in which all the mathematical entities of physical theory are real, such as in the classical theory (Newtonian physics). Everett predicts that interaction between two (or more) macro systems typically split the system into a superposition. Here, the states of the macro systems are correlated with or dependent upon each other. Each element of the superposition evolves independently of the other elements in the superposition. In this interpretation, superposition evolves forever according to Schrodinger equation. Each time a suitable interaction takes place between any two quantum systems, the wave function splits, develops even more branches. Hence, the many worlds interpretation does not abolished the border between macroscopic and microscopic systems, rather it it pushes the boundary of both [5]. Mathematically, superposition can be defined as

$$|\psi\rangle = \sum_n c_n |\psi_n\rangle$$

(1)

where $c_n$ denotes arbitrary complex coefficient, and each of the components $|\psi_n\rangle$ simultaneously present in the quantum state and often referred to as coherent superposition [3], which are linear.
World (branches of the universal wave function) split when different component of quantum superposition decohere from each other. Decoherence refers to the loss of coherency or absence of interference effects between the elements of superposition. Decoherence also occurs when irreversible events occur. Yet, before the world split, superposition state of the two worlds will co-exist in which some components of the two worlds are mixed [7]. After splitting, worlds almost never fuse in the forward time direction, but often divide [6]. Decoherence does not destroy the superposition, but it simply extend to include the environment and precludes the observation of coherence at the level of the system [3]. If the states of the macro system are becoming correlated or entangled with each other, it is impossible to understand the states in isolation from each other and they must be viewed as one composite system. If one of the systems is an observer and the interaction is an observation, then the effect of the observation is to split the observer into a number of copies, which are unaware with the other systems [4]. When the world split, the other world is still existed and it does not vanish. Despite each other-world also occupies the space and time as we do after the world split, we are not aware with these other worlds. We can only follow one world and the other world cannot be observed [6].

Gell-Mann and Hartle extended the role of decoherence in defining the Everett world and mentioned it as many histories. In many histories, each coarse grained (or classical history) is associated with a unique time ordered sequence of sets of irreversible events. Many histories define a multiply-connected hierarchy of classical histories, where each classical history is a child of any parent history. Child history has only a subset of the child defining irreversible events and parent of any history which has superset of such events. Climbing up from child to parent moves to coarser grained consistent histories, and the top is reached when the history has no defining events. Oppositely, the bottom of the coarse-grained tree terminates with the maximally refined set of decohering histories, ie. the last decoherence position [6].

3. Holon and holarchy

The word “holon” originated from the Greek word, “holos” meaning whole with the suffix “on”, meaning particle or part. Holon is used to represent the basic element of a particular holistic view or holonic view [8]. A holon basically is a whole-part construct, that may be composed of other holons but at the same time becomes a component of higher level holons. Super-holon (or senior holon) is composed of other holon called as sub-holons or junior holon [9][10]. The self organized holon evolves to a higher level of complexity and capability. Therefore, a natural hierarchy is simply an order of increasing wholeness. These sequences of increasing wholeness (increasing holon) will transcend and include its predecessor. When time goes on, today’s wholes are becoming tomorrow parts [11].

Holarchy can be defined as a system of holons at different level. It is a nested hierarchy of holon in which part/whole occurs simultaneously. Each higher level holon includes and transcends its lower level holon and the higher level holon has emergent properties that are not found in its lower level [12]. This system of multiple hierarchies of holons causes mutual influences among them [13]. Since holons are built from the other holons, further development should not leave earlier gain of development, instead a new level (a higher level holon) transcends and includes the previous level of development, transforming rather than discarding early learning.

Holon must have four fundamental features, those are (i) self preservation (agency or autonomy properties) which indicates that holon has ability to maintain its own structure, autonomy and agency. It is a capacity to maintain its own wholeness, otherwise the holon then it simply cease to exist (ii) self adaption (communon), meaning that the holon must be able to adapt and to link-up with other super-ordinate holon. Self adaption creates new properties to emerge for the subsequent inclusion of holon in super-ordinate holon and it also creates new classes of holon. If it fails, the holon simply will erased. Wilber mentioned that balance is needed between autonomy and communion in order to maintain a holon, otherwise the holon can break apart or experiencing self dissolution, which is the regression for the holon, (iii) self transcendence, the holon has its own and emerging qualities which are not found in the holons that it includes. (iv) self dissolution is the ability to break down to its sub-holon, meaning that holon breaks up along the same vertical lines they used to form, the process of subsequent inclusion in upward direction is transformed into a process of subsequent breakup or splitting [8][11]. Self preservation is complement of communion (self adaption) which has horizontal properties whilst the remaining of the last two are vertical in nature, those are self transcendence and self dissolution.

If higher level holon can exert influence over the lower level one, the higher level holon can over-dominate or even repress and alienate the lower level one, which is pathological to the holon. Moreover, there are also a negative vertical drives, which may result in over identification which result in ascending bias such as “too much (influence) from this world (holon)” or “toward the other world” whilst the negative descending will attribute development too much “from the other world” or “toward this world” [14]. If a particular holon is cease to exist, then all of the higher holon are also destroyed because they depend in part on the lower holon for their components [11].
Basically, there are three types of holarchies, i.e., developmental, ecological, and governance holarchies [10]. In this paper, we will focus mainly on the ecological holarchy. Governance holarchy is related to organization theory and multi-agents systems. Therefore, this holarchy is not related to the subject that we discussed. Meanwhile, developmental holarchy, in our discussion, represents a single world which evolved to higher holarchy. Single world may be derived from the Copenhagen interpretation or as a representation of the particular world in many worlds. Finally, ecological holarchy may represent many worlds in a more comprehensive way than developmental holarchy.

4. Weaving the future: do we want to witness the end of our civilization?

According to the quantum theory, when two macro systems interact, the world splits into different new worlds. There are two possible scenarios in the ecological holarchy. First scenario, one holon may evolve into a senior or super-holon, merged with previous super-holon, creating superposition states or it will create a new independent super-holon (based on self-emergence properties) encapsulate other sub-holons which are previously at the same level. Since the new super-holon will preserve its history, it is difficult for the other sub-holons in the ecological holarchy to maintain their structure, autonomy, and agency capacity. In such cases, the higher level holon over-dominates, represses and even alienates the lower level holon, which is pathological to the holon. Further, junior or sub-holons may be diverted to the wrong decision by senior holon due to over-domination, and unfortunately they are unable to alter the superposition and coherence situation. The worst is, they may cease to exist.

In the dawn of society 1.x, holons are local and isolated. Success, failure, and disappearance of the holon did not propagate to the other holons. Yet, by the end of the society 1.x, we witness two world wars followed by cold wars, increasing radicalism, environment degradation, many economic crises and collapse which actually represents the emergence and dissolution of the holon in pathogenic holarchy. This pathogenic holonic formation can be traced back in the era of colonialism, in which the development of super-holon went beyond its traditional border and treated other holons as sub-holons which were assumed as retarded, primitive and obsolete.

Also, by the end of society 1.x and the early day of society 2.x, in terms of many worlds, we actually involved in many major splits at the coarse grain in our civilization history, e.g., Hitler was defeated, or Soviet Union collapsed. Of course, there are other worlds where Hitler won the war, Soviet union won the war in Afghanistan and it did not collapse, which may be better or worse than our world. Suppose that our world is better than Hitler’s world, but we are
aware now that we are heading to the wrong direction. Now, we are waiting our civilization to be split again into more radical view of religion or free fight liberalism (social Darwinism). In terms of environment, we are also waiting whether global warming process can be halted or it may become worst, leading to uninhabitable planet.

Radicalism flourished because their super holon has been destroyed, leaving the sub holon which emerged more than one thousand years ago and now paving the way for creating a new super holon based on this old holon. Moreover, post modernism and flat-world thinking also destroyed previous super-holon, leading to anomie even though the nature actually follows the holonic views, where hierarchy is a must. The roles of states diminish and the roles of individu increases. In society 2.x and 3.x, these super holon flaws may impact globally with catastrophic consequences, that is the end of our civilization.

Based on the previous discussion, it seems that we always forced to follow the developmental holarchy with concentric holon and coherent state for each holon as in the scenario 1. With the advancement of technology and more globalized world, holon growth, creating new super holon. The drawback of the scenario 1 is that any alteration will occur in global scale. Therefore, when the world split, it will be occurred on the coarse grain of the existing senior (super) holon. Here, the flow of our history seems to be linear following a “single path” of the many worlds. The drawback is, we do not have enough choices or alternatives when the world split. The fallacy in the early stage of our history will be propagated in the future. The new emerging super holon may inherit this fallacy except the world/history is split by force (eg. through war). Description of the first scenario is shown in Figure 4.

In the second scenario, a new emerging super-holon is able to develop it self-dissolution capability. In this scenario, each sub holon has capacity to evolve into higher holon, encapsulated in the senior holon, in superposition state or entangled among each other (two holons merging). In the entangled state, two or more sub holons may correlate to each other, even though they are separated by time and space. Many different values and histories of each holon can be preserved by super-holon, creating ecological holarchy which resembles the onion pattern (Figure 5). Therefore, in the fine grain scale of the sub holons, we have many parallel worlds. Splitting in one of these sub holons will not necessarily splitting the coarse grain of the super holon.

In the second scenario, the role of super holon should be defined clearly. For instance, in order to keep our planet inhabitable, we must developed humanosphere (super-holon) which made our planet healthy, has ability to recover their environment degradation, capable to develop social and economic systems which are not widening the gap between the poor and the rich creating more stable growth, etc. These clear goals will keep the coarse grain from splitting prematurely. Description of the second scenario is shown in Figure 6.
5. Conclusion

Our society has involved into society 2.x and ready to move further into society 3.x. Yet, if this transition follows the developmental holarchy as described before, our society is in danger because one holon always tries to dominate and other holons should be suppressed. In this case, the society is uniformed, follows one path of the many worlds in the coarse grain holon (super holon) in which all flaws should be corrected forcefully to split the world in the coarse grain level. However there is no guarantee that the new world is better since it shares the same history with the old one. With the advancement of information technology, the development of holon become shorter and the correction in the coarse grain will be more frequent leading to more chaotic world. Hence, stability can only be maintained by creating dominant holon. If we do not want to witness the end of our civilization, ecological holarchy should be developed in society 2.x, since this approach give respect to other (sub) holon. Therefore, any changes in fine grain (sub) holon will not damage the coarse grain. The coarse grain will split less frequently in ecological holarchy compared with developmental holarchy.

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Fair trade organic coffee production in Southern Lao PDR.—Vulnerability or strength of household coffee farmers

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Abstract

Coffee is one of the world’s most popular beverages and the second largest traded commodity after petroleum. Coffee is cultivated in about 80 countries across the globe and entangles huge business worldwide. Laos, Champasak province has the largest area of land for coffee production which is approximately 1.5 million hectares. In the world coffee market, Laos shares about 0.25 percent of market worldwide. In 1986, the coffee production in Laos was converted from conventional farming to organic farming. This change is linked to the vulnerability of the organic coffee farmers and fair trade. The research is based on combined approaches. Our quantitative household survey of 260 farmers randomly selected in Lao, PDR is complemented by over a 50 qualitative in-depth interviews. The results show the impact on vulnerability household organic coffee farmers and Fair Trade. The income of organic coffee farmers in Laos is changing which depending on the variable of market, labour, land, and governance structure. The results suggest that the umbrella organization for Laos coffee cooperative structure may change that vulnerability to be strength.

Keywords: Coffee; Organic; Laos

1. Introduction

Coffee is one of the most traded economic crops. Coffee is not only the ingredient of popular caffeine beverages, but also create revenue stream for several producing countries (Procafe, 2008; Sipaseuth and Walter, nd). In 2011, world’s coffee production was 8.18 million tons, an increased from previous year 0.58 million tons or 7.6%. This resulted from the expansion of the coffee cultivation in Brazil, Viet Nam, Colombia, and Ethiopia from their suitable climate. Indonesia, the third coffee bean exporter in the world, however, was the only country with 11.2% decreased production according to heavy rains during harvesting season (Food Institute Thailand, 2012 and Wikipedia foundation, 2013).

Coffee consumption in world’s market has been expanded continuously. An increase in coffee trade from 8.0 to 8.3 million tons from 2008 to 2011 is calculated to be 1.2% increase per year. When considering the location of consumers according to import and export countries, the export countries appear to consume with a growing rate when compared with the European Union countries or the United States. Brazil has campaigned its people to drink more coffee and also attempts to improve coffee products to stimulate the market share of the coffee and its related products. In Viet Nam, coffee beverages are very popular among younger generation, leading to a burst of coffee shops in large cities around the country (Food Institute Thailand, 2012). Lao, PDR has its own unique policy in agronomic, i.e. non-pesticide cultivation, organic farming, and natural farming (DOA, 2007). Most coffee farming in Lao, PDR is organic. Among the various agricultural export products, coffee has the most advanced production and marketing system, creating revenue of 27 million dollars USD in 2007 (Nestel, 1995; Philaphone, 2011). Coffee production in 2008 was 0.033 million tons, of which exported for 0.027 million tons was exported. The remainder was for coffee beverage industries within the country (Office of Plan, 2008). The coffee plant was largely cultivated in Bolaven Plateau in Champasak province in the southern region of the country. There are 20,000 families in 250 villages in Lao, PDR who grow coffee. This include private company such as Dao Heuang, Sinouk, Paksong Highland (Lao Coffee Association, 2007& Lao Mountain Coffee, nd).

Lao coffee bean is among the highest quality in the world due to the fact that it is grown in 1,300 m above the sea level, with suitable temperature and humidity. The soil in Bolaven Plateau is volcanic soil with micro-nutrients essential for coffee growing and do not require fertilizer. This in turn allows the low unit cost of coffee production (Cambrony,
Organic coffee farming is more profitable than natural or chemical farming for 20-30% (ICO, 2001). Although all coffee cultivation in Lao, PDR is organic, most lack the official certificate for organic farming (Philaphone, 2011). This results in a moderate price for those farmers as opposed to high price if the farms are certified (Giovannucci and Ponte, 2005; Calo and Wise, 2005; Kuminoff and Wossink, 2010; Lapple, 2010).

Besides the un-certification of the coffee farming, individual farmers and manufacturers are confront with limitation in market and export of the coffee product. For instance, the expense for international standard organic certification is relatively high and inability to enroll the world trade system (Helvetas, 2003). Therefore, this study aim to investigate the situation of the coffee farmers. The research question is dose coffee production leads to better quality of life and family strength or vulnerability?

2. Research Methodology

This study used both qualitative and quantitative data analysis. A questionnaire was distributed to 260 coffee farmers. An interview was performed in 69 farmer families in three villages with the largest, medium and lowest cultivation area. These were Setkhot village, Katouad village, and Luck 11 village in Paksong district, Champasak province. The statistics was analyzed using SPSS for Windows (Statistical Package for the Social Sciences) and content analysis.

3. Study area

Study site in three villages in Paksong district, Champasak province. These were Setkhot village, Katouad village and Luck 11 village (see Figure 1.). Setkhot village was founded in 1973, it has 478 families with total of 2,168 villagers. Katouad village was founded in 1948, it has 175 families with total of 1,017 villagers. Luck 11 village was found in 1973, it has 85 families with total of 459 villagers. The physical setting of the three villages is suitable of coffee plantation. It is rich of natural resources especially the origin of water supply from the forest, resulting in equally distributed rain. The temperature and humidity are optimal for coffee cultivation. As well, the volcanic soil in the area is rich with micro-nutrients essential for coffee growth (The Office Paksong Administrative, 2009). The coffee plant was introduced to Lao, PDR approximately in 1940 by the French in the area of Luck 42 village, Paksong district, Champasak province. There were 5 cultivars, Arabica, Robusta, Riberica, Exelsa, and Xary. Currently, the remaining cultivars are Arabica, Robusta, and Exelsa. The first two are most popular in growing (Ministry of Agriculture and Forestry, 1998). The coffee plantation since then has been spread in the villages in Paksong due to the rich nutrient in the soil. The plantation area increased continuously. The three chosen villages for our study show that 39.9, 23.1, and 18.1% of the farmers own 1.6-3.1 hectares, less than 1.6 hectares, and 4.8-6.3 hectares of the plantation area, respectively.

Table 1. Coffee plantation area of the farmers in three chosen villages

<table>
<thead>
<tr>
<th>Village</th>
<th>&lt;1.6( ha)</th>
<th>1.6-3.1( ha)</th>
<th>3.2-4.7( ha)</th>
<th>4.8-6.3( ha)</th>
<th>6.4-7.9( ha)</th>
<th>&gt;7.9( ha)</th>
<th>Total (ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
<td>No. %</td>
</tr>
<tr>
<td>Setkhot</td>
<td>53 20.4</td>
<td>61 23.4</td>
<td>20 7.7</td>
<td>20 7.7</td>
<td>2 0.8</td>
<td>9 3.4</td>
<td>165 63.4</td>
</tr>
<tr>
<td>Katouad</td>
<td>2 0.8</td>
<td>35 13.4</td>
<td>5 1.9</td>
<td>19 7.3</td>
<td>3 1.2</td>
<td>1 0.4</td>
<td>65 25.0</td>
</tr>
<tr>
<td>Luck 11</td>
<td>5 1.9</td>
<td>8 3.1</td>
<td>7 2.7</td>
<td>8 3.1</td>
<td>0 0</td>
<td>2 0.8</td>
<td>30 11.6</td>
</tr>
<tr>
<td>Total</td>
<td>60 23.1</td>
<td>104 39.9</td>
<td>32 12.3</td>
<td>47 18.1</td>
<td>5 2.0</td>
<td>12 4.6</td>
<td>260 100</td>
</tr>
</tbody>
</table>
4. Result & Discussion

4.1. Coffee production process

The coffee farmer in area was start plantation in 1965, with Arabica, Robusta, and Reberica. During that time there was no seed cultivation for trading. Until 1996 the demand for coffee seed and the market for coffee grew higher therefore the coffee seed was cultivated for selling to the farmers. Conventional plantation process of coffee uses the stick for making hole for young coffee plant and needs only rain water for maintaining the soil humidity. Weed management is required and fertilization is from the wasted seed coat and organic fertilizer (Nilavong, 2010). The seed harvest starts once the coffee seeds are ripe with red or yellow color, or green for raw. The beans are then sun dried and the seed coat was cracked and the beans are ready for trading.

The conventional cultivation method was not efficient due to the rusty disease and fog from low temperature. Until 1975, the decrease in fog from higher temperature led to the re-cultivation of Robusta and Arabica. In 1996, Catimor, the hybrid cultivar invented by the Nurn Soong Seed Research Station, was introduced for its fast harvesting time. At present, the majority of farmers in the villages have a profession in coffee cultivation. The coffee production today is more accurate according to the standard growing process. The process includes using cultivated seeds, organic fertilizers, wasted seed coat, and biological fertilizers. The harvest method is done several rounds and aim for only the ripe seeds to control to quality of the coffee beans. The drying process is also performed according to the standardized protocol (Wannasiri, 2008).

The labour for coffee plantation is from the farmers. The farming families farmers who have a shortage of labour hires workers for the cropping processed which included the soil preparation, plantation, and harvest. Main labour is needed in weed management and seed harvest since the area has rain year-round. Also, almost of the farmers hire workers from outside the area like Savannakhet province, Attapeu province, and Khong district in Champasak province. This is incident similar to those of Mexico, Ethiopia, and Nicaragua (Lim et al., 2007; Valkila, 2009 and Bradford et al., 2011).

4.2. Market and trading of the coffee production

In the past, organic coffee from Lao, PDR has been exported without any organic certified documents and therefore there was no advantage from premium price setting. Eighty per cent of coffee produced in Lao, PDR is exported to European countries like Poland, Germany, Belgium, and Switzerland. The rest is to Japan, USA, and ASEAN countries such as Viet Nam and Singapore (JICA, 2001& Lao Coffee Association, 2008). These import countries use Lao coffee beans with no mentioning of the origin of the beans to blend with other brewed or instant coffees. Therefore, the export of Lao, PDR coffee is it the form of the raw beans with low price comparing with instant...
The biggest coffee export company in Lao, PDR is Dao Heuang Company, sharing 70% of the total export. The rest of the export shares among Sinouk Coffee Company, Jhai Coffee Company, Lao Mountain Coffee Company, and several other small trading companies. The coffee association of Lao, PDR indicated that two years were required for setting up reasonable condition for import and export of organic coffee to international markets. It also planned to export 20,000 tons of organic coffee in 2009, valued 30 million dollars USD. The export coffee is expected to increase in the coming years. Lao, PDR has to produce organic coffee under the European Union standard so it can export to USA and Japan as well (Lao Coffee Association, 2008).

The coffee bean trade in the village is mainly through the local agencies and middle merchants. Some sell directly to the company and require cash. Another trading model is the farmers form a group and trade the coffee beans with the company. The leader of the group receives money and splits it with the members. Coffee beans can be traded in several forms including one-layer peeled or double-layer peeled beans, red beans, and green beans (the farmers receive money before the beans ripe). The most popular trading form is red beans since the farmers can trade fast with no labor or processing needed (Suwanwisolkij, 1999).

It is found that trading coffee beans with middle merchants or company agencies cause price disadvantage to the farmers. Moreover, harvesting and releasing coffee beans in the market at the same time as the other farmers along with the reduced price from the seed humidity lead to buying rejection or suppressed price from the merchants. Some farmers choose to not sell but dry and process the beans for better price.

4.3. The impact from coffee production

Our interviews with the farmers indicate that coffee cultivation result in the stable profession for them. They have more income when growing coffee (Philaphone, 2011). The better economy of each member of the village lead to new house, new car, and commodities. The new road in the village from coffee trading income allow other villagers to conduct business more easily. An example are the food carts. Variety of food from outside upscale their meals and therefore their health. All young members receive basic education and also higher education. When ill, they are able to afford the hospital bills.

Fig 2. Coffee trading model of the farmers
Coffee farmers can sell their product to several channels including middle merchants, trading agencies, quality coffee production center and Lao coffee companies. From our study, we find that farmers who are members of quality coffee production center (cooperative) receive higher price than selling to the other trading channels. The members of the center will process the coffee beans by themselves before direct export. For those who choose middle merchants, agencies, or coffee companies, at the end all the coffee will be collected at the company ready to be exported. Our findings are similar to those of (Vilavong, 2004 and Sisomboun, 2011).

5. Conclusion

The analysis of the income of coffee farmers annually shows that 34 farmers or 13.1% have income less than 1000 dollars USD. One hundred fifty two farmers or 61.9% have income 1000-3900 dollars USD. Thirty nine farmers of 15.1% have income 4000-6900 dollars USD. Thirteen or 5.0% have income 7000-9900 dollars USD. Thirteen or 5.0% have income more than 10000 dollars USD.

Table 2. Annual income of the coffee growing in 3 villages

<table>
<thead>
<tr>
<th>Village</th>
<th>Annual family income from coffee growing (%)</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>&lt;1000 $</td>
<td>1000-3900 $</td>
</tr>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Setkhot</td>
<td>17</td>
<td>6.5</td>
</tr>
<tr>
<td>Katouad</td>
<td>8</td>
<td>3.1</td>
</tr>
<tr>
<td>Luck</td>
<td>9</td>
<td>3.4</td>
</tr>
<tr>
<td>Total</td>
<td>34</td>
<td>13.0</td>
</tr>
</tbody>
</table>

The projection of the world’s coffee trading during 2010-2015 indicates that it will increase for 11.3 billion dollars USD. The freshly brewed coffee beverages will share more than 50% of the total. Instant coffee market increases 23%, while fresh coffee market increases 17%. In addition, the coffee market tends to direct to the premium coffee products including organic coffee (Food Institute, Thailand, 2012). This fact benefit the Lao, PDR’s coffee farmers since the growing location is perfectly suitable for organic coffee farming. We find that the average growing area of each farmer is 1.6-3.1 hectares. A lot of labor is needed for coffee production. Therefore, most farmers sell red beans and have average income 1000-3900 dollars USD, considered as 61.9% of the total farmers. The farmers who join the quality coffee production will sell to the center (cooperative) with about 30% higher price than selling to general merchants. Farmers who sell green beans will receive lowest price. Therefore, it should be suggested that strengthening the quality coffee production center or the coffee cooperative will also strengthen the individual coffee farmers as well. This finding is in agreement with the improvement and development of Latin America and South Africa coffee associations (Bacon, 2005; Lim et al., 2007; Valkila, 2009; Bradford et al., 2011).

6. Recommendation

Coffee farmers in southern Lao, PDR have grown coffee for trading since 1996. This profession has brought wealth to the farmers. However, the farmers need more education in coffee production process and also learn to negotiate in the coffee market system. Our recommendations are as follows:

1) An insurance policy in coffee crop price
2) Implementation and development strategy to strengthen the Laos coffee production cooperative
3) Development and technology transfer about coffee production process to the farmers

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Effect of Gibberellic Acid and Nitrogen on Dry Matter, Harvest Index and Solar Radiation Conversion Efficiency in Peanut at Wetland

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Abstract

Dry matter (DM), harvest index (HI) and solar radiation energy conversion efficiency (CE) with effect of gibberellic acid and nitrogen fertilizer application on peanut in wetland. An experiment was conducted on a gray alluvial soil at Jambegede Research Farm, Indonesian Legume and Tuber Crops Research Institute, Malang, East Java, Indonesia about 335 m above sea level, from July to November 2011. It was arranged in a Split-split Plot Design with three replications. Peanut varieties as main plot consisted of two treatments; they were Kelinci and Kancil varieties. Three gibberellic GA3 variation as sub plot consisted of 0, 50 and 100 mg kg⁻¹. Three nitrogen fertilizer variations as sub-sub plot consisted of 0.23 and 46 N ha⁻¹. The dry matters, harvest index and radiation energy conversion efficiency values were monitored during the growth period of two varieties of peanut. The result indicated that Kelinci varieties have been higher DM and CE values than Kancil variety. The application of gibberellic acid GA3 50 and 100 mg kg⁻¹ not yet increase DM and CE values. Then, that application of N 23 and 46 kg ha⁻¹ values would help to increase both DM and CE values. Harvest index shown even on Kancil variety (0.54) greater than Kelinci variety (0.52).

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Keywords: gibberellic; gray alluvial; nitrogen fertilizer; radiation conversion; wetland

1. Introduction

Economic yield of a crop is function of growth rate, duration of growth, and proportion of growth realized in the grain component [1]. Growth rate depends on the ability of a crop to capture light and the efficiency of conversion of intercepted light into biomass. Efficiency conversion of the sun energy lead us to understand the crop and biomass result, since biomass result depends directly on the competence of plants to utilize the sun energy for accumulation to become biomass. Plants’ internal factor that is really influential to solar energy efficiency is pigment, notably chlorophyll and leaf nitrogen content. Result showed that application of nitrogen increases 10-15% peanut’s leaf chlorophyll contents [2, 3]. In its relationship with efficiency of the sun energy, regulatory substance application can be increased absorption of the sun energy [4] through photosynthesis step-up, so it can increase translocation assimilation. Reported that gibberellic acid GA3 on leaf peanut by concentrates 50 mg kg⁻¹ increases leaf index and seed weight [5]. The objectives of the research are to study the influence variety of peanut, gibberellic acid GA3 and nitrogen fertilizer to dry matter, harvest index, and solar radiation conversion efficiency.

2. Materials and Methods

A field study was conducted at the Jambegede Research Farm of the Indonesian Legume and Tuber Crops Research Institute, Malang, East Java, Indonesia (8°09’49”S, 112°33’22”E) and at an altitude of 335 upper sea levels during the summer cropping season from July until November 2011. The site was wetland with gray alluvial soil type, clay loam in texture and a soil pH 6.2. Using two peanut varieties which comprised of Kelinci
(Valensia type) and Kancil (Spanish type), nitrogen fertilizer, gibberellic acid (GA$_3$), potassium KCl 75 kg.ha$^{-1}$, phosphorus SP-36 100 kg.ha$^{-1}$, insecticide Furadan 3-G, fungicide dithane M-45. Those equipments were utilized a roll-meter, weights, an oven, a Light meter LX 101A, a thermometer, a hygrometer, and a hand sprayer. Treatments were arranged in split-split plot design in randomized complete block with three replications. The varieties were used which consisted of Kelinci (V1) and Kancil (V2) as a main plot, gibberellic acid (GA$_3$) in 0(G$_0$), 50(G$_1$) and 100 mgkg$^{-1}$ (G$_2$). As a sub plot, nitrogen fertilizer in 0(N$_0$), 23 (N$_1$) and 46 (N$_2$) kg N.ha$^{-1}$, respectively.

Soil tillage was carried out using hand tractor, then wetland was divided as three groups and each plot are divided 200 by 500 cm. Distance among groups were 100 cm and distances among plots were 30 cm. Seeds of peanut were sown one seed per hole that made by dibber with distance 20 by 20 cm in rows, which were oriented north to south (N-S). To avoid fly attack in the early growth, Furadan 3-G were given on whole 10 kg.ha- plants. The basal fertilizer was applied at rate KCl 75 kg.ha$^{-1}$ and phosphorus SP-36 100 kg.ha$^{-1}$. The KCl and SP-36 fertilizers were placed in holes before planting. And half of total fertilizer N was applied above whole plant while the implantation was conducted. Remaining fertilizer N was given four weeks after planting. The gibberellic acid (GA$_3$) was applied 30 and 60 days after planting (DAP) with spray on leaf which 50 and 100 mgkg-1 concentration, solution volume sprays 500 liters.ha$^{-1}$. Pest and disease control and other cultural practices were consisted dunging, watering, and mowing performed to optimize growth and development. Mowing and heaped up at the age 14 and 25 DAP. Pest and disease prevention in the effort preventive were done at the age 21 and 40 DAP. The destructive sampling for recording data on different growth parameters by taking four random plants sample at the age 26, 44, 57, 75, and 100 DAP.

Radiation interception was measured above and under plant canopy by using light meter LX 101A model. A series of measurements consisted of 3 times above the canopy and 3 times on surface soil. Radiation interception to be measured among 08.30 and 15.00-hour local time in a site clear weather. Solar radiation data was recorded daily at Karangkates Climate Station, Malang, East Java, Indonesia. The observation consisted of dry matter; harvest index and solar radiation conversion efficiency were calculated for parameters. The plant parts were separated into root, stem, leaf and pod, and dried to a constant weight in an oven at 72 hours and 80°C. The HI was defined by pod weight divided by total plant weight. The CE was measuring change in total DM (gm$^{-2}$) per change in cumulative solar radiation (MJm$^{-2}$) for each harvest interval. All data were statistically treated using the analysis of variance (F test) on significant difference level 5%. If F test computing showed significant, the analysis was continued by least significant different (LSD) Analysis data was conducted with programs STATS version 2.5 and excel program 2007.

3. Results and Discussion

3.1. Dry Matter

Dry matter of Kelinci and Kancil varieties of peanut during growth was pointed out on Figure 1. In the early stage of the plant until age 100 DAP, it responds higher DM of Kancil than Kelinci. Then DM’s pointed after 44 DAP sharp until age 75 DAP, which is ranging 6.23-28.02 g.plant$^{-1}$, and at the age 100 DAP DM Kelinci variety was as big as 25.84 g.plant$^{-1}$ and Kancil 36.04 g.plant$^{-1}$ (Figure 1). Gibberellic’s influence at the age 26 DAP of Kancil variety until points out step Kelinci variety after age 75 DAP decreases. Gibberellic 100 mgkg$^{-1}$ give supreme responses on DM (26.15 g.plant$^{-1}$) and is contemned on without application gibberellic (25.63 g.plant$^{-1}$), but such in common application gibberellic 50 and 100 mgkg$^{-1}$ can’t yet increase DM plants (Figure 2). This situation was appropriate yielding observational [6] Gibberellic’s application 50 mgkg-1 haven’t increased root weight and leaf of peanut. Conducted fertilizer of N 26 kg.ha$^{-1}$ giving highest response on DM 100 DAP (26.96 g.plant$^{-1}$), while was contemned on without application (23.90 g.plant$^{-1}$) (Figure 3). Application fertilizer of N by dosed 23 and 46 kg.ha$^{-1}$ increased DM than with neither. Nitrogen fertilizer has reported that application fertilizer N will increase DM [7].

3.2. Harvest Index

Harvest index measurement resulted to have no interaction among varieties. Harvest index shown even on Kancil variety (0.54) relative the same of kelinci variety (0.52). Here after, for harvest index without and gibberellic GA3 application about (0.54) and nitrogen application (0.55). Combining treatment that higher assigns harvest index value outgrows to be reached on gibberellic acid 100 mgkg$^{-1}$ on kelinci variety (0.58) (Figure 4).
Figure 1. Dry matter accumulation monitored during the growth period of peanut. Linear model of Kelinci and Kancil varieties in a series is $y = 7.025x - 5.171 (R^2 = 0.902)$ and $y = 9.019x - 8.811 (R^2 = 0.992)$.

Figure 2. Effect of gibberellic acid on dry matter. Linear model of gibberellic with dose 50 and 100 mg kg$^{-1}$ in a series is $y = 7.016x - 4.952 (R^2 = 0.891)$, $y = 6.991x - 5.167 (R^2 = 0.916)$, and $y = 7.061x - 4.861 (R^2 = 0.906)$.

Figure 3. Effect of nitrogen on dry matter. Linear model of nitrogen fertilizer with dose N: 0, 23, 46 kg ha$^{-1}$ in a series is $y = 6.349x - 5.391 (R^2 = 0.952)$, $y = 7.222x - 4.654 (R^2 = 0.895)$, and $y = 7.499x - 4.939 (R^2 = 0.857)$. 
3.3. Solar Radiation Conversion Efficiency

Solar radiation intensity measurement plant growth no presented. It shows maximum was 567.1, Minimum 244.8 and mean 403.22 cal.cm\(^{-2}\).day\(^{-1}\) during growth (not shown). Conversion efficiency of solar radiation energy variety of Kelinci and Kancil up to growth was pointed out on Figure 5. In The early plant until age 100 DAP responds more CE for Kancil as compared to Kelinci. Then CE pointed after 44 DAP sharper until age 75 DAP ranging 0.12-1.23%, and at the age 100 DAP that CE variety of Kelinci 0.91% as big as and Kancil 0.93% (Figure 5)[8]. Finding different CE between variety on ground breaking pod inlay. That also supported research Collino et al. [7] Gibberellic's influence at the age 26 DAP until 75 DAP points out step-ups, afterwards decrease until 100 DAP. Application gibberellic 100 mgkg\(^{-1}\) gives to respond the same efficient on CE (0.92%) as compared to application gibberellic (0.91%) (Figure 6). Nitrogen treatment 46 kg.ha\(^{-1}\) giving highest response on CE 100 DAP (0.96%), while was conterned on without application (0.85%) (Figure 7). Reported that application fertilizer N will increase CE's values [9]. Based on this fact was sighted from solar radiation energy aspect, apparently pholotosynthesis is a process that is inefficient. Since just ranging 0.85 until 0.96% of falling energy gets to be changed chemical energy in carbohydrate. The CE relative lower was reported by [10], energy loss is caused biochemistry process to go to vegetative parts and generative plants up to growth. In the early growth to form leaf with obstetric protein which higher than plant other part. Solar radiation intensity increased with photosynthesis rate until on optimal intensity. After intensity step-up optimal won't increase photosynthesis rate speed again.

Figure 5. Conversion efficiency monitored during the growth period of peanut. Linier model of Kelinci and Kancil varieties in a series is \(y = -0.123x^2 + 0.978x - 0.83(R^2 = 0.905)\) and \(y = -0.121x^2 + 0.960x - 0.774 (R^2 = 0.922)\).
Figure 6. Effect of gibberellic on conversion efficiency. Linear model of gibberellic with dose 50 and 100 mg kg$^{-1}$ in a series is $y = -0.114x^2 + 0.919x - 0.764$ ($R^2 = 0.912$) and $y = -0.119x^2 + 0.948x - 0.77$ ($R^2 = 0.926$).

Figure 7. Effect of nitrogen on conversion efficiency. Linear model of nitrogen fertilizer with dose $N$: 0, 23 and 46 kg ha$^{-1}$ in a series is $y = -0.072x^2 + 0.643x - 0.508$ ($R^2 = 0.940$), $y = -0.134x^2 + 1.047x - 0.864$ ($R^2 = 0.918$), and $y = -0.149x^2 + 1.146x - 0.972$ ($R^2 = 0.890$).

4. Conclusion

The Kelinci variety has shown higher DM and CE values than Kancil variety. The application of GA$_3$ 50 and 100 mg kg$^{-1}$ does not yet increase DM and CE values. Then, that application of $N$ 23 kg ha$^{-1}$ value would help to increase both DM and CE values. Harvest index shown even on Kancil variety (0.54) is greater than kelinci (0.52).

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Analysis of Ear Mushroom (Auricularia sp.) Cultivation using The Cutting Waste of Forest Tree Species

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Abstract

Demand for ear mushroom (Auricularia sp.) in Indonesia increases steadily from year to year. Mushroom production in Indonesia is mainly using sawdust from sawmills as growth media; however, the availability is limited. Alternative solutions are needed to solve this problem and to increase mushroom production, especially ear mushroom, in Indonesia. In fact, the mushroom grows naturally on dead stems or branches of trees. Therefore, the purpose of this research is to study the possibility to grow ear mushroom directly on dead stems of cutting waste as an alternative for sawdust. This research has been conducted from December 2012 until July 2013 at SEAMEO BIOTROP, Bogor, Indonesia. Twigs and stems of 3 species of trees, namely teak (Tectona grandis), jabon (Anthocephalus cadamba) and sengon (Falcataria moluccana) were used in the research. Tree stems of teak, jabon, and sengon with 10-15 cm in diameter were chosen for this research. The tree stems were cut into 20 cm long pieces and then 20 holes with diameters of 1.3 cm were evenly drilled into the stems. As for the tree twigs, the twigs of teak, jabon and sengon were cut into 20 cm long pieces, then bound together to form an overall diameter of 10-15 cm. All stems and twigs were soaked in the water for 7 days. Before being inoculated with mycelia ear mushroom, the stems and twigs were pasteurized at temperature 90-100°C for 12 hours. As much as 60 gram of ear mushroom mycelia were inoculated into stem and twigs in the laminar airflow and then were shaken, so that the ear mushroom mycelia evenly covered the growth media. The inoculated stems and twigs were then incubated for 1.5 month or until mycelia are fully grown. After that, the media were moved from incubator to a mushroom growing hut to produce fruit bodies of ear mushroom. The temperature was controlled between 22-30°C while the humidity was controlled between 80-90%. Harvesting was started when the ear mushroom showed shrinkage and thinning at the edges of the mushroom. These are the signs of the optimum growth of ear mushroom. This research was conducted with Randomized Complete Design (RCD) with 8 treatments of mushroom growth media, i.e. JT K (teak stem), JT R (teak twig), SG K (sengon stem), SG R (sengon twig), JB K (jabon stem), JB R (Jabon twig), C S (sawdust without nutrition) and BI O (sawdust with nutrition). Each treatment was replicated 5 times, with three samples at each replication. Variables observed were fresh weight of ear mushroom, amount of ear mushroom harvested, diameter of ear mushroom, and time of initial harvest. The three tree species (teak, jabon and sengon) are potential to be used as growth media to culture ear mushroom.

Keywords: ear mushroom, stems, twigs, jabon, sengon, teak, sawdust

1. Introduction

Edible mushrooms are a good source of protein that have high economic value. However, their potency has not been optimally utilized. Mushrooms could be used in agriculture, forestry, food, medicine industries and the environment. Mushrooms grow wild in nature on tree trunks, either rotting or living tree trunk. One of those mushrooms is ear mushroom (Auricularia sp), which is naturally grown on tree trunk or wood wastes.

Research on ear mushroom in Indonesia has been started in the 1970s. The mushroom species could grow in cold to hot climate, and in wide temperature range from 12 to 35°C. Optimum temperature to grow ear mushroom, however, is between 20-30°C, with ideal humidity of 80-90%

Recently, demand for ear mushroom has increased, which is met by importing dried or powdered ear mushroom. In March 2010, import of dried ear mushroom reached 19.33 tones with the highest import occurred at the beginning of 2010 reaching 58,227 tones per month. Due to the high demand for ear mushroom, it is necessary to determine alternatives methods to culture ear mushroom. That is currently using sawdust as growth media.

Sawdust availability is limited to several areas only due to high demand for other uses apart from mushroom growth media. The use of tree cutting waste seems to be promising as mushroom growth media since the mushroom...
**species naturally grow on dead steams. 80% of populations in Indonesia live in villages nearby forests, which use tree-cutting waste as firewood. Therefore the use of tree cutting waste as mushroom growth media is reasonable. Among prime wood species grown in Indonesia are teak (*Tectona grandis*), jabon (*An thocephalus cadamba*), and sengon (*Falcataria moluccana*). This research used the stems and twigs of those wood species as mushroom growth media.**

2. **Materials and methods**

2.1 **Materials**

This research was conducted from December 2012 until July 2013 at SEAMEO BIOTROP and the laboratory of Forest Pathology the Faculty of Forestry, Bogor Agricultural University. Materials used in this research were stem and twigs of teak, jabon, and sengon from bogor, ear mushroom mycelia, plastic sheet, and cotton. Equipments used in this research were hygrometer, laminar airflow, autoclave, measuring unit (ruler), drum, and wood driller.

2.2 **Methods**

Tree stems of teak, jabon, and sengon with 10 -15 cm diameters were chosen for this research. The tree stems were cut into 20 cm long pieces, and then 20 holes with diameters of 1.3 cm were evenly drilled. As for the twigs, tree twigs of teak, jabon, and sengon were cut into 20 cm long pieces, and then bound together to form a 10-15 cm of diameter. All stems and twigs were soaked in water for 7 days to decrize wood extractive compounds then were used for ear mushroom growth media. Before being inoculated with mushroom mycelia, the stems and twigs were pasteurized with autoclave for 12 hours at temperature of 90-100°C.

The inoculation process was conducted in laminar airflow. As much as 100 g of ear mushroom mycelia were inoculated into each stem and bunch of twigs and then were shaken, so that the inoculums evenly covered the growth media. The inoculated stems and twigs were then incubated for 1.5 month or until mycelia are fully-grown. After 1.5 month or when mycelia are fully grown, the media were moved from the incubator to a mushroom hut to stimulate the production of fruit bodies of the ear mushroom. The temperature was controlled between 22-30°C while the humidity was controlled between 80-90%. Harvesting was started when the ear mushroom showed shrinkage and thinning at the edges of the mushroom fruit bodies. These are the signs of the optimum growth of ear mushroom.

This research was conducted in a Complete Randomized Design (CRD) with 8 treatments of mushroom growth media, i.e. JT K (teak stem), JT R (teak twig), SG K (sengon stem), SG R (sengon twig), JB K (jabon stem), JB R (jabon twig), BI O (sawdust mix wood from saw mill additional amount of 15% of rice husks, 2% of mizzen flour and 1% of gypsum and C S (sawdust only). Each treatment was replicated 5 times with three samples at each replication. Variables observed were fresh weight of ear mushroom, amount of ear mushroom harvested, diameter of ear mushroom, and time to initial harvest.

3. **Result and Discussion**

The analysis of variance of this research showed that the growth media had significant effect (P<0.001) towards the fresh weight of fruit bodies of the ear mushroom, the number of fruit bodies of ear mushroom, diameter of ear mushroom and the time of initial harvest. Ear mushroom is easily grown on tree trunks, stems, or twigs.

<table>
<thead>
<tr>
<th>Variables observed</th>
<th>Degree of significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fresh weight of ear mushroom fruit bodies</td>
<td>12.91**</td>
</tr>
<tr>
<td>Amount of ear mushroom fruit bodies</td>
<td>15.27**</td>
</tr>
<tr>
<td>Diameter of ear mushroom fruit bodies</td>
<td>13.89**</td>
</tr>
<tr>
<td>Time to initial harvest</td>
<td>39.60**</td>
</tr>
</tbody>
</table>

Notes: ** Indicates that the variables observed were significant at P<0.001
Table 2. Effect of growth media towards growth and production of ear mushroom

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Fresh weight of ear mushroom (gram)</th>
<th>Amount of ear mushroom (ind)</th>
<th>Diameter of ear mushroom (cm)</th>
<th>Time to initial harvest (days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>BI O</td>
<td>106.53 a</td>
<td>13.70 c</td>
<td>5.26 ab</td>
<td>27.30 b</td>
</tr>
<tr>
<td>C S</td>
<td>51.70 bc</td>
<td>7.53 d</td>
<td>5.06 b</td>
<td>40.26 b</td>
</tr>
<tr>
<td>SG K</td>
<td>50.40 bc</td>
<td>22.06 b</td>
<td>3.82 de</td>
<td>37.06 b</td>
</tr>
<tr>
<td>SG R</td>
<td>30.73 cd</td>
<td>14.26 c</td>
<td>3.89 de</td>
<td>37.06 b</td>
</tr>
<tr>
<td>JB K</td>
<td>87.95 a</td>
<td>27.33 ab</td>
<td>4.37 bc</td>
<td>38.66 b</td>
</tr>
<tr>
<td>JB R</td>
<td>59.60 b</td>
<td>29.13 a</td>
<td>3.52 e</td>
<td>35.66 b</td>
</tr>
<tr>
<td>JT K</td>
<td>53.11 bc</td>
<td>15.30 c</td>
<td>5.75 a</td>
<td>97.73 a</td>
</tr>
<tr>
<td>JT R</td>
<td>21.38 d</td>
<td>11.00 cd</td>
<td>4.64 bc</td>
<td>88.26 a</td>
</tr>
</tbody>
</table>

Notes: numbers followed by different letters showed significantly different effect at P<0.001

Based on the Duncan Multiple Range Test, stems and twigs of 3 species tree (teak, jabon and sengon) showed potential to be used as growth media to culture ear mushroom: fresh weight (21.38-106.53 gram), amount of ear mushroom about 7.53-29.25 ind, diameter about 3.52-5.75 cm and time to initial harvest 27.30-97.73 days. The success of ear mushroom cultivation is determined by quality of growth media, cultivation process, environmental factor and quality of ear mushroom mycelia. The Temperature and humidity in a mushroom hut to stimulate the production of fruit bodies of the ear mushroom had been recorded 26.8-31°C temperature and humidity of 75-90%. The optimum temperature to grow ear mushroom, however, is between 20-30°C, with ideal humidity of 80-90%.

From three species of tree used, they had different specific gravity. Jabon wood had the average of specific gravity about 0.42 (0.29-0.56) with strength class III-IV, the chemical component of wood consists of cellulose 52.4%, lignin 25.4% and pentose 16.2%. Sengon wood had the average of specific gravity about 0.33 (0.24-0.49) with strength class IV-V, the chemical component of wood consists of cellulose 49.4% lignin 26.8% and pentose 15.6%. Teak wood had the average of specific gravity about 0.60 (0.46-0.67) with strength class II, the chemical component of wood consists of cellulose 47.5%, lignin 29.9% and pentose 14.4%³. Mushroom is an organism that has no chlorophyll, so it requires organic substances such as cellulose, starch, lignin and glucose. The formation of the fruit body cells that may not be separated from the existence of matter content that is required by fungi in the growing medium. From the data the results obtained on the three types of plants have Jabon Fresh weight of ear mushroom and ear mushroom amount of higher. In addition, the emergence of the pinhead can be caused by the activity of mycelium growth in the media, which is influenced by environmental factors such as temperature, humidity, moisture and light.

Diameter of ear mushroom harvested from teak is significantly higher compared to other treatments. Teak is a growing medium with a type of wood that has a high density. Ear mushroom harvested from hardwood growth media has better quality than those harvested from softwood growth media⁶. Teakwood is a type of wood that has tectoquinon extractive substances that are inhibiting the growth of fungi. This can be seen in the types of teak wood that has a longer harvest time compared to other treatments.

In comparison to twig, ear mushrooms on lower branches of the stem (Jabon, Teak, Sengon trees) were very good considering the weight, amount and diameter.

Based on the weight of mushroom of jabon, the mushroom growth is heavier on stem, but in terms of number of mushroom growth is higher in twigs with smaller diameter. The thickness of mushroom is affected by amount of mushroom growth. The growth of mushroom is affected by a nutrition absorption by the mushroom⁷. Stems generally have a higher density than wood branch.

### 4. Conclusion

Three tree species (teak, jabon and sengon) show potential to be used as growth media to culture ear mushroom. Within three types of wood, jabon is the best and followed by teak and sengon. In terms of quality or diameter of ear mushroom, teak is the best, but it has a long harvest time. The study shows that the stem is more suitable as ear mushroom media than the twigs.
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References

Spatio-Temporal Analysis of Sacred Groves in the Raigad District, Maharashtra State, India

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Abstract

1. Introduction

Sacred groves are the unique relic landscapes consisting rare flora and fauna. These are the patches of primeval vegetation which are protected by local communities and are the living examples of conservation of forests. They are landscapes with typical geographical features and are protected on the basis of religious practices and faith. People of the village are not allowed access to certain parts or entire groves and hence the vegetation is left untouched. These taboos in a way served as a means to conserve forest resources. This primate vegetation plays an important role in the ecosystem and aesthetic services to the local communities. Unfortunately at present sacred groves are facing destruction, degradation and desecration due to rapid urbanisation and developmental interventions. The expansion of market economy in the post globalization era places heavy demand for forest resources. The decline of sacred groves can also be attributed to the changes in the social values and religious beliefs as a result of modernisation. Shrinkage of sacred groves due to such encroachments is a serious matter of concern and there is need of concrete steps towards protection of sacred groves.

2. Objectives

The present study is devised with an objective of understanding the problems of sacred groves. Thus the study attempts to know the current status of the sacred grove in the Raigad district of the Maharashtra state in India. The Raigad district geographically lies within the Konkan region, which is bound by the Western Ghats towards the east and the Arabian Sea towards the west. Due to its unique geographical setting, the Konkan region receives the heavy rainfall and thus has deciduous to semi-evergreen forest. Here there are number of community managed sacred groves. As this district is located in proximity to the Mumbai city and Navi Mumbai it is facing impacts of the urban development. Furthermore this district is emerging as a big centre of attraction for MNCs, SEZs, international airport, ports, thermal power stations and other developers.

3. Methodology

The spatio-temporal analysis of the sacred groves in the Raigad district is carried out with the help of Survey of India topo-sheets, satellite imageries and is supported by field visits. One of the objectives of this paper is also to review existing legislative and judicial instruments regarding conservation of sacred groves and its local execution. The study also aims to understand the opinions of the local community about the sacred groves and their role in protecting these forest reserves. For the purpose, open ended individual and group interviews will be conducted.

4. Conclusion

This paper is expected to throw light on the implications of human onslaught on these ecologically sensitive habitats and also explore the impact of the shrinkage and degradation of these sacred groves on the local communities. Most importantly, this study also would bring out the relationship between the level of awareness and perceptions of the local communities and conservation of their own forest resources.

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1. Introduction

Due to rapid expansion of cities there are conflicting claims between the rural and urban forces. There is a competition for land and other natural resources. The fringe zone is characterised by mixed land uses, where rural activities and mode of life are in rapid retreat (Thomas, 1990). There has been an increasing concern regarding degradation of land resources. One of such land resource for which concerns are expressed is sacred groves. Large amount of research has been carried out and concern has been expressed by scholars due to the significance of this indigenous ancient practice of conserving forests. For example, Gadgil and Vartak (1975) have carried out the ethno-botanical study of sacred groves in Maharashtra and North Kanara. Enormous amount of scientific study has been carried out on sacred groves in India which has established the presence of the practice of the community forest conservation for example, Sharma and Kulkarni (1980 & 1983) Vartak and Kumbhokar (1984), Vartak et al. (1986), Buch (1987), Nair (1987), Nipounage (1988), Amrithalingam (1998), Tiwari et al. (1998), Deshmukh et el (1998) Rao (2002) etc. The importance of sacred groves from socio-cultural and religious aspect was carried out by Bhasin (1999), Raman and Palavaryan (1997) reported in their study that there was an ancient Tamil practice of worshipping trees, the practice that exists even today. The study by Ramchandran (1993) reported 240 groves in Kerala and highlights that these contain rare and endangered species of plants which need immediate protection. The Indira Gandhi Rashtriya Manava Sangrahalya (IGRMS), Bhopal, Madhya Pradesh has reported the existence of more than 100,000 sacred groves in India.

2. Meaning of Sacred Groves

The word ‘Sacred’ means considered to be holy or connected with a god and the word ‘Grove’ means a small area of land with trees. Thus by combining these two words one can say sacred groves is ‘A small area of land of trees grown on it and that are considered to be holy by the local human community’. Sacred groves are the examples of the tradition of worshipping nature. The institution of sacred groves dates back to the pre-agrarian hunting gathering societies and is also known to be existed in many parts of India. Rules are made by communities for their protection. In some cases there are punishments also for the violations of these rules. Rules vary from grove to grove however, often prohibit the felling of trees and the killing of animals, but do allow for the collection of firewood, fodder, and medicinal plants by local people (Hughes and Chandran, 1998). Sacred groves traditionally protected small patches of vegetation types and managed by the local communities through a wide range of management practices, (Deshmukh et el, 1998). In Maharashtra state also large number of sacred groves is found in tribal as well as nontribal areas. Sacred groves are known by different names in Maharashtra as they are called Devrai or Devrahati in the western part and in the eastern part they are known as Degudi. The study of Gadgil and Vartak recorded 233 sacred groves in Thane, Raigad, Kolhapur, Jalgaon, Pune and Satara districts. A study by Bombay Natural History Society shows existence of about 1600 SGs in Maharashtra (Deshmukh et al., 1998). Mahadev Koli tribe in the Western Ghats of Maharashtra also has the tradition of sacred groves (Roy Burman, 1992).

3. Ecological Importance of Sacred Groves

Sacred natural sites are indicative of the health of the ecosystem and biodiversity conservation that enjoys support from local people. In addition cultural and spiritual significance to local people, such sites protect habitats and species that are excluded from formal systems of protected area networks. The sacred groves have evolved as reservoirs of biodiversity. Many Sacred groves constitute pristine vegetation, and are particularly rich in trees and associated groups of organisms like epiphytes, amphibians, reptiles, birds, butterflies, etc. Many Sacred groves hold water resources in the form of springs, ponds, lakes, streams or rivers. The vegetation of the grove itself retains water, soaking it up like a sponge during wet periods and releasing it slowly in times of drought. These are last refuge for endemic and endangered plant and animal species. These are storehouses of medicinal plants valuable to village communities as well as modern pharmacopoeia. Sacred groves contain relatives of crop species that can help to improve cultivated varieties. Sacred groves help in keeping the water cycle in local areas and provide irrigation for agriculture in drier climates.

4. Threats to Sacred Groves

Tropical landscapes are being transformed by globalising economic forces at an unprecedented rate, through forest clearance, mining, industrial development and urbanisation (World watch Institute 2006, State of India's environment, Citizen's Report, 2008). Sacred groves are destroyed when cities grow, railways, highways and pipelines are laid. Due to modernisation local traditions are weakening under the impact of urban culture. Modern education system fails to instil respect for local traditions. As a result, the institution of sacred groves is losing its cultural importance for the younger generation. In the past few years, there has been an increase in concern for the degradation of these community
based institutions of conserving forests. Thus it was felt necessary to identify the factors which led to these degradations and to investigate the current threats to these ecosystems and to find out actions for sacred grove restoration.

5. Objectives:

The present study is devised with the following objectives:

- To understand problems/threats to sacred groves in the study area.
- To find out the opinions of the local community about protection of sacred groves in the study area.
- To know role of urbanisation in shrinking size of sacred groves.
- To explore the status of the sacred groves in the study area.

6. Study Area:

Raigad extends from 17°51’N to 19°8’N latitude and 72°51’ E to 73°40’longitude. The total geographical area of the district is 7152 kms² and forest occupies about 41 % (FSI, 2011). The Raigad district is emerging as a hub of attraction for MNCs, developers, and is well positioned to be the next big growth centre being in proximity to Mumbai. The topography is mainly hilly in the regions of the Sahyadri Ranges and sandy beaches near the Arabian Sea. The Sahyadri stretches like a huge wall from north to south of the district having alternate valleys and hill ridges. District has 15 tehsils and has 26 census towns, 11 statutory towns and 1999 villages in year 2011. Many small ports are located here along with Jawarlal Nehru Port Trust as an international port. Roha, Patalganga, Mahad, Rasayani, Taloja and Nagothane are the main industrial centres developed in Raigad district. Matheran (eco sensitive zone), Karnala and Phansad are the protected areas in this district. As per 2011 census district had a total population of 26,35,394, whereof 24.22 % live in urban areas mainly in tahsils adjutant to the city Mumbai.

7. Sacred groves in Raigad district:

In Raigad district small sacred groves can be seen around villages on privately owned land. Such land historically belonged to the rulers/king. Sacred groves were seen in many villages as abundant land was available for other uses. Following are the characteristics of sacred groves in the Raigad district:

- At present most of the sacred groves are owned by state Revenue Department, and district collector has rights to take decisions over their uses.
- In some cases ownership is with local temple trust or with Gram Panchayat.
- Management, religious functions, supervisions and all decisions related to sacred groves are taken by a group of village elders.
- The size ranges from 0.1 hectares to about 125 hectares.
- Most of the sacred groves are near or around temples.
- Some groves are near burial grounds or crematoriums and some are abode of ghosts.
In protection of sacred groves legal system of Forest Department is not used because the rules of management are based on cultural and social ethos.

At many places resources of sacred grove except water are not used by people.

In spite it is community property land is generally not used for grazing.

Table – Scared Groves in Raigad

<table>
<thead>
<tr>
<th>Sr. No</th>
<th>Village</th>
<th>Tahsil</th>
<th>Area in Ha</th>
<th>Deity</th>
<th>Population*</th>
</tr>
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<tr>
<td>1</td>
<td>Adi Thakur</td>
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<td>Mhasala</td>
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<td>Alibag</td>
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<td>Ramdhameshwar</td>
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<td>Uran</td>
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<td>Vardanidevi</td>
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<td>Bhai Devi</td>
<td>889</td>
</tr>
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<td>1.01</td>
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<td>Bhai Devi</td>
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<td>Mangaon</td>
<td>1.01</td>
<td>Gamdevi</td>
<td>976</td>
</tr>
</tbody>
</table>

Source: BNHS 1999

* Population Census 2001

8. Sample Case Study of Kankeshwar Sacred Groves:

Kankeshwar is the largest grove in the Raigad and it has been selected for a sample study. Latitudinal and longitudinal location of this place is around 18°44'33"N and 72°55'6"E. Main temple is a Hoysala style structure built by Raja Ramdeorai Yadav in 1764. The height of the Shiv temple is 54 ft. Kanakeshwar, group of temples are located on a hill range near the sea coast. This hill is almost 386 mts high and one has to climb 700 - 750 steps to reach the temple. The special attraction is an ancient sweet water tank enclosed in traditional structure of black stone. Every year, there is a fair on Kartik Poornima (Generaly in November) in Hindu calendar. About 100 to 200 people daily visit the hill temple. Visits are more on the holidays and during vacations. During the time of annual fair in month of November more than one lac people visits the temple. During this period there is maximum damage to scared groves.
8.1. Analysis of the closed ended questions:

Out of the total 75 respondents 82% are males and 18% are females. Majority of the respondents belong to 18 to 59 age group.

51% respondents are farmers followed by businessmen which are 24%. 20% respondents are service men working in the hotels or government. 5% respondents belong to teaching, the co-relation between the occupation and their responses regarding the denudation of the forests could not be identified. When asked about whether they know about the presence of the sacred groove in their village, 76% respondents said that they were aware that there exists a sacred groove atop. They knew about the concept of the sacred grove. 17% of them knew that there is forest atop but they said that they are not aware of the sacred grove.

An attempt was made to find out the reasons for visiting the groove and its possible impact on the forest degradation. 36% of villagers visit the groove on the occasions of religious festival. 28% of them visit for collecting fuel wood which is also noteworthy. 14% of them take their animals for grazing in the forest areas. 22% of them visit for various other reasons like collecting various forest products, fetching water, visiting temple etc. Villagers were asked about their opinion regarding the importance of the grove to the village. 74% of them responded that the grove has economic importance and 26% responded that the grove has ecological importance.
Respondents were also asked about the present status of the forest and 77% of them said that they are not happy about the present status of the grove and the forest is rapidly degrading in recent years. 23% of them said that there is no problem to the grove and there is not much change in the status of the forest. These are probably the government officials. Majority of the respondents i.e. 73% of them felt that the grove should be protected and the remaining 27% felt that the place should be made available for the various facilities at the temple place and infrastructure need to be improved as the place is increasingly becoming important from tourism point of view.

Communication with villagers and observation shows that the forest at Kankeshwar is extremely threatened due to the impact of urbanization the indigenous culture is declining and the sanctity of the grove is being eroded. There is a clear indication that the threats to the sites are mostly anthropogenic and include agricultural expansion and the clearance of vegetation for setting up homesteads or through the extraction of forest products and most notable are the stone quarries which are causing severe damage to the forests. The knowledge of the ecosystem and its benefits is low among the people. The temple trust which is at present managing the sacred grove is responsible for expanding their activities on forest land. They were not even aware of the threats to the sacred grove and possible fallout. An attempt was made to make them aware and they agreed to look into the matter. Some of the respondents were reluctant to accept the very fact that the forest is degrading. Even the Government officials did not agree with the degraded status of the forest. Locals stated claiming part of grove as their owned property and stated putting fence. Commercial plantations of mangoes also observed inside the grove. Interaction among the locals revealed that there has been a growing knowledge gap between generations and there is declining interest in conserving them as sacred spaces. The conflict of modern views and traditional beliefs has a negative impact on the sites. Main reason of degradation of this grove is conflict of ownership rights between temple trust and forest department. The forest Department is claiming the ownership of grove under the section no. 35 of the forest act of India. The matter is under great controversy and it is in the court litigation. As the ownership is yet to establish, no one takes responsibly of the grove protection and village people takes advantage of it. Overuses of forest resources like grazing and fuel wood collection are the major threats. Some of the new permanent structures are emerging near the temple that includes a tank, mobile tower, houses, dharmashala etc.
Forest fires during December to May are quite common phenomenon in this grove. Some of the respondents also revealed that forest fires are purposefully lit by the people for encroachments. Another major threat which researchers sensed is the growth of tourism and related activities. On religious occasions large number of tourists visits this place and the forest bears the brunt of this large influx of tourists. Natives of the place, tribal have also cut trees for domestic purpose. Though tribal families have been provided gas cylinders they cannot afford it and they cut wood from the grove which is freely available. As per government’s policy of Joint Forest Management tribals are allowed to use resources from the forest. These tribals also sell wood illegally in the markets or to individuals. To support the findings of the field survey satellite imageries for 2004 and 2013 were referred. This reveals the change that has taken place for the past one decade in the forests of the study area. The boundaries of the Kankeshwar sacred grove were identified by referring the Survey of India toposheet. Loss of forest and vegetation cover is evident in the changes between these two images of 2004 and 2013. Canopy of the forest appears less dense in 2013.

9. Recommendations for Sacred Groves Restoration

Following measures can be adopted for Sacred Grove protection:

- Sacred groves can be conserved by using various government schemes like Joint Forest Management and Village Eco-development Scheme, social forestry etc.
- Economic benefits should be given to the local communities.
- Local coordination committees should be formed in which people from various categories like government and NGO are involved. Such committees would be useful in monitoring the status of the forest.
- We visited sacred groves during monsoon and realised that during this season there is abundant natural vegetation which also consists of indigenous species. The seeds of these should be collected and gene stock of such species is created and also replanted in the same area.
- To educate these locals and to create awareness in them camps should be conducted which can be named as nature education camp.
- Since the place has gained the importance as a pilgrim centre it is essential to have controls on the arrivals of tourists.
- It is essential to control stone quarries through community participation.
10. Conclusion

- Though majority of the respondents were aware of the concept of the sacred grove, their use of the forest is exhaustive. Cutting trees for fuelwood, grazing of animals, are pausing threats to their sacred grove.
- Despite locals are responsible in causing damage to the forests, at the same time they also expressed concern about the degrading status of the grove. Their interest is economic and not ecological.
- Government officials are also not willing to accept the fact that the groove is degrading.
- The district Raigad is in close proximity to the City Navi Mumbai and as a result due to the impact of urbanisation, is undergoing major changes. The indigenous community has become business oriented and the traditions, culture are weakening. The sanctity of the grove is thus eroded. The presence of commercial plantations, encroachments on land, illegal private construction, stone quarries, tourism etc are the major threats to the sacred grove.
- Conflicts between the ownership and legal status is also one the major threats to the sacred grove.

References

Abstract

The inner city of Nakhon Ratchasima Province, in the northeast of Thailand, is an area of economic growth and density of population, but in the past, it was an agricultural area. The edge of the urban area is in the west, north and east which is regarded as upstream and downstream. This paper is to analyze the land use change of urban agriculture in Nakhon Ratchasima Municipality using Geographic Information System (GIS) and open source satellite imagery Google map of Quickbird satellite. More urbanization is taking place in this area. Many areas, especially the area which is located at the edge of the river in the north and the east, is changed into residential and manufacturing. The products from agriculture are vegetables and its amount will further decrease according to the proportion of the area. Furthermore, it will affect the agriculturist and continuously lead to the decline of the area and impact the food supplies in cities.

1. Introduction

Land use changes rapidly by various activities, especially in agricultural areas. In the past, agricultural area remained very much unchanged. But the economic, residential, industry and tourism development increases and the agricultural land usage further decreases. Nakhon Ratchasima Municipality, located in Amphoe Mueang Nakhon Ratchasima, Nakhon Ratchasima Province, Northeast of Thailand, considered the area as major economic center of the province. As natural rivers flowing through urban areas, water resources are important in exploiting the land, especially for agriculture. The agricultural land uses areas on the edge of urban areas, most of the area on the west, north and east. This is regarded as upstream and downstream.

The development and expansion of the area has increased the construction of buildings such as the department store, commercial buildings, housing estate and residential housing. This is consistent with the land use regulation of a comprehensive plan in Amphoe Mueang Nakhon Ratchasima. By definition of agricultural areas in Nakhon Ratchasima Municipality, and the commercial and residential areas, it is predicted that the proportion of agricultural land in the future will further decrease. The issue is not only the concern about the decline of agricultural areas. But every square meter of lost agricultural usage will lead to an increase in food prices. Opportunities, access to food quality and food safety for city residents will be reduced. Thus, to achieve food security and quality of life, the further breakup of agricultural encroachment area must be stopped and the land usage situation has to be improved. Regeneration of the remaining area of agriculture aims to restore integrity to the quality of the food supply.

2. Study area

The study area is in Nakhon Ratchasima Municipality located on Amphoe Mueang, Nakhon Ratchasima Province Northeastern of Thailand. Geographical coordinates are 14°56’ 40” to 14°59’ 43” N, 102°01’ 38” to 102°07’ 40” E. A total area 37.50 square kilometers, high from sea level about 174 to 206 meters, distance from Bangkok by automobile 255 kilometers and by train 264 kilometers. The area is a plains sloping eastward, the north of the city is the lowlands, and the south western is a plateau. The soil was sandy loam. The natural river flow north side length of about 12 kilometers [1].

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3. Materials and methods

This research study used the base maps, the satellite image data and research documents from academics research papers and related documents. The following materials and methods are used in this study:

3.1. The base maps & the satellite image data


3.2. The Comprehensive plan data

The comprehensive plan Mueang Nakhon Ratchasima covered areas of 29 local governments and consists of one municipality (the study area), 8 Subdistrict Municipality and 20 Subdistrict Administrative Organization. The land use of comprehensive plan of Mueang Nakhon Ratchasima, according to determined plan of land use on Ministerial Regulation comprehensive plan of Mueang Nakhon Ratchasima B.E. 2547 (2004). Classified into 11 types [2]:

1) Residential low density (yellow)

For utilization land for the residential light and public institutions, public utilities and public facilities, the outer space of urban areas with residential medium density do not allow all types of industry and for land use of other activities. Available not more than 15% of the plots of land, permission required.

2) Residential medium density (orange)

For utilization land for the residential and public institutions, public utilities and public facilities, a continuous area or surrounded areas, commercial and residential high density. The environment and wind direction as well do not allow all types of industries and for land use of other activities. Available not more than 20% of the plots of land, permission required.

3) Commercial and residential high density (red)

Central business district area, social characteristics of Thailand, trade and businesses, can also not be separated from residential buildings, such as shops and residences or commercial buildings and residences, for land use of other activities. Available not more than 20% of the plots of land, permission required.

4) Industrial and warehouse (purple)

To avoid urban pollution there should not be any factories in the comprehensive plan. The city has a special responsibility as the city is industrial and has a seaport, but must be free of pollution and must be proportional to the area of residential premises to suit the wind direction and green buffer or green belt, for land use for other activities. Available not more than 15% of the plots of land, permission required.

5) Separate industry (laver)

Separate with industrial land use in the community, such as automobile repair, molded metal, construction materials etc. Many industrial workers in the community and is a well-equipped infrastructure and basic services, but to prevent nuisance and danger [3], for land use for other activities. Available not more than 15% of the plots of land, permission required.

6) Rural residential and agricultural (green)

Buffer zone of the urban area in concept of urban forest to prevent the expansion, the prevention of pollution outside comprehensive plan areas to purify the air, comprising garden, farms, forests etc. between future urban area and planning boundary, for land use for other activities. Available not more than 30% of the plots of land, permission required.
7) Open spaces for recreation and environmental conservation (limegreen)

The community has a great environment to relax in the fresh air, exercise, health, and quality of life. The land belonged to the state for utilization, recreation or related to recreation, environmental or public benefits. Private ownership land and allows the occupier for utilization, recreation or related to recreation, environmental, residence, agriculture or related to agriculture, public utilities and public places or public benefits.

8) Educational institution (olive)

Land use for education consists of a library, university, college, school, kindergarten, nursery etc.

9) Religious institution (gray)

Land use for the temples, mosque, church, churchyard, crematorium, cemeteries etc. Not included temple ground outside the temple. A meeting space for the public to engage with religious people. Land use of this type was initially included in the communities and the urban area is the hub of people in the community.

10) Public institution / Civic (blue)

Land use for the activities of the government and enterprises, consist service centres and government offices such as waterworks authority, electricity authority, postal, telephone exchange, hospital, police station etc. expanding the activities of the government and enterprises, use of the government land or public land.

11) Future roadway (pink)

Land use for construction of roads; public utilities and public places.

![Fig.1. The Land use on Ministerial Regulation of comprehensive plan of Mueang Nakhon Ratchasima in 2004.](image-url)

The comprehensive plan Mueang Nakhon Ratchasima started with the ministerial regulation No.13 B.E.2529 (1986) since March 16, 1986 and lasted until March 15, 1991, covering an area of 41 square kilometers. There was one time improvement with the ministerial regulation No.104 B.E.2534 (1991) since December 13, 1991 until December 12, 1996, covering an area of 228 square kilometers. But in 2004 a ministerial regulation to enforce the comprehensive plan has been announced. The second announcement of a ministerial regulation, royal decree No.121, Volume 47, was dated on July 26, 2004 with a total area of 314.30 square kilometers. It consisted of one municipality (the study area),

...
8 Subdistrict Municipality and 20 Subdistrict Administrative Organization. The announcement of ministerial regulation to enforce of comprehensive plan Mueang Nakhon Ratchasima No.2 B.E.2550 (2007), which have been amended certain stipulations of the comprehensive plan Mueang Nakhon Ratchasima in 2004. As follows [4]:

- Determining the percentage of land use to other activities of percent……, the plots of land ask of permission as a percentage……, of land this type in each area.
- Determining the percentage of land use to other activities of commercial and residential high density, available not more than 20% of the plots of land ask of permission as a 5% of land this type in each area.
- Determining the percentage of land use to other activities of rural residential and agricultural, available not more than 30% of the plots of land ask of permission as a 20% of land this type in each area.

The comprehensive plan Mueang Nakhon Ratchasima, improve No.2 expire on July 25, 2009, during the implementation of improve No.3, still enforce the ministerial regulation of comprehensive plan Mueang Nakhon Ratchasima in 2007, another two times, which expired on July 25, 2011.

3.3. Geographic information system & Remote sensing technique

Land use change of urban agriculture in Nakhon Ratchasima Municipality was mapped using Geographic information system (GIS), software ArcGIS 9 ArcMap V.9.2. The techniques to overlay maps of land use data was remote sensing techniques that interpret satellite imagery with visual analysis [5].

4. Results

4.1 The land use change of urban agriculture in Nakhon Ratchasima Municipality in 1980, 2000 and 2007

The area of Nakhon Ratchasima Municipality is generally plains and rolling plains, southwest and south to the low hills are not steep altitudes. The slope down to the north, next to the north of the urban area is the lowlands. These locations are often flooded in the flood season and the utilization of the area is for agriculture. Early settlements were in the area of the original city and scattered around the moat to the west along the road to reach the railway station. Currently, an area such as the downtown area is another center of the community with a high density. Because of the terrain obstacles and restrictions, there is a military zone on the south side, the north side is the lowland in the rainy season and a railroad leads through the urban area to expand along the length of the east and west. The highway No. 2 is a residential and industrial area, while the area to the east is a large public marsh as an obstacle to urban growth. Expanded to the southeast along the highway No. 224 is mostly the industrial factory processing of agricultural, and industrial estate.

The Nakhon Ratchasima Municipality area of the National Economic and Social Development Plan has been designated as a principal city of the northeastern region. In the years 1994-2001 settlement has changed and improvements or change of land use within the urban areas has happened. The expansion up vertically has the high buildings in the downtown area, whilst the expansion horizontal connected with other areas. The settlements and the expansion of space has increased density in the downtown area. Use of space which is still available and also with the expansion of urban areas in the radius is along the major transport routes. The expansion increased the apparent and affect land use include the area to the west and southwest as a result of the settlement community residents, to support personnel and student of universities and colleges in the area. The highway No.2 parallel to the secondary roads No.205 is the expansion of the commercial and residential, and the highway No.224 area of expansion in the settlement of the residential and industrial. The development and expansion consistent with the Seventh National Economic and Social Development Plan (1992-1996) and the Eighth National Economic and Social Development Plan (1997-2001), Thailand’s sound economic position is internationally recognized. In addition, sustained public investment in economic and social infrastructure has made a significant contribution to an overall rise in incomes, living conditions and quality of life [6]. However, in the first year of the Eighth plan, Thailand experienced a severe economic crisis with great impact on individuals and society, including problems of increased employment and poverty. Restoring economic stability and reducing the impact of the crisis thus became a priority. The Ninth Plan (2002-2006) adopted the Sufficiency Economy Philosophy to guide the development and administration of the country, at the same time as continuing the holistic approach to people-centered development from the Eighth Plan. The plan prioritized solutions to problems arising from the economic crisis in order to build an economy with strong internal foundations and resilience to external changes, while aiming for balanced development with respect to people, society, economy, and environment in order to achieve sustainable development and the well-being of the Thai people. The performance under the Ninth Plan can be summarized as adequately successful. The national economy grew steadily. The stability of the economy improved. Poverty fell, while the quality of life of people improved greatly as a result of expansion of health services,
better health insurance in both quality and quantity covering a majority of the population, and a decline in drug problems. But the Thai economy remains vulnerable to external instabilities, while problems persist over poverty, income distribution, and quality of education, security of life and property, and transparency in government administration. These remain priorities for a solution [7].

During the period of the Tenth Plan (2007-2011), Thailand will face major changes in many contexts that will present both opportunities and constraints for national development. Both people and systems must be fully prepared to adapt to future changes and reap benefit by keeping up with globalization and building resilience in all sectors, in accordance with the Sufficiency Economy Philosophy.
Table 1. The land use change in Nakhon Ratchasima Municipality in 1980, 2000 and 2007.

<table>
<thead>
<tr>
<th>Types of land use</th>
<th>Year/area (sq.km.)</th>
<th>Land use change (sq.km.)</th>
<th>Land use change of total area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban</td>
<td>21.85</td>
<td>30.88</td>
<td>+10.6</td>
</tr>
<tr>
<td></td>
<td>32.45</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Agriculture</td>
<td>13.40</td>
<td>5.42</td>
<td>-9.78</td>
</tr>
<tr>
<td></td>
<td>3.62</td>
<td></td>
<td>-1.11</td>
</tr>
<tr>
<td>Open space</td>
<td>1.93</td>
<td>0.97</td>
<td>+0.29</td>
</tr>
<tr>
<td></td>
<td>0.82</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>0.32</td>
<td>0.23</td>
<td></td>
</tr>
<tr>
<td></td>
<td>0.61</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (sq.km.)</td>
<td>37.50</td>
<td>37.50</td>
<td></td>
</tr>
</tbody>
</table>

The development and expansion of the Nakhon Ratchasima Municipality view of land use changes (Table 1.), timeframe 27 years, land use changes of urban type focused on commercial and residential development. 28.67 percent increase of total area, as a result of the economic development policy of the National Economic and Social Development Plan mentioned above. In 2007, the development and expansion of urban areas in the economy is still expanding, which has been affected by the Asian financial crisis in 2004. Land use changes of agriculture are affected of the most developed.

4.2 The urban agriculture areas of comprehensive plan in 2004 and the land use in 2007

Fig.3. The urban agriculture areas, (a) comprehensive plans in 2004; (b) the land use in 2007.
The land use changes of urban agriculture by comprehensive plan in 2004 and the actual land use of satellite imagery in 2007, considered in the Nakhon Ratchasima Municipality, determining land use comprehensive plan in 2004, duration of 20 years to enforce. Without defining the agricultural land use areas, definition of land use of residential medium density (orange), and commercial and residential high density (red). In 2007, the development and expansion of land use in Nakhon Ratchasima Municipality has coincided with the patterns defined in 2004. Agricultural areas steadily decreased 26.08 percent of total area, most areas on the north side. Most of the activity is to grow vegetables, flowers and fishing.

5. Conclusion

The urban planning of Thailand does not feature the preservation and development of food production area or urban agriculture area, because the definition of urban does not include agricultural areas. Therefore, the comprehensive plan and urban development plan are not related to agriculture. Later the word “urban and rural” could be found in the Urban Planning Act, B.E. 2518 (1975), and found determining the vision of the comprehensive plan of Bangkok and some Provinces. However, states provide preserved fertile agricultural areas. When considering the specifications classified by land use planning, the authorizations (except for government agencies such as the National Housing Authority, Community Organizations Department Institute, and public utility and public assistance) allow land development for agriculture, but with the option to change into land development for housing in later time. The urban planning statute of Thailand still differs from other countries, especially to countries that use the approach of smart growth in planning, which defines that all planning must identify agricultural and natural areas to be prevented. The government and the community are responsible for the restoration in perfect condition of the production of quality of food-to-food security in the urban. Because agricultural areas are particularly important as a food security of the urban, food supply must be ensured in sufficient quantity and quality to consumption based on basic economics unit of the community and urban utilization of the land resources, the source of support and water cleanup and green space. Additional studies should be performed in the future to identify issues of the farmers, the details for commercial or livelihoods, including, the markets and the existence of the agricultural areas within urban areas.

Acknowledgement

The author would like to thank the Department of Public Works and Town & Country Planning of Ministry of Interior, the Land Development Department of Ministry of Agriculture and Cooperatives for support land use data, Google map for support open source satellite imagery. And Research and Development Institute, Nakhon Ratchasima Rajabhat University for support and permission for this work.

References

Message Appeal and Presentation Order of Public Service Ads: Experimental Study of Egg Enriched with Omega-3 Promotion

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Abstract

Functional food is known in Indonesia since early 2000s in line with the change in health lifestyle. High market growth does not occur on all functional foods. Some manufacturers have strengthened promotion by including third party reviews on leaflets in the product packaging to gain a better market response. Third Party Organization (TPO) endorsers issues are arising since TPO endorsers in rational appeal ads did not perform well compare to typical endorsers in emotional appeal ads in order to influence consumers. The purpose of this study was to examine emotional and rational appeals ads effect to perceived persuasion and presentation order identity of third party organization endorrenger and message content in advertising on perceived persuasion. Experimental laboratory was conducted with factorial design 2×2 ads type (rational vs emotional) and presentation order of identification source and message (recency vs primacy). Undergraduate students enrolled in the Faculty of Animal Science, Gadjah Mada University, were used as subjects. Random assignment was used to put subjects to the experimental group in order to reduce bias from subject variance. The result has shown that rational and emotional appeals had no significant effect in perceived persuasion where the perceived persuasion average of rational ads effect was 5.6453 compared to 5.6247 on emotional ads effect. Furthermore, in rational appeal advertisement the recency presentation order affect higher perceived persuasion (p<0.01) with 6.0000 than primacy presentation order which was 5.2907. However, in emotional type public service, presentation order has no effect to the perceived persuasion which was 5.5275 in recency presentation order compare to 5.6822 in primacy presentation order.

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Keywords: public service advertising; functional food; egg

1. Introduction

Today’s human concern of dietary has moved from foods that meet the needs of nutritional adequacy to foods that offer longer-term prevention of chronic diseases, which are met from functional food. Functional food is a food group that provides health benefits beyond its basic ingredient function [1], [28] and is made up of foods that are commonly consumed in normal amounts and do not include products aimed at specific consumer groups, which is food supplements for specific dietary requirements [16]. This definition is in line with consensus at the First International Conference on East-West Perspectives on Functional Foods in 1996 which defines functional foods as foods that contain active components that can provide health benefits, beyond its basic benefits provided by the nutrients contained in them [33]. Functional food of animal products varies on fortified foods and beverages form with addition of a number of healthy ingredients such as Omega-3, antioxidants and probiotics in dairy and non-dairy product such as meat and egg.

Japan is the pioneer of functional foods which began in the 1990s [33] and until recently Japan, USA and Europe are the biggest market of functional food [34] that valued U.S. $ 30 in 2007 [2]. That market size is the result of functional food industry growth rate that is higher than the conventional food which is 10% per year compared to 2-3% per year [22] and in 2009 functional food market continued to grow at a rate ranging between 8.5% and 20% annually [31].

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Functional food was introduced to Indonesia by the early 2000s in line with the lifestyle changing and consumer awareness for a being healthier despite the fact that Indonesia is one country that has a natural functional food, especially in the form of beverage such as wedang jahe, wedang secang, dadih and dali (fermentation buffalo milk). Due to limited promotional efforts, not all functional foods are widely accepted. Conceptually, an attribute that is offered in functional food named credece quality requires high cost to be detected before or after the purchase [3], so that it makes more work to do for the marketers [6],[12]. The high cost of attribute detection resulted in the fact that most of the consumers generally use assessment conducted by a third party or recommendation of salesperson.

One product that has a great chance to be developed and marketed is eggs enriched with Omega-3. Eggs, one of poultry products, are one of the top ten ranked functional food named by consumer [21]. Technological developments such as chicken rations manipulation intended to change the composition of fatty acids in the eggs [9], [24], [26] to produce eggs with saturated fatty acid content and lower cholesterol [9]. This product can be consumed to prevent the prevalence of cardiovascular disease which is quite high in developing countries at 28% [32] by lowering blood cholesterol levels, which is one of the indicators of the cardiovascular disease prevention [25]. Eggs enriched with Omega-3 are distributed through the supermarket chain to upper-middle socioeconomic strata market segments. A number of manufacturers have involved and included third party reviews on leaflet in the product packaging to gain a better consumer acceptance. However, the data shows that the value of sales of Omega-3 enriched eggs in Indonesia is relatively still around 0.3 - 0.5% of the total value of sales of chicken eggs which is 18.7 billion dollars per year [14].

Experimental studies conducted to examine the effects of marketing communications showed the weak role of independent agencies as third party organization endorsement (TPO) in persuading consumers [27]. TPO is closely related to individual expert endorsement but may be viewed as more independent in order to deliver product reviews [7]. The existence of TPO in a public service advertisement is expected to enhance the credibility of the product since the reviews were conducted independently and were not influenced by the interests of the TPO on the sales of these products [18], [23] and will increase product reputation [30] and affect consumer belief and attitudes [7]. However, the question is the weak role of TPO due to the its weak credibility or attractiveness or influence of emotional vs. rational appeals selection in advertising in order to encourage better information processing. Emotional appeal ads have greater flexibility to suit the taste of viewers than ads with a rational appeal [27]. Rational appeal in advertisements has lowered participant attention that affects information processing of advertising messages meanwhile emotional appeal could motivate individuals for a better information process [13]. Thus, a specific study needs to be conducted to examine differences in the effects of rational and emotional advertising theme and mention the order of the TPO in an advertisement. An experiment was conducted to examine the effects of the presentation order of TPO as a source of information and message content of audio visual public service advertisement in persuading consumers.

2. Literature Review and Hypothesis development

Empirical studies showed the lack of empirical understanding of what must be considered in public service announcements [11]. An empirical study conducted [27] on the functional food product showed that TPO in rational appeal ads were not able to show the effects of persuasion stronger than the typical endorser in emotional appeal ads. One of the reasons is that TPO does not have a strong attractiveness despite perceived neutral and has high credibility so persuasive effect noticeably higher in commercial advertising [29] as [7] also propose that typical consumer endorser are more suitable for low risk product or low involvement product [8]. However, there is criticism that the mentioning of independent agencies as source of information at the end of public service advertising undermines the credibility of an independent agency to influence information processing. This criticism was based on a study[5], [20] that describes recency type presentation order in advertisements that mention the identity of the TPO in the beginning followed with the content of message, which will lead to stronger integration information processing between TPO identity and product information. In contrast, type of primacy (starting with the message content and closed with the mention TPO identity) there is a chance of weak integration in information processing. Mentioning the name of TPO in the early part of ads will put the main attention on TPO, which determines information processing [10]. Enlightening is also taken from belief-adjustment theory that an individual believes is affected more when the product information presented at the end (recency) than at the beginning (primacy) of the advertisement because the product information will be available in the working memory of consumer [4].

However, mixed results have been obtained from a number of studies of TPO advertising effect to consumer response [29]. Rational appeal that is generally used in public service ads with independent agency as TPO might be one possible cause. Inability of public service ads that mostly delivered in rational appeal to meet the tastes of consumer produces low attention of consumer. Expert endorsers that are heavily used in public service ads do not attract audience better than typical endorsers [27]. Emotionally charge advertising appeal may exhibit a tendency to attention [19], emotional response [15] and attitude toward advertisement [35].
H1: Emotional appeal advertising affects perceived persuasion toward the efficacy of the product higher rational appeal advertising.

H2: Recency type presentation of public service advertisement affects perceived persuasion toward the efficacy of the product higher than primacy type

3. Research method

Experimental laboratory was conducted with factorial design 2×2 with independent variables were ads type (rational vs emotional) and presentation order of identification TPO and message (recency vs primacy). Rational appeal advertising in this case is the public service advertising that introduces an independent agency as TPO while emotional appeal advertising put common type of consumer in as an endorser. Both approaches are generally used ads in advertising in Indonesia.

Undergraduate students at the same level that enrolled in Faculty of Animal Science, University Gadjah Mada were used as subjects on the basis that they understand the topic so that they can understand the information in food functional advertising as an experimental treatment. Random assignment was used to put subjects to the experimental group in order to reduce bias from subject variance. Demographic variable such as age and gender as well as the role and activity of subject in food shopping were measured to control the possibility of confounding effects. Participants were placed in the class and received a series of ads exposition including one of the ads to be treated in this experiment. Participants then filled out a questionnaire that is used to measure the treatment effect on the dependent variable that is perceived persuasion to product attribute.

4. Result and Discussion

Table 1. The results of the different advertising appeals emotional vs. rational and presentation order primacy vs. recency on perceived persuasion

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Perceived persuasion</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>SD</td>
<td>t-stat</td>
</tr>
<tr>
<td>Rational (N= 60)</td>
<td>5.6453</td>
<td>0.9158</td>
<td>-0.108</td>
</tr>
<tr>
<td>Emotional (N = 43)</td>
<td>5.6247</td>
<td>0.9758</td>
<td></td>
</tr>
<tr>
<td>Rational advertisement (N=60)</td>
<td>5.2907</td>
<td>1.0618</td>
<td>-3.088</td>
</tr>
<tr>
<td>Primacy (N=30)</td>
<td>6.0000</td>
<td>0.6751</td>
<td></td>
</tr>
<tr>
<td>Recency (N= 30)</td>
<td>6.0000</td>
<td>0.6751</td>
<td></td>
</tr>
<tr>
<td>Emotional advertisement (N=43)</td>
<td>5.6822</td>
<td>0.8666</td>
<td>0.498</td>
</tr>
<tr>
<td>Primacy (N=27)</td>
<td>5.5275</td>
<td>1.1614</td>
<td></td>
</tr>
<tr>
<td>Recency (N=16)</td>
<td>5.5275</td>
<td>1.1614</td>
<td></td>
</tr>
</tbody>
</table>

H1 testing result indicated that rational and emotional appeals had no significant effect to influence perceived persuasion variable. The means of perceived persuasion for both rational and emotional treatment group were good enough that were 5.6453 and 5.6427 (scale 1-7), respectively. This result demonstrated that both types, known public service advertisement, were able to form a positive attitude toward the product attributes, even though rational appeal advertisement used expert endorser while emotional advertisement used typical endorser. H2 result seems to be inconsistent to previous study that revealed stronger effect of emotional-type of commercial ads to perceived persuasion than the effect of rational-type of public service ads [27]. This finding can be explained by the fact that the subjects who were involved in this study had high involvement to product categories (Omega-3 egg) by high mean of healthy life motivation variable. Analysis showed the percentage subject with high healthy life motivation (mean average≥ 3.5) was 90.3% then only 9.7% of subjects have low healthy life motivation (mean average<3.5) that enacted both central route and peripheral route persuasion work well on information processing. Moreover, the high average value perceived persuasion on rational experimental group mainly was the contribution from the rational recency experimental group that is 6.000 but it low in rational primacy type that used in previous study.

H2 testing result showed that recency presentation order in rational appeal persuasion affected perceived persuasion more than primacy presentation order do (p<0.01). This result indicated that pronouncing TPO identity on the beginning of advertisement was capable to increase the connectivity of information source and message content.
Therefore information that was delivered by recency type of rational appeal public advertisement developed perceived persuasion better to the product attribute as empirical evidence obtained by [10] that the TPO become able to be the central attention to the subject when subject are digesting the information embedded in service public advertisement.

Table 2. Analysis of variance result of public service ads type on perceived persuasion

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>Perceived persuasion</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>SD</td>
<td>Levene's test</td>
<td>F stat</td>
<td>Sig.</td>
</tr>
<tr>
<td>Recency-Rational (N=30)</td>
<td>6.0000</td>
<td>0.6751</td>
<td>0.065</td>
<td>1.804</td>
<td>0.172</td>
</tr>
<tr>
<td>Primacy-Emotional (N=27)</td>
<td>5.6822</td>
<td>0.8666</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recency-Emotional (N=16)</td>
<td>5.5275</td>
<td>1.1614</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

On the other hand, presentation order type in emotional type public service had no effect to the perceived persuasion. Emotional appeal is able to meet the audience information appeal taste so as to foster a positive attitude toward the product attributes no matter if the identity of the TPO mention at the earlier or later stage of public service ads. Emotional appeal ads were capable to stimulate audience emotion that would interact to the attention since both of are involved in information processing [19]. Performance capabilities of emotional appeal ads indicated by the relatively high mean value of perceived persuasion among treatment groups, that was 5.6822 in primacy and 5.5275 in recency presentation order. Further analysis is conducted using ANOVA to justify similarity of capabilities emotional type ads both primacy and recency to recency rational type showed that there was no difference those type of ads in influence perceived persuasion (Table 2). Furthermore, these studies did not control involvement and previous knowledge on functional food variables that possibly to interact with message appeals in information processing. As an example, strong claim in advertisement content is more successful than weak claim if involvement is controlled [17]. However it can be confirmed that demographic variable and role of subject in food decision-making process and shopping behavior were controlled to prevent those variables to be confounding effects (Table 3). Further test to confirm age as moderating variable did not supported (F = 1.361, sig = 0.174) that means no significant evidence of age to be moderating variable.

Table 3. Homogenity testing of background variables

<table>
<thead>
<tr>
<th>Variable</th>
<th>Pearson chi-square</th>
<th>Asymp sig (2-sided)</th>
<th>Inference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>38.990</td>
<td>0.001</td>
<td>Potentially as moderating variable</td>
</tr>
<tr>
<td>Gender</td>
<td>1.277</td>
<td>0.735</td>
<td>Homogen</td>
</tr>
<tr>
<td>Involved in food decision making</td>
<td>0.857</td>
<td>0.836</td>
<td>Homogen</td>
</tr>
<tr>
<td>Involved in food shopping</td>
<td>5.871</td>
<td>0.118</td>
<td>Homogen</td>
</tr>
</tbody>
</table>

5. Conclusion

This study concluded that emotional and rational type had no effect on persuasion towards the product. However, presentation order of TPO identity at the beginning of advertising affected perceived persuasion in rational type of public service advertising and resulted perceived persuasion better than those emotional appeal public service ads. Implication of this study is that marketer should take into account the attention of consumers because estimates show that people look at advertisements but few of them really take something in their purchasing decision process due to information overloaded. The attention could be attained through stimulate emotional state of the consumer from the emotional appeal public service ads or to enhance attention by inform the name of TPO earlier in public service that has to be developed on rational appeal. Thus, care must be taken when designing messages to achieved perceived persuasion as expected.

References


Assesment of LD\textsubscript{50} of physic nut (\textit{Jatropha curcas} L.) Seeds Extract as Bio-Insecticide for Controlling Disruption Rove Beetles (\textit{paederus} sp.) in Urban Area

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Abstract

Physic nut seeds (\textit{Jatropha curcas} L.) contain phorbol ester, ricin, saponins, flavonoids and phenolics. The compounds, which have activity as a bio-insecticide are phorbol ester and ricin. Rove beetle (\textit{Paederus} sp.) has pederin toxins that can cause acute dermatitis Paederus, vesicle lesions and small pustules in humans and animals [2]. Therove beetle (\textit{Paederus} sp.) outbreak data indicates that the outbreak had spread widely in high-populated areas in Indonesia in early 2012. The aim of this study was to determine the effect of multiple doses and the LD\textsubscript{50} value of the extract of physic nut seeds (\textit{Jatropha curcas} L.) as bio-insecticide on mortality rove beetles (\textit{Paederus} sp.). The experiment was performed with multilevel dose, starting from 1 ppm, 10 ppm, 100 ppm, 1000 ppm, 10\,000 ppm, and 100\,000 ppm in 6 treatments and 3 repetitions. The solvent used was ethanol 70%, and the control (0 ppm) only contains distilled water. The conclusion from the research was that the extract dose physic nut (\textit{Jatropha curcas} L.) seeds as a bio-insecticide caused 50\% mortality (LD\textsubscript{50}) of rove beetles (\textit{Paederus} sp.) was 49531 ppm. The highest mortality of rove beetles 93.33±11.54\% from dose 100\,000 ppm of physic nut seeds ethanol extract.

Keywords: \textit{Paederus} sp.; \textit{Jatropha curcas} L. extract; Bio-insecticide; Urban area

1. Introduction

Rove beetle, in scientific language \textit{Paederus} sp., is the insect that generally lives, reproduces and develops in the rice fields. Surabaya is the city in Indonesia that had the first outbreak of rove beetle (\textit{Paederus} sp.) in 2012. Rove beetle (\textit{Paederus} sp.) has an about 1 cm long, orange-colored body, the lower abdomen side and the head are dark and with a hidden a pair of wings. There are 622 species of rove beetle (\textit{Paederus} sp.) that spread throughout the world. These cases have been reported outbreaks of dermatitis in Australia, Malaysia, Sri Lanka, Nigeria, Kenya, Iran, Central Africa, Uganda, Argentina, Brazil, France, Venezuela, Ecuador and India [1]. Actually, \textit{Paederus} sp. beetle is the biotic agent for controlling planthopper in the agriculture fields, especially in the rice plant. However, as the development of the regions in Indonesia, the habitats of rove beetles (\textit{Paederus} sp.) is narrower, even disappeared and turned into residential, industrial and urban areas. In addition to the habitat being displaced due to changes in utilization and other predisposing factors, the appeal to the lighting of the lamps at night in residential and industrial areas is also one root cause. Therefore, many cases are currently caused by migration of rove beetles (\textit{Paederus} sp.).

Rove beetle (\textit{Paederus} sp.) is an insect which can not bite and live in rice fields. The rove beetle body contains \textit{paederin} toxin in its abdomen, if the body is pressed it will releasing \textit{paederin} toxin which can cause acute pae derus dermatitis in humans and animals. Lesions of the disease from outbreaks data are vesicle lesions, bullae, small pustules, erythema and a burning feeling on the skin [2]. \textit{Paederin} toxin produced by insect species \textit{Paederus} that can cause pae derus dermatitis is commonly happening in the tropical regions [3]. Dermatitis caused by the \textit{Paederus} beetle called pae derus dermatitis is a result by contact with \textit{Paederin} and is a toxin hemolimpha [4] (Fig. 1(c)). The treatments of the

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E-mail address: wind.psurgeon@gmail.com
lesions is to rinse the skin with water and then used steroids and local antibiotics. The rove beetle (Paederus sp.) outbreaks data indicates that it happens widely in high-populated areas such as Jakarta, Surabaya, and Bandung [5]. Reported in Surabaya, rove beetle (Paederus sp.) has struck 200 people made up of children and adults [6]. The number of recorded rove beetle cases were approximately 559 cases in March 2012 and 337 patients were from Surabaya [7].

Fig. 1. (a) Reports indicate that rove beetles (Paederus sp.) are at the corner of the damp walls and ceilings; (b) Paederus beetles; (c) One of the symptoms (clinical signs) of dermatitis Paederus [5].

Synthetic pesticides have a broad spectrum of activities, effective and toxic to the various of insects. But using of synthetic pesticides has negative impacts, such as insects resistance, pesticide residues, suppress natural enemies of pests or population of the beneficial pest, environmental pollution, and disruption pheromones in female animals [8]. In addition, the effect of synthetic pyrethroid insecticides residues in the short term can lead to chronic diseases [9]. Therefore, it needs an environmentally friendly pesticide and effective to controlling of pests such as bio-insecticides.

The physic nut (Jatropha curcas L.) is a tree that grows and develops well in Indonesia. In fact, almost in all regions of Indonesia this plant could be grown. Jatropha curcas L. is included in the Euphorbiaceae family and commonly called physic nut. In general, this plant is more often used in bioethanol or biodiesel. However, as the development of science and technology it is now known that physic nut (Jatropha curcas L.) seeds contain toxic compounds such as lectins (curcin), anti-trypsin (trypsin inhibitor), saponins, phytoestrogens, phorbolester, free fatty acids, diasiglicerol, sterols, monoasilglycerol, poler far [10], and ricin [11], which is very effective for controlling pests. Therefore, we have a creative idea to make use of the physic nut (Jatropha curcas L.) seeds extract as a bio-insecticide for controlling insect pests, especially rove beetles (Paederus sp.). The research was targeted to determine the effect of multilevel doses and the LD50 value of the physic nut seeds extract (Jatropha curcas L.) as bio-insecticide on mortality rove beetles (Paederus sp.).

2. Materials and methods

2.1. Time and place

Research carried out since April to May 2012 at the Laboratory of Pharmacology, division Pharmacology, Departament of Anatomy, Physiology, and Pharmacology (AFF), Faculty of Veterinary Medicine, and Laboratory of Inter-University (Pusat Antar Universitas), Bogor Agricultural University.

2.2. Materials and tools

Materials used in this study include the physic nut (Jatropha curcas L.) seeds, ethanol 70%, distilled water, and 105 rove beetles (Paederus sp.) in various ages, sizes and species obtained from rice field at Cibanteng, Dramaga, Bogor.

The tools used in this study include of a flask, Erlenmeyer size 2000 mL and 1000 mL, stirrer, digital scales, plastic cups size 1000 mL, gauze pads, thermometer, rubber, spray equipment, mortar, tulle fabric (as flap), syringe 3 mL and 1 mL, blender, rotary evaporation machine.

2.3. Extraction of physic nut (Jatropha curcas L.) seeds

Physic nut (Jatropha curcas L.) seeds were obtained from the fruit of physic nut tree, which is quite old (black color), then shelled and the contents of the seeds taken. The seeds have been dried by oven at 50°C for 24 hours. After the seeds were dried, then weighed the seeds (seeds weight 256.03 grams). The body of physic nut seeds were crushed using a blender. The next step, the simplicia was soaked with 2 liters ethanol 70% (maceration process) for 24 hours.
and stirred once per hour (stirred for ± 5 minutes). The solvent used in this study was 70% ethanol because the liquid is more selective, non-toxic, neutral, its good absorption and ethanol can be mixed with water [14]. Ethanol is also effective as a solvent in the manufacturing of herbal extracts that contain substances pesticides [15]. Immersion of simplicia was filtered and the water of immersion results taken. Dregs of the filtering was taken and carried out the second soaking with that dregs (treatment and time similar with first soaking). Thus, the filtration results obtained 4 liters (water of immersion results) of crude extract of physic nut (*Jatropha curcas* L.) seeds after twice of filtrations. The latter, performed to evaporation process at the Laboratory of Inter-University (Pusat Antar Universitas), Bogor Agricultural University. From that process, obtained 80 grams physic nut (*Jatropha curcas* L.) seeds extract.

2.4 Collecting the rove beetles (*Paederus* sp.)

The rove beetles (*Paederus* sp.) were manually caught in the Cibanteng rice field, Dramaga, Bogor. After the rove beetles (*Paederus* sp.) were obtained, they were collected in large plastic cup (size of glass is ± 1000 mL) containing soil and straws. Then, the cup was covered with a tulle fabric.

2.5 Treatments in rove beetles (*Paederus* sp.)

The treatments used 21 plastic cups, each containing 5 rove beetles (*Paederus* sp.). This study consisted of 6 treatments with 3 repetitions (Table 1). The treatment was to spray physic nut (*Jatropha curcas* L.) extract seeds at multilevel dose 1 ppm, 10 ppm, 100 ppm, 1000 ppm, 10000 ppm, 100000 ppm. Treatment doses of the extract obtained from mixing of 10 grams physic nut (*Jatropha curcas* L.) seeds extract with 100 mL distilled water. Dose of 100000 ppm was obtained from the mixing which is taken 1 mL, then diluted into 9 mL distilled water and homogenized in a spray tube. After that, 1 mL was taken from a dose of 100000 ppm, which then diluted with 9 mL distilled water to obtained doses of 10000 ppm. The next dose was obtained by the above technique until 0 ppm dose (as control) was reached. At the beginning of the treatment, each cup which contained rove beetles (*Paederus* sp.) was sprayed twice in accordance with the prescribed dosage. Observations made at intervals of 5 minutes for 4 hours.

Table 1. The treatment design of physic nut (*Jatropha curcas* L.) seeds extract against rove beetles (*Paederus* sp.).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Distance Seed Extract Dose (ppm)</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
<td>0</td>
<td>5 5 5</td>
</tr>
<tr>
<td>Group 1</td>
<td>1</td>
<td>5 5 5</td>
</tr>
<tr>
<td>Group 2</td>
<td>10</td>
<td>5 5 5</td>
</tr>
<tr>
<td>Group 3</td>
<td>100</td>
<td>5 5 5</td>
</tr>
<tr>
<td>Group 4</td>
<td>1000</td>
<td>5 5 5</td>
</tr>
<tr>
<td>Group 5</td>
<td>10000</td>
<td>5 5 5</td>
</tr>
<tr>
<td>Group 6</td>
<td>100000</td>
<td>5 5 5</td>
</tr>
</tbody>
</table>

2.6 Observation

Observation was made by calculating the number of dead rove beetles (*Paederus* sp.) (mortality) every 5 minutes for 4 hours. The results of the observations was recorded in the observation table.

2.7 Statistical analysis

Data obtained from observations were analyzed with analysis of various (ANOVA) in the form of Completely Randomized Design with 6 treatments and 3 repetitions. Then followed by Duncan multiple test area to test for differences between treatments. Then analysis LD$_{50}$ value was analyzed with probit analysis to express the toxicity referring to concentrations killing 50% of the rove beetles (*Paederus* sp.).
3. Results and discussion

This research has used 1 control group and 6 treatments with 3 replications. The number of samples in each group was 5 rove beetles. In the treatment group extracts of physic nut seeds (Jatropha curcas L.) were given with dose of 1 ppm, 10 ppm, 100 ppm, 1000 ppm, 10000 ppm, and 100000 ppm. The control group of rove beetles were given distilled water. The results showed that the number of rove beetles died in the control group was 0% in all replications.

Table 2. Observation result of physic nut (Jatropha curcas L.) seeds extract has killed the rove beetles (Paederus sp.).

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Physic nut seed extract dosage (ppm)</th>
<th>Mortality (%)</th>
<th>Average total mortality (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Repetition A</td>
<td>Repetition B</td>
</tr>
<tr>
<td>Control</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Group 1</td>
<td>1</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Group 2</td>
<td>10</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Group 3</td>
<td>100</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Group 4</td>
<td>1000</td>
<td>0</td>
<td>40</td>
</tr>
<tr>
<td>Group 5</td>
<td>10000</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>Group 6</td>
<td>100000</td>
<td>100</td>
<td>80</td>
</tr>
</tbody>
</table>

Fig. 2. Level of mortality of rove beetles after treatment.

Fig. 3. Probit analysis for LD$_{50}$ of physic nut seeds extract to mortality of rove beetles.
The results of this study have shown that the mortality of rove beetles by physic nut extract dose (Jatropha curcas L.) as bio-insecticide with 1 ppm (0%), 10 ppm (6.67±11.54%), 100 ppm (13.33±11.54%), 1000 ppm (13.33±11.54%) and 10000 ppm (13.33±11.54%) did not differ significantly. Mortality rove beetles with 5 doses of extract treatment of the physic nut seeds (1, 10, 100, 1000 and 10000 ppm) had a significant difference in mortality to rove beetles at a dose of 100000 ppm (see Table 2 and Fig. 2). So it can be shown that the highest mortality rove beetles found in physic nut seeds extract with dose 100000 ppm. Lethal dose 50% (LD<sub>50</sub>) of the physic nut seeds extract from probit analysis was 49531 ppm for mortality rove beetles (see Fig. 3). The lower the LD<sub>50</sub> value of the substance the higher activity to kill of experimental animals (high toxicity) with only needing to lower concentrations to lethal experimental animals [16]. Physic nut seeds extract has LD<sub>50</sub> value of 1507 ppm for 24 hours of testing and 866 ppm for 48 hours of testing against Aedes aegypti mortality [17].

Plants have potential as bio-insecticide because they naturally have a bioactive chemical compounds as defense in the form of toxins (pesticide), repellent (attractant), or inhibitors (antifidan) against insect pests [12]. Bioactive compounds are thought to function as pesticides of physic nut (Jatropha curcas L.) seeds extract in this study was phorbol ester and ricin [18]. Based on a phytochemical test it was reported that ethanol extract of physic nut seeds contains saponins compounds, flavonoids [16], and phenolics [19]. However, phorbol ester and ricin are compounds contained in physic nut seeds allegedly causing the death of the rove beetles. It is supported by several studies that have reported that physic nut seeds extract as a potential bio-insecticide.

All parts of physic nut (Jatropha curcas L.) contain ricin, but the highest concentrations of ricin found in the seeds. This compound causes abnormalities in organ functions, such as renal failure. The mechanism is blocking the function of essential protein body. Other toxic compounds contained are RCA (Ricinus Communii Agglutinin) that causes blood clotting and as a result of hemolysis occurred. Ricin compounds also cause bleeding in the small intestine and tissues [20]. These bioactive compounds are contained in physic nut (Jatropha curcas L.).

Phorbol ester of physic nut (Jatropha curcas L.) oil is useful as an application of the treatment and control of various types of insects and in some cases derive good results [10][13]. Based on research, this potentially bioactive substances can act as insecticides to Spodoptera frugiperda [18]. The main substances contained in biocidal physic nut seeds extracts that phorbol ester. Insecticidal activity of phorbol ester is due to stimulation of the cellular targets of protein kinase C (PKC) [21]. Phorbol esters contained in the extract of physic nut seeds has been reported that giving effect to skin irritation and tumor promoter by stimulation of protein kinase C (PKC). The natural substrate of PKC is diacylglycerate (DAG). Insecticidal activity of phorbol esters has been reported by several researchers, including giving effect to Maduca sexta, Helicoverpa armigera, Culex sp, Busseola fusca, Periplaneta americana, Blatella germanica, and Oncopeltus fasciatus [22]. Mortality of rove beetles (Paederus sp.) has been caused by these compounds. While all the rove beetles (Paederus sp.) included in the control group survived until the end of the observation (see Table 2), the rove beetles (Paederus sp.) which suffered death showing the condition of rigid body.

4. Conclusion

The conclusion from the research is that the extract dose physic nut (Jatropha curcas L.) seeds as a bio-insecticide caused 50% mortality (LD<sub>50</sub>) of rove beetles (Paederus sp.) was 49531 ppm. The highest mortality of rove beetles 93.33±11.54% is in dose 100000 ppm of physic nut seeds ethanol extract.

Acknowledgements

First, we would like to thank God, and then for our lecturers for all your help, advices and support. For our family who keep support us in this study. Especially thank you for Muhammad Viqih and Muhammad Alex for all your help and contribution. We are also grateful to the Faculty of Veterinary Medicine, Bogor Agricultural University and all who have contributed in this study.

References


Abstract

This study is to analyse the implementation of School Milk Program (SMP) for elementary school pupils of fourth and fifth grade at Argosari Muhamadiyah Elementary School, Bantul Regency, Daerah Istimewa Yogyakarta Province (DIY Province). The extension and discussion to the teachers, pupils and their parents on milk especially fresh milk (pasteurized milk) about milk content, the advantage for human beings and the milk production process from farmer was part of the program. It was accomplished by a special educational trip for the pupils to the dairy farm in Faculty of Animal Science, Gadjah Mada University in order to get deep comprehension about milk, where it comes from and how it processed. Furthermore, they were also asked to draw what they saw in the trip and it is to be hoped that their knowledge on milk would give more impression in their mind that would make them more milk minded. In this SMP, the pupils can get the milk by saving some of their pocket money every day. The results showed that most of the parents (61.29 %) and 62.50 % of the pupils want to save 500 IDR per day, even 22.58 % parents and 34.37 % pupils want to save of 1,000 IDR per day and the remainder wants to save less than 500 IDR per day for buying pasteurized milk. It can be concluded that either parents or pupils are able to save 500 IDR per day to buy fresh milk (pasteurized milk). About 62 % of the parents wanted the SMP and also drinking milk together (for pupils) were held once a week in the school. With this way the school would be able to hold the routine agenda of drinking milk together. It was also hoped the pupils in the rural areas could keep drinking fresh milk (pasteurized milk) routinely of their own free will and not depending on the milk aid program, since they had been the milk minded.

1. Introduction

Milk has many nutrients that children need to grow and develop strong bones. The kind of milk consumed by Indonesian people at the present time is different from those consumed by developed countries. The Indonesian people drink so little amount of liquid milk compared to those of other countries. In 2007, the amount of liquid milk consumed in Indonesia was only 18 %, while in Europe almost 100 %, The United States 99.7 %, India 98 %, Thailand 88 %, and China 76.5 % [4]. According to [5], the total consumption of milk by Indonesian people in 2007 was 7.3 litter/person/year [3]. Milk drinking tradition of the Indonesian people has to be changed gradually. To get used to drink liquid milk or pasteurized milk can be commenced with the school milk program for school pupils.

The school milk program had ever been carried out at several areas in Indonesia such as in Sukabumi, Semarang and West Bandung. The Government of Sinjai Distric had brought a milk program to the school pupils by an additional menu program. If the program of providing milk to the school pupils will soon be able to be fulfilled and become a national program, it is hoped to give double benefits. First, with the increase consumption of milk, it would improve human resources, so it would be an effective means to prevent a “lost generation”. Second, it would decrease the dependency of marketing milk to The Milk Processing Industry (MPI) and the farmer would have a stronger bargaining position not only as a price taker but also in turn they could enhance their income.

Drinking fresh milk is the best choice to get the best benefits from a glass of milk. Although processed milk has been added some nutrients, fresh milk has perfect milk nutrient content and provides good benefits for the body. Feeding program for school children in Indonesia is far behind compared to other countries. In 1940, The US started to...
develop National School Lunch Program and officially continued the program since 1969. This program has been successful to increase the milk consumption of children and its impact to children’s intelligence and health conditions [2].

The government of Thailand supported School Milk Program for children by giving them fresh milk at school. This program utilized 33% fresh milk production in the country. This program significantly impacted the increased milk consumption and the revenue of dairy farmers [1].

Thailand started dairy development since 1960 and was successfully increasing national milk consumption through school milk program, which was launched since 1983. Nowadays every year in 260 days more than 6 million children in schools drink milk [7]. As [6] mentioned, the milk program for school children has been contributed to the national milk consumption up to 50%. The program started with powder milk and gradually changed into fresh milk from the country’s production.

Milk for children at school has been also implemented in Indonesia. The [4] concern was to encourage medium milk processing industry (MPI) to produce milk for supporting milk for children at school program. The medium-scale MPI got guaranty in the sustainability of fresh milk supply and milk marketing network by a captive market in particular period, such as through the milk program for school children. Thus, there was interdependency between on-farm activities and the milk handling, processing, distribution and marketing to consumer.

Drinking fresh milk has other benefits such as the price aspect. So far, people think that milk is expensive food. They obviously bought processed milk such as Ultra High Temperature (UHT) milk, which has a luxury package and a high price. But this does not apply to fresh milk. Fresh milk is certainly more affordable since there is no need to process in manufacturing. In an economic calculation, the price of milk powder is double the price of fresh milk from farmers. By a more affordable price of milk, it can be consumed by people of every income level (low to high income class). It will enforce the habit on consuming milk and will increase national milk consumption.

The implementation of SMP can help the children practice what they learn in their classroom about healthy eating and the impact of drinking milk for their body, brain, and health

2. Materials and Methods

The materials of this study are elementary school pupils of fourth and fifth grades at Argosari Muhamadiyah School, at Sedayu, Bantul, in DIY Province together with their parents. Providing extension and discussion to the teachers, pupils and their parents on milk especially pasteurized milk about its ingredients and the advantage for human being and how to get the milk. It was accomplished by a special educational trip for the pupils to the Faculty of Animal Science GMU in order to get more comprehension about milk, where did it come from, how was it processed. Furthermore, they were also asked to draw what they saw in the trip and it is to be hoped that their knowledge on milk would give more impression in their mind that would make them more milk minded. On the occasion, there was an agenda of drinking milk together.

![Figure 1. Schema of the School Milk Program agenda](image-url)
3. Result and discussion

The school Milk Program had much been performed in Indonesia, but it was usually by giving milk free to the people for several times, therefore if the program finished, the milk drinking also stopped. With the program of the Faculty of Animal Science GMU, the pupils were asked together to save parts of their pocket money every day, so if they had been saving the money they would be able to buy milk. With this way, the school would be able to hold the routine agenda of drinking milk together, on the other hand pupils could also drink pasteurized milk routinely. It was also hoped the pupils in the rural area could keep drinking pasteurized milk routinely on their own free will and not depending on the milk aid program, since they had been the milk minded.

The results of the study showed that the average of pupils brought pocket money of 2,000 IDR every day. The price of fresh milk/pasteurized milk was 2,000 IDR per cup. From the data collected most of the parents (61.29 %) and 62.50 % of the pupils want to save of 500 IDR per day to buy fresh milk (pasteurized milk) even 22.58 % parents and 34.37 % pupils want to save of 1,000 IDR per day and the remainder wants to save less than 500 IDR. It can be concluded that either parents or pupils are able to save 500 IDR per day to buy fresh milk (pasteurized milk). Also 62.29 % of the parents want the program of drinking milk together to be held once a week in the school. On the other hand, the program of drinking milk together can be held once a week.

With the above data, we can analyse the implementation of SMP in the rural area through SWOT analysis as follow:

<table>
<thead>
<tr>
<th>Strength</th>
<th>Weakness</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. There is a will from the pupils to drink milk together at school.</td>
<td>1. Most of the people consume milk in the form of milk powder and condensed milk.</td>
</tr>
<tr>
<td>2. The willingness of pupils to save their pocket money for buying milk at school and support by the parents.</td>
<td>2. Most of the people consider that milk is only for baby.</td>
</tr>
<tr>
<td>Opportunity</td>
<td>Threat</td>
</tr>
<tr>
<td>1. Availability of fresh/ pasteurized milk supplier.</td>
<td>1. Low accessibility of fresh/pasteurized milk in the rural area.</td>
</tr>
<tr>
<td>2. Availability of facility to keep fresh/pasteurized milk.</td>
<td>2. Fresh/pasteurized milk (ready to drink) storage not available at school.</td>
</tr>
<tr>
<td>3. Availability of extension service for pupils to explain the advantage of fresh milk (pasteurized milk)</td>
<td></td>
</tr>
</tbody>
</table>

Figure 2. SWOT analysis

Based on a SWOT analysis (Table 1), it is shown that drinking milk in school will continue and it is sustainable because they realized that the milk is good for their health. Pupils in Muhammadiyah Argosari elementary school bought 450 cups of fresh milk (pasteurized milk) per week, which means every student drinking two cups of milk per week in school. Although the program is officially finished, they are still routinely drink milk. The supplier reported that Muhammadiyah Argosar I Elementary School regularly buy fresh/pasteurized milk.

The School Milk Program will be successful and sustainable if organizers set up and pay attention to the necessary facilities and infrastructures. Not merely providing help by offering free milk and then the program just stopped and left without any evaluation. If SMP with this method would be held nationally to all primary school children in addition to the increase milk consumption in Indonesia, it would also change the kind of milk consumption of Indonesian people namely from powder or condensed milk to liquid milk or pasteurized milk. And it can help dairy farmers in marketing of fresh milk. So far, the marketing of fresh milk from farmer is 92% to MPI which it tends to be monopsony-market-structure and farmer is price taker. When demand of pasteurized milk increases, there would be another alternative fresh milk market instead of MPI, since pasteurized milk processing can be done by the industry of middle scale than factory industry. Therefore, the fresh milk market is more competitive and there is an increase in the bargaining power of the farmer.

4. Conclusion

All of the pupils and teachers in Muhammadiyah Argosari Elementary School have been participated during SMP. All of the pupils joined to save their pocket money for buying milk at school but the number varies. With this way the
school would be able to hold the routine agenda of drinking milk together or the SMP in this area successfully and sustainably.

SMP will become successful and sustainable if the program organizer pays attention to the facilities and infrastructures. Further program and policy should be realized that the strength, the weakness, the opportunity and the threat of the people are main drivers to make a sustainable school milk program (not only by government aid). With a continuous success of SMP, the issue of sustainable future for human security is supported through the increase of milk consumption and the welfare of dairy farmers.

Acknowledgements

We must express our deepest appreciation to the Faculty of Animal Science, Gadjah Mada University for funding the program, Department of Socio-Economics of Livestock and all teachers and pupils at Muhammadiyah Argosari Elementary School, Sedayu, Bantul, DIY Province, Indonesia, for the help and support during the program.

References

Zoonoses Impact Endoparasites of Orangutan Ex-Captive at Lamandau River Wildlife Reserve, Central Borneo

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\textsuperscript{b}Degree Program Faculty of Agriculture, Bogor Agricultural University
\textsuperscript{c}Department of Animal Disease and Veterinary Public Health, Faculty of Veterinary Medicine, Bogor Agricultural University
\textsuperscript{d}Orangutan Foundation UK, Central Borneo

Abstract

Gastrointestinal parasites are important infectious causes of diarrhoea in Orangutan ex-captive. However, distribution data of gastrointestinal parasites in wildlife reserve are scarce. This research aims to identify the distribution of endoparasites in Orangutan ex-captive at Lamandau River Wildlife Reserve, Central Borneo. All 30 samples feces were microscopically examined after a fixative concentration and took from fresh samples feces. Identification was used by Ridley's method and floating method. We found protozoans Entamoeba coli (60%), Balantidium coli (60%), and Entamoeba histolytica (10%) that can be zoonotic to human. Helminth eggs were found to Ascarid type (43.3%), Strongyloid type (6.7%), and Trichurid type (16.7%). The results showed that protozoan and helminth can be infected from human to Orangutan, and vice versa. This can cause zoonotic disease.

Keywords: Endoparasites; Orangutan Ex-Captive; Zoonotic Disease

1. Introduction

One of the great ape species to inhabit Southeast Asia is the Orangutan (\textit{Pongo pygmaeus}). Orangutan is an endangered species of native animals in Indonesia. Orangutans are included in the category of endangered species by the IUCN (International Union for Conservation of Nature) Red List\textsuperscript{1}. Orangutan releases activity is targeting to prevent this species from the extinction. These efforts cannot be separated from a variety of problems, including infectious diseases of the gastrointestinal tract\textsuperscript{2}. Infections with gastrointestinal parasites are wide spread among Orangutan, mainly ex-captive\textsuperscript{2,3}. Several studies have shown susceptibility of non-human primates to many agents causing human disease\textsuperscript{4}. The pathogen exchange is believed to become potentially high, as a consequence of the close phylogenetic relationship between humans and non-human primates. Awareness of the potential zoonotic pathogen transmission is essential, since direct or indirect contact between human and non-human primates and of their excreta is inevitable. The maintenance of the high standard of any wildlife reserve compels management to provide the necessary care and wellbeing of animals, particularly caged animals\textsuperscript{5,6}.

2. Materials and Methods

2.1. Site research

The research taken place faecal in the area of the Lamandau Nature Reserve, whereas faecal examination at the Protozoologi and Helmintologi Laboratory, Department of Animal Diseases and Veterinary Public Health, Faculty of Veterinary Medicine at Bogor Agricultural University, Indonesia.
2.2. Ex-captive orangutan

Orangutan faecal samples used in this study were from a total of 30 individuals. The location was taking at Camp Gemini and Siswoyo Lamandau Nature Reserve, Central Borneo. Orangutan is a semi-wild solitary, so the faecal collection made on each individual with the help of field officers.

2.3. Preservation of orangutan faecal

Samples were taken from a fresh faecal of approximately 10 g of each individual. Orangutan faecals were split into two parts. The first faecal sample was inserted into a plastic vial (diameter 5 cm) and 5-10 drops of fixation solution SAF (sodium acetate, acetic acid and formaldehyde) were added. The second faecal sample was inserted into a plastic bag and given 10 drops of potassium bichromate. The collection of samples was done in the morning, as the orangutans habitus let them usually defaecate after waking from the nest. The identification of orangutans was helped by field officers to avoid taking faecal from the same individual.

2.4. Macroscopic examination

Macroscopic examination of the inspected faecal was done shortly after orangutan defaecate. Inspection parameters were such as consistency, faecal color, foreign bodies, fragments of adult worms or undigested food.

2.5. Microscopic examination

Microscopic examination of faecal was done using two methods by Ridley’s methods and buoyancy method. The second examination was carried out as a way to detect the presence of gastrointestinal parasites in faecal orangutan as a comparison to be more accurate and thorough.

2.6. Ridley’s method examination

Faecal examination was performed using the Ridley’s method with SAF solution fixation (sodium acetate, acetic acid and formaldehyde 40%). Observations by Ridley’s method was done by faecal samples about 1 gram, put in a tube with a diameter of 4 cm, then added 9 ml SAF solution. Samples of orangutans faecal were destroyed by the rod and shaken, then filtered. Then, 3 ml of ethyl acetate tube inserted into the sample and shaken for 1 minute. Samples were then centrifuged 1500 rpm for 2 minutes. In the centrifuge the supernatant was discarded except for the deposits. The remaining sediment was added to a solution of 3 drops of SAF. These results were taken with a pipette and then dropped over the object glass and covered with a cover glass and observed with a microscope magnification of 40 times.

2.7. Floating method examination

The floating method examination was used by saturated salt solution. Faecal was put in a plastic cup and then added with saturated salt solution. Faecal was first stirred until blended and then filtered and finally centrifuged at 1500 rpm. Then, the supernatant was discarded and the sediment was saturated with salt solution added little by little until the convex surface of the tube. The cover glass was placed on the surface of the tube for 5 minutes. Cover glass was removed and placed on the object glass and observed with a microscope magnification of 40 times.

3. Results and Discussion

3.1. Result

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consistency</td>
<td>Soft – Hard</td>
</tr>
<tr>
<td>Colour</td>
<td>Green – Blackish brown</td>
</tr>
<tr>
<td>Fragments of the helminth (worm)</td>
<td>None</td>
</tr>
<tr>
<td>Undigested food</td>
<td>Plant seeds</td>
</tr>
<tr>
<td>Foreign objects</td>
<td>None</td>
</tr>
</tbody>
</table>
Table 2. Microscopic examination

<table>
<thead>
<tr>
<th>Type of Infections</th>
<th>Total (Individual)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Helminth</td>
<td>5</td>
<td>16.7</td>
</tr>
<tr>
<td>Protozoa</td>
<td>9</td>
<td>30.0</td>
</tr>
<tr>
<td>Mixed</td>
<td>12</td>
<td>40.0</td>
</tr>
</tbody>
</table>

**Protozoa Infections**

- **Balantidium coli**: 18 (60.0%)
- **Entamoeba coli**: 18 (60.0%)
- **Entamoeba histolitica**: 3 (10.0%)

**Egg Helminth Type Infections**

- **Ascarid**: 13 (43.3%)
- **Strongylid**: 2 (6.7%)
- **Trichurid**: 5 (16.7%)

---

![Fig. 1. (a) Balantidium coli; (b) Entamoeba coli; (c) Entamoeba histolitica; (d) Ascarid type; (e) Strongylid type; (f) Trichurid type](image)

3.2. Discussion

Results of macroscopic examination have shown that the consistency of faecal was soft until hard. Consistency of a hard faecal was usually found in puppies orangutan (*Pongo pygmaeus*), whereas in adult individuals are relatively more lenient. Orangutan faecal showed dark brown to yellowish green. The objects found in orangutan faecal are seeds of plants as undigested food. From all orangutans examined, almost all were identified as being infected by endoparasites. *Pongo* sp., being one of the great apes is highly susceptible to many human diseases. Zoonoses is a disease that can spread from animals to humans and vice versa. The endoparasitic digestive tract infections in orangutan were protozoan and worm.

Protozoans that are most often found in the faecal of orangutan are *B. coli* and *E. coli*. *B. coli* is a zoonotic pathogen that can cause subclinical infection in humans. *B. coli* is a large ciliated protozoan that is present in the pig...
which of many were found in the samples are parasites commonly found in the human body: E. coli non-pathogenic can cause the weakened condition or even death of animals that have low immunity, such as caused by stress, pregnancy, poor conditions, as well as old age and disease infected. The most important factor of E. histolytica regarding the human influence on the role of NHP is that it is a potential reservoir for zoonotic transmission, so that it cannot be underestimated. Ascarid egg type which of many were found in the samples are parasites commonly found in the human body. Another egg type were strongyloid and trichurid, this kind found much in the ground, commonly in human too. It can make a transmission to Orangutan or vice versa. Free ranging orangutans are arboreal and their diet includes mostly fruits, leaves, bark, buds, and flowers. This condition makes them less predisposed to soil-transmitted helminthic infections like hookworms and Ascaris spp. The presence of Strongyloides parasites in captivity suggests their susceptibility to waterborne, foodborne and soilborne infections due to ground dwelling, crowding and poor hygiene.

The Release Central of orangutans need to health monitor the wildlife including endoparasitic infections (worms and protozoan). This prevents the possibility of transmission among orangutans in the wild. Orangutan is very sensitive to waterborne, foodborne and soilborne infections due to ground dwelling, crowding and poor hygiene. Ascarid egg type w

The conclusion is that the endoparasites identified in the samples can infect the Orangutans and human or vice versa, because this endoparasite was detected in excreta of Orangutan ex-captive at Lamandau River Wildlife Reserve, Central Borneo.

Acknowledgements

Authors would like to thank the BKSDA Central Borneo and Orangutan Fondation UK for the research permit to work in Lamandau Nature Reserve; drh. Fikri and Mr. Tigor for help in the orangutan reserve. The study was financially supported by Orangutan Fondation UK. The author would also like to thank Dr. drh. Hj. Umi Cahyaningsih, MS and to anonymous reviewers for their helpful comments.

References

Market Conduct of Vegetable Seed Industry In Indonesia

Bambang Sayaka

Abstract

In Indonesia’s industry of vegetable seed, there are 124 domestic investment companies and 10 foreign investment companies. The domestic seed companies consist of large and small-scale producers. This study aims to analyze the market conduct of both domestic and foreign vegetable seed producers in Indonesia. This study was carried out in Jakarta, West Java, Central Java, Yogyakarta, and East Java Islands from April to November 2012 using a descriptive approach of functional analysis and cost and income analysis of the seed companies. Most large seed producers, both domestic and foreign seed companies, produce the vegetable seed on their own farm land and also collaborate with seed growers’ groups. The seed growers consist of small farmers who made agreement contracts with the seed companies. This collaboration between seed companies and seed growers’ groups is beneficial to both parties. The seed companies do not have to rent the farmland, it is easy to get labor and could share the risks. On the other hand, the seed growers get higher profits rather than growing vegetable crops and they get capital assistance from the seed companies. The small-scale vegetable seed companies usually rent for the farmland for growing seed or ask the other parties to grow their seed with certain fee. Seed marketing conducted by the large-scale companies is integrated vertically, namely from seed growing, processing, packing, branding, and distributing. Small-scale vegetable seed producers usually just process their products, but marketing is carried out by other parties. Capital assistance to the small-scale seed companies is urgent in order to improve their business scales including marketing distribution networks.

Keywords: Indonesia, vegetable seed, large-scale producer, small-scale producer, market conduct, profit

1. Introduction

1.1. Background

Law No. 13/2010 on Horticulture deals with horticulture sub sector conduct including horticulture seed business. Horticulture is defined as anything related with fruits, vegetables, medical plant substance and floriculture including mushrooms, moss, and aquatic plants functioning as vegetables, medical plants, and/or ornamental plants [1].

In the domestic industry of vegetable seed there are 124 domestic investment companies and 10 foreign investment companies. Those multinational producers are located in the Provinces of Jakarta, West Java, Central Java, Yogyakarta, and East Java. The vegetable seed producers are located in Sumatera, Java, Bali, west Nusa Tenggara, and Sulawesi.

The article 100 verse 3 of Act No. 13/2010 states that foreign ownership of in the horticulture business is maximal of 30 percent. During four years after the Act legislation or the latest in 2014 all foreign investors in horticulture business has to sell their shares such that their share ownership is not more than 30 percent (article 131).

All of the business sectors in which foreign investments are allowed, are previously regulated in the Presidential Regulation (Perpres) No. 77/2007 then it was changed into Perpres No. 36/2010 [3]. In the Annex of Perpres No. 36/2010, seed business is open to foreign investment. Maximum foreign investment in staple food seed industry is 49 percent. Other food crop seed business including that of horticulture seed allows foreign investment not more than 95 percent. Limitation of foreign investment in horticulture business is based on domestic seed horticulture industry sovereignty.

Around 70 percent of Indonesia’s vegetable seed market share is dominated by those of multinational companies. For example, East West Seed Indonesia controls 45 percent of domestic market seed share. Especially for the tomato, chili, and cucumber seeds this company controls 60-70 percent of the domestic market share [4]. Currently this company produces 160 varieties of vegetable seed varieties as many as 3,000 tons per year [5].
It is necessary to anticipate impacts of this Law implementation on horticulture seed industry conduct related with its effectiveness. Change in foreign investment in the horticulture (especially vegetable) seed industry may affect changes in conduct and performance of the horticulture seed market.

1.2. Objectives

This paper aims to analyze the conduct of domestic vegetable seed market in Indonesia. The market conduct is affected by capital and technology owned by the producers. In addition, the market conduct will affect the producers’ performance. Specifically the paper analyzes: (i) seed distribution, (ii) payment methods, (iii) product promotion; (iv) profits of seed producers, distributors, and growers; (v) seed producers’ responses to the rule of foreign investment share ownership; and (vi) training and technology transfer from multinational seed companies to the small-scale companies.

2. Methodology

2.1. Conceptual Framework

Market structure of a product is basically affected by the product supply and demand [6]. Related with Indonesia’s vegetable seed industry, the seed supply is affected by the raw material or the seed parent stock, technology, durability, value, volume and business objective. Seed demand is affected by price elasticity, vegetable production growth rate, substitution, marketing types, purchase method and seasonal character. Government policy, such as Law of No 13/2010 on horticulture, may affect the structure, conduct, and performance of the company in the seed industry.

2.2. Locations of the Study

The study was conducted in the most-intensive production and marketing areas of local and multinational vegetable seed companies, namely in Jakarta, West Java, Central Java, Yogyakarta, East Java, and Bali Provinces. The study was also carried out in the head offices of the seed producers.

Respondents of this study consisted of foreign and local seed producers, vegetable farmers, distributors and retailers. Other respondents were officials of the Directorate General of Horticulture, Indonesia’s Investment Coordinating Board (BKPM), Agricultural Service Offices at provincial levels, and Vegetable and Food Crop Seed Control and Certification Agencies (BPSBTPH). There were 16 local producers and 6 foreign producers and the total respondents were 117 persons.

Primary data consisted of vegetable seed prices, volumes, and value of sale and vegetable varieties. Secondary data included total number and types of vegetable seed producers and regulations on horticulture business investment. The study also collected data and information on farmers’ preference and market strategy of vegetable seed.

A descriptive analysis, i.e. a functional approach, was carried out to analyze the conduct of vegetable seed industry. Performance of the vegetable seed industry was analyzed using a cost and income analysis of the vegetable seed producers, distributors, and growers.

3. Results and Discussion

3.1. Seed Producers

Besides the multinational vegetable seed companies, this industry also attracts local investors. Some of the multinational seed producers are PT East West Seed Indonesia (ESWI), PT Branita Sandhini (Monsanto), PT BISI Internasional Tbk (BISI), PT Clause Indonesia (Clause), PT Oriental Seed Indonesia (Oriental), and PT Koreana Seed Indonesia (Koreana). Local seed producers among others are PT Inko Seed Makmur, PT Prabu Agro Mandiri, PT Primaseed, PT Aditya Sentana Agro (Aditya), CV Aura Seed Indonesia (Aura), and PT Benih Citra Asia (BCA).

Many seed producers, both multinational and local companies, in Indonesia indicate that this industry is promising. Relatively higher vegetable seed prices than those of food crop seed are not constraint to the farmers to purchase the vegetable seed.

3.2. Market Conduct

The vegetable seed producers distribute their products through distributors, retailers or directly to the farmers. The large seed producers usually sell their products through agents or branch offices. New seed varieties are usually introduced through a farmers’ land demonstration. The large seed companies usually have their own extension workers
or usually called as the technical service workers. These private technical service workers will give extension to the farmers growing their respective companies’ seed products. Feedback from the vegetable farmers will be received immediately by the seed producers through their extension workers.

Distributors’ payment method to the multinational seed producers is by cash. Payment from distributors to the local seed producers is using a credit scheme of one to three months. During the peak vegetable planting season, the seed producers will not give any credit scheme to the seed traders, but the company has to pay in cash or credit in advance. The producers usually transported their seed products to the distributors’ outlets. Around 95 percent of the seed is sold before its date of expiration. The unsold seed is usually due to its low growth rate and the traders will expel it. Based on the traders’ experiences, they will just sell limited quantity of vegetable seed to reduce the risk of unsold seed.

Most seed producers collaborate with seed growers in producing the seed. Few producers produce the seed by themselves to ensure the seed quality and less cost. Seed growers get capital assistance from the seed producers. The seed grown by the seed growers is the seed already tested by the breeders internally and is produced for commercial purpose. Requirements for seed grower’s area: (i) the member of seed grower’s group; (ii) holding farmland through ownership or rent; and (iii) approved by the seed grower’s leader.

Seed promotion is usually carried out by large seed companies. Promotion methods consist of free samples to the farmers, leaflets, posters, and banners. Seed promotion is also conducted using mass media, such as television, radio, newspaper, and magazine. The large seed companies, especially the multinational ones, carry out promotion intensively because they have sufficient financial resources. To some extent, seed promotion is effective because the farmers will easily observe the new varieties released the seed producers through the companies’ advertisements.

3.3. Profits of Vegetable Seed Industry Actors

The seed producers’ profit is the difference between value and costs of seed growing, processing, packing, and marketing. Profits earned by the seed producers vary and depend on the types of crops and quality ranging from 63 to 200 percent.

Seed traders get low profit per seed package they sell, i.e. 1 to 3 percent per seed pack, but they earn much profit in total numbers. Besides selling vegetables seed, the distributors and the retailers usually also sell agricultural inputs, such as fertilizer and pesticides and some agricultural-equipments, such as pesticide sprayers.

The seed growers’ profit is determined by the seed yield and type of crop seed. They may earn profit between 60 to 130 percent of their cost of production. It is possible that the seed growers get loss if their seed production is relatively low such that its selling value is less than its production cost. Most seed producers collaborate with seed growers in producing seed through partnership in which the growers provide farmland, fertilizers, pesticides and labour.

Parental seed supply is the seed companies’ subject to agreement that the parental seed is not transferrable to other farmers and the growers have to sell all of the seed they produce to the seed companies. This collaboration is beneficial to both parties. The companies do not need their own relatively large area for seed production and also share the risks with growers. On the other hand, the growers get profit which is higher than they produce vegetable for consumption purpose. Some seed companies, for example Koreana, produce the seed at its own green houses. This company argues that self-produced seed is easier to control.

3.4. Responses to the Foreign Share Ownership

Chapter 100 of Law No 13/2010 states that foreign investment in horticulture industry, including the vegetable seed industry, is only allowed for the large-scale horticulture business (verse 2). All of the multinational vegetable seed companies agree on this issue. They will not invest on small or medium scale horticulture business in Indonesia. It is also less beneficial if the foreign seed companies invest for small and/or medium scale business.

Investment on horticulture business is limited to 30 percent (chapter 100 verse 3) and it will be applied four years after the Law No 13/2010 is enacted or not later than the year 2014. Most of the multinational vegetable seed companies do not agree with this rule. There is one foreign company already selling their shares to local investors, for example PT BIS. They suggest that the rule is applied to the new investors, but the established companies are allowed to fully control the share ownership. There will be two negative impacts if the is rule is applied to all multinational companies in the horticulture industry. First, it creates uncertainty to foreign investment because the other Law allows 100 percent ownership of foreign share. Second, investment ownership transfer to local investors and technology transfer to the domestic investors (chapter 101) are wrong. The foreign investors argue that selling of companies’ share publicly will make them dependant on the majority of shareholders. On the other hand, technology control is accessed through long-term research and development structurally. Thus, they will not transfer their technology freely to the domestic investors. The multinational seed companies see the domestic seed producers as their competitors and not their partners.
Some of the foreign investors, however, state that if they have to sell their investment to the local investors, they are still allowed to hold larger companies’ shares, for example at least 51 percent. It means that the foreign investors are still able to control the companies. The BKPM suggests if the rule of 30 percent foreign investment ownership is applied, it is possible that the foreign investors with only 30 percent of share ownership are granted the right to control the company.

All of the domestic vegetable seed producers agree to the rule of 30 percent of foreign share ownership. They are willing to buy the foreign shares based on the existing market price. The domestic market share will increase as the foreign market share decreases. Most government officials and researchers agree that the local investors hold the share majority in seed industry. They also believe that they are able to run the vegetable seed companies formerly owned by the foreign investors. However, it is necessary to anticipate the impact foreign share ownership. So far, the multinational vegetable seed producers are superior in inventing the improved vegetable seed varieties than those the domestic seed producers.

4. Conclusion and Policy Recommendation

4.1. Conclusion

All large-scale seed producers sell their products through distributors and then they distribute the seed to retailers or farmers. Large-scale producers usually have their own marketing agents. Farm experiments at farmers’ farmland are the common way of seed promotion. The distributors will determine the most promising varieties for seed production. Seed producers’ profits are relatively high, namely more than 30 percent of selling value. On the other hand, seed traders’ profits are relatively small, but large volumes of seed sale let them receive more nominal profits. Vegetable seed growers get higher profits than vegetables farmers. Foreign seed producers usually ask cash payment for their products from distributors. Local seed producers apply credit payment from traders varying from 1 to 3 months period. Around 95 percent of seed supply at traders’ level is sold out before date of expiration. The traders will limit their supply to avoid unsold seed. The expired seed is eradicated as the growth rate is below the standard. Seed production is carried through partnership with seed growers. Some producers produce the seed by themselves based on efficiency and safety reasons. Most multinational seed producers do not agree with the rule that they have to sell most of their share due to anticipated lost control of the companies. These companies also reject to transfer their technology to local investors as they get it through intensive, costly research and development activities.

4.2. Policy recommendation

Seed promotion is effective in seed distribution, but small producers could not conduct it, as it requires much financial resources. Limited seed promotion through vegetable farm demonstration is suggested to the small producers. Collaborating with seed growers will improve growers’ income and share the producers’ risk. Producing seed without collaboration with seed growers is possible but seed production is limited for relatively small quantity. Local seed producers need to improve their performance, especially in term of improved varieties invention. New varieties invention is absolutely urgent to local producers such that they are able to compete with foreign producers in the long run. The government needs to encourage vegetable seed investment to improve its performance. Ruling the foreign vegetable seed investors to sell their major share may improve the domestic seed investors’ share ownership. It needs more intensive assessment as this policy may affect the vegetable seed industry performance. Forcing the multinational seed companies to transfer their technology seems difficult to implement, as the technology is the determining factor in vegetable seed market competition.

Acknowledgement

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References

Resistance for Two Woods Species from School Building with Cigarette Waste Water to Subterranean Termites Attack

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Abstract

Sengon (Paraserianthes falcataria) and Nangka (Artocarpus integra), which are often used as school building material, were soaked for 5 hours using cigarette waste water to study their resistance against termites. For comparison, untreated wood were prepared. All wood specimens were tested against subterranean termite (Coptotermes curvignathus Holmgren) in the laboratory. Sizes of wood specimen were 2 × 0.8 cm in cross-section for subterranean termite. Three replications were conducted in the laboratory test. Results showed that Sengon (Pariserianthes falcataria) and Nangka (Artocarpus integra) were more resistant to subterranean termite. Based on the Indonesian National Standard 2006, wood resistance against subterranean termites increased one class higher when samples were treated with cigarette waste water than wood without treatment. Bioactive compounds was isolated from cigarette waste water (soak from Syzygium aromaticum). The formulation product consist of Fenol as active ingredient on controlling the target pest. The result of cigarette waste water test indicated 2-Propenoic acid, 3-phenyl, (CAS) trans-Cinnamic acid (CHCO₂H). The Fenol formulation showed an efficacy level of wood protection at 30% (v/v).

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Keywords: Subterranean termite, termite resistance, cigarette waste water, Coptotermes curvignathus

1. Introduction

Subterranean termites Coptotermes curvignathus Holmgren are an important group of urban insect pests in tropical countries [1, 2]. The economic loss due to termite attack increases every year and in the year 2000 it is estimated to reach 373 million US$. On the other hand, two kinds of woods, which are often used as building material, are usually used for building of schools as well and show a low wood resistance. Moreover, the social as well as ecological impact caused by termite attack should also be considered [3].

Currently, most of termicidides are using chemicals. Although insecticidal treatments have been used worldwide to prevent and control subterranean termites since the late-1960s, the new management concepts have recently gained popularity with the increased public concern about environmental soundness [4]. Therefore, the search for less or non-chemical alternatives is very urgent and needed. One of the technologies, which show potential to be developed as alternative, is using cigarette waste water.

Cigarette waste water are cloves soaking Syzygium aromaticum, one promising plant species which can provide sufficient quantities of active compounds as a result before cigarette production process [7] and has been use for large scale pest management [5, 6]. Some researchers have used cigarette waste water for plant biopesticide and wood preservative [8, 9]. The main objective of this study is to develop of a non-destructive termite control methods using cigarette waste water that could be applied to control subterranean termites C. curvignathus Holmgren attack.

2. Materials and Methods

2.1. Cigarette Waste Water

Cigarette Waste water derived from clove marinade (Syzygium aromaticum) before the cigarette manufacturing process. This water waste which contains phenol released, was used for soaking wood specimens for 5 hours. For comparison, wood without treatment acted as control sample. For cigarette waste water treatment, wood specimens were soaked in 10%; 20%; 30%; 40% and 50% cigarette waste water for 5 hours using cold soaking process. All treated woods were conditioned at room temperature for one month prior to the tests. The width and thickness of
Sengon and Nangka woods were 2 and 0.8 cm respectively while the length was according to the purpose of the test. The number of replications was 3 for laboratory tests.

2.2. Wood Treatment Test

Samples of Sengon (Paraserianthes falcataria) and Nangka (Artocarpus integra) wood which are often used as school building material from Semarang, Indonesia, were used in the experimental research. This research compared two wood school building that were utilized the same age, which is two years. Then, the wood specimens (2.5 × 2 × 0.8 cm) were put in the oven at 100 °C until constant weight and then placed in a 450–500 ml wide-mouth round glass of jar with a bottom area of 25–30 cm². Each glass of jar was then added 200 g moist sand (7% moisture content under water holding capacity) and 200 healthy and active worker subterranean termites (Coptotermes curvignathus Holmgren). The jar was then kept in a dark room at 25–30 °C with more than 70% relative humidity for four weeks. Each week the bottles were weighed and if moisture content of the sand reduced 2% or more, water was added to reach the standard moisture content. At the end of the four weeks, weight loss of wood specimens and termite mortality percentages were determined (SNI 2006).

Prior to the bioassay, sample of woods were conditioned in the oven at 60 °C for three days and weight of dry oven wood sample was measured. Dried-oven wood samples were subjected to the termite attack in laboratory scale. Two hundred and one hundred fifty workers of termite were subjected to forced feeding test and then fifty soldiers were introduced along into the container. This container was kept at room temperature in dark condition. The observation was conducted every two days during four weeks test periods. Termite mortality rate and sample weight loss were recorded.

Sample weight loss = \( \frac{(ODS1 - ODS2)}{ODS1} \times 100\% \)  \hspace{1cm} (1)

ODS1 is oven-dried sample before test, while ODS2 is oven-dried sample after test

2.3. Formulation of Fenol from Syzygium aromaticum soak

The preparation standart was 100 mg stock each of fenol standart transferred to 100 ml satndart volumetric flask containing 20 ml methanol, mixed thoroughly and diluted to 100 ml mark with methanol. Then the sample preparation coke oven effluent sample fwasiltered through 0.45 µ membrane filters and injected 1.0 µl sample Syzygium aromaticum soak in GCMS system directly.

3. Results and Discussion

Untreated Sengon was more resistant than untreated Nangka up to three weeks of laboratory treatment but after that, both woods had the same level of resistance. There was no evidence of fungi attack and instead deterioration of both woods was due to termite attack. Cigarette waste water treatment did not enhance the resistance of Nangka against subterranean termite attack (Table 2). However, Sengon wood showed better resistance against termite damage for up to three weeks. Leaching rate is greater in wood with lower density.

Emulsion stability testing is very important and an integral part of formulation development. This test was conducted using bottle test method in order to find the optimum ratio between active ingredient and emulsifiers. Termite mortality observation showed cigarette waste water has higher toxicity level. The result of the wood treatment test indicated, that Nangka (Artocarpus integra) with cigarette waste water (10%) treatment has lower efficacy level compared to Sengon (Paraserianthes falcataria) with cigarette waste water (10%). In highest concentration, cigarette waste water gave 100% termite mortality rate at 50% concentration on 5 hours soak of bioassay.
Table 1. Termite subterranean mortality percentage of the efficacy test of cigarette waste water treatment from *Syzygium aromaticum* soak

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Conc (%)</th>
<th>Soaking (hours)</th>
<th>Sengon (<em>Paraserianthes falcataria</em>)</th>
<th>Nangka (<em>Artocarpus integra</em>)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control</td>
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<td>0</td>
<td>0.00±0.00</td>
<td>0.00±0.00</td>
</tr>
<tr>
<td>10%</td>
<td>1</td>
<td>0</td>
<td>0.00±0.08</td>
<td>0.00±0.07</td>
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<tr>
<td></td>
<td>2</td>
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<td>0.00±0.10</td>
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</tr>
<tr>
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<td>0</td>
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<td>40%</td>
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</tr>
<tr>
<td></td>
<td>5</td>
<td>100.00±0.00</td>
<td>100.00±0.00</td>
<td></td>
</tr>
</tbody>
</table>

Each sample was scored and these values were the averages of three replication.
Table 2. Weight loss of wood specimen and termite mortality during in laboratory

<table>
<thead>
<tr>
<th>Test specimens</th>
<th>Conc (%, v/v)</th>
<th>Soaking (hours)</th>
<th>Sengon ( (Paraserianthes falcataria) )</th>
<th>Nangka ( (Artocarpus integra) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (untreated wood)</td>
<td>0</td>
<td>5 ± 5.27</td>
<td>4 ± 2.60</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>7%±0.04</td>
<td>9%±0.06</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>9%±0.05</td>
<td>4%±0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>10%</td>
<td>6%±0.03</td>
<td>5%±0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5%±0.02</td>
<td>13%±0.10</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>15%±0.08</td>
<td>18%±0.14</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3%±0.01</td>
<td>7%±0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>5%±0.02</td>
<td>7%±0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>20%</td>
<td>12%±0.07</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>15%±0.08</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>7%±0.03</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3%±0.02</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3%±0.02</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>30%</td>
<td>4%±0.03</td>
<td>2%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2%±0.01</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>5%±0.03</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>6%±0.03</td>
<td>4%±0.03</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3%±0.02</td>
<td>5%±0.04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>40%</td>
<td>1%±0.01</td>
<td>2%±0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>2%±0.02</td>
<td>1%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1%±0.01</td>
<td>3%±0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>1</td>
<td>3%±0.01</td>
<td>2%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3%±0.01</td>
<td>3%±0.02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>50%</td>
<td>1%±0.00</td>
<td>2%±0.01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1%±0.01</td>
<td>1%±0.00</td>
<td></td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1%±0.00</td>
<td>1%±0.00</td>
<td></td>
</tr>
</tbody>
</table>

Each sample was scored and these values were the averages of three replications.

Table 3. The F values from analysis of variance results

<table>
<thead>
<tr>
<th>subterraneal termite</th>
<th>Weight loss</th>
<th>Mortality</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wood species (A)</td>
<td>3.964**</td>
<td>6.366**</td>
</tr>
<tr>
<td>Treatment (B)</td>
<td>96.756**</td>
<td>14.981**</td>
</tr>
<tr>
<td>Interaction (AB)</td>
<td>1.298*</td>
<td>1.559*</td>
</tr>
</tbody>
</table>

**=highly significant difference; *=significant difference.

Table 4. Result Duncan’s test

<table>
<thead>
<tr>
<th>Test, response</th>
<th>Wood failure degree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>control 10% 20% 30% 40% 50%</td>
</tr>
<tr>
<td>Subterraneal termite</td>
<td>a a b Bc c C</td>
</tr>
<tr>
<td>Weight loss</td>
<td>a a b Bc c C</td>
</tr>
<tr>
<td>Mortality</td>
<td>c bc b Ab ab A</td>
</tr>
</tbody>
</table>

The table above indicates no significant difference between the same letter in each test.
Results for wood failure degree after four weeks in laboratory test and their analysis are shown in Tables 1. Untreated Sengon (Paraserianthes falcataria) was more resistant than untreated Nangka (Artocarpus integrifolia) up to four weeks of laboratory treatment, but after that both woods had the same level of resistance. There was a significant inverse association between percentage of mass loss and specific gravity [10] and the higher density of sengon made it more resistant compared with Nangka. There was no evidence of fungi attack and instead deterioration of both woods was due to termite attack [11]. After four weeks exposure to subterranean termite in the laboratory, wood weight loss and termite mortality of both wood species were determined (Table 2). Untreated Sengon wood had better resistance to termite attack than untreated Nangka as seen from the lower weight loss of wood and higher termite mortality of the former.

After four weeks exposure to subterranean termites in the laboratory, wood weight loss and termite mortality of both wood species were determined. Untreated Sengon wood had better resistance to termite attack than untreated Nangka as seen from the lower weight loss of wood and higher termite mortality of the former (Tables 1 and 2). Cigarette waste water treatment affected wood resistance to subterranean termite attack. The treatment increased the resistance of samples as indicated by their lower weight loss and higher termite mortality compared with untreated wood.

Cigarette waste water treatment significantly affected wood resistance to subterranean termite attack (Table 3 and 4). The treatment increased the resistance of samples as indicated by their lower weight loss and higher termite mortality compared with untreated wood.

As shown in figure 1, sample cigarette waste water result confirmed 2-Propenoic acid, 3-phenyl, (CAS) trans-Cinnamic acid (CHCO=H). The bioassay data of wood protection suggested that cigarette waste water showed absolute antifeedant activities, while fenol indicated relative activity. In fact, 2-Propenoic acid, 3-phenyl, (CAS) trans-Cinnamic acid (CHCO=H) is originally a raw fraction which is obtained from the process of fenol isolation. Many reviews suggest Syzygium aromaticum soak as safe to human, plant, and beneficial insect [12, 13]. More importantly, using nature based termicide will gradually reduce our dependence on the toxic chemicals, and new prospective for environmentally termite control method [14, 15].

Acknowledgements

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References


Combining Ability of Yield Component in Chili
(Capsicum annuum)

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Abstract

An effort that can be done to improve the productivity of chili pepper is developing hybrid varieties by establishment of pure lines and testing the crosses among them. A set of crosses produced by involving a number of lines in all possible combination is designated as diallel crosses. Diallel analysis gives general and specific information combining ability of parents and their crosses. After the selection and evaluation, we obtained information about the value of heterosis and heterobeltiosis of hybrid, which need general combining ability (GCA) and specific combining ability (SCA) evaluation. Information on GCA, SCA, and parents' performance is needed to identify which combinations will result in potentially high-yielding parents or hybrids. The objective of this study is to determine the value of heterosis, heterobeltiosis, general combining ability, and specific combining ability hybrids of parental crosses by half-diallel scheme.

Field experiment was conducted using a three-replicated randomized complete block design consisting of 21 chilli pepper genotypes, consisting of 15 genotypes from IPB series, developed through half-diallel crosses from six parental lines. The highest value of SCA and heterosis were obtained from four crosses, based on the reproductive characters. The number of total fruit and total weight of fruit were obtained from the IPB C-111 × IPB C-120 crosses. The harvesting date and fruit flesh thickness were obtained from IPB C-2 × IPB C-111. The variable length of fruit and flowering date were obtained from IPB C-5 × IPB C-159. The weight per fruit and fruit diameter were obtained from IPB C-120 × IPB C-159. The highest heterobeltiosis value in number of total fruit, total fruit weight, and harvesting date were obtained from IPB C-111 × IPB C-120 crosses. IPB C-5 is considered as the parent with the highest GCA on fruit weight, fruit diameter, flesh thickness, and total weight of fruit. On the other side, IPB C-120 is considered as parent for length of the fruit and the fruit stalk length.

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Keywords: chili, heterosis, heterobeltiosis, combining ability

1. Introduction

Chili pepper (Capsicum annuum L.) is one of the important and high-valued vegetables in Indonesia. Besides as cooking spice or as seasoning or flavoring ingredients for household needs, chili is also utilized in the food industry such as chillipowder, sauces, condiments, oleoresins, and dyes [1], as well as in the pharmaceutical industry as drugs for analgesia [2]. Chili fruit contains capcaisain (spicy flavor), provitamin A and vitamin C [3].

Based on data from the Central Bureau of Statistics in 2011, the total area of the chili harvest in Indonesia reached 295,764 ha with productivity average reached 6.43 ton ha\textsuperscript{-1}. The value is still low because productivity can only reach 17–21 tons ha\textsuperscript{-1} [4]. The low productivity of chili pepper in Indonesia is caused by several things. Low productivity of chili pepper in Indonesia is because of the small numbers of using high yielding varieties (hybrid) which have high quality seed and strike of pest. An effort that can be done in order to improve the productivity of chili is developing

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hybrid varieties. In hybrid development, we have to make pure lines and crosses between pure lines. A set of crosses between pure lines involving a number of parents for the selection and evaluation of combinations is called diallel crosses [5]. Diallel crosses are defined as all possible combinations of crosses in a group of parents (pure lines) involving their parents. Diallel crosses which done on parents (pure line) will give information about the value of heterosis and hybrid heterobeltiosis.

Heterosis is the deviation of the F1 offspring with respect to average parents (pure line), which is expected by calculating the difference of F1 with the average heterosis of parents. The difference between the F1 progeny with the highest average value of parents is called heterobeltiosis [7]. Determination of the value of heterosis and heterobeltiosis requires initial evaluations, which are usually in form of general combining ability (GCA) and specific combining ability (SCA) estimation.

GCA and SCA estimation are necessary in the early phase of the improvement of crop characters in order to identify combinations of parents, which will result in potentially high-yielding progenies. Combining ability is a common concept to classify pure lines relatively according to their respective hybrid performance [8]. Not all combination of pure line crosses will result superior hybrid [9]. Therefore, the combining ability of pure lines needs to be tested to determine the best combination for the production of hybrid seed. The population, which is identified, has high general combining ability (GCA), probably have also high specific combining ability (SCA) [10]. Combining ability, which is obtained from a cross between two parental lines, can provide information regarding cross combinations for better heredity [21]. The objective of this study was to determine the combining ability and heterosis from half diallel crosses of six genotypes of chili.

2. Methodology

The experiment was carried out at the experimental field of Institut Pertanian Bogor (IPB) Leuwikopo Darmaga from October 2012 to March 2013. Twenty-one chilies genotypes, consisting of 15 crosses from IPB half-diallel crosses and six chili pepper parental lines namely IPB-C2, IPB-C5 and IPB C-19 as smooth chili, IPB C-111 as semiwirinkled chilli, IPB-C120 and IPB C-159 as wrinkled chili. The experiment was arranged in a randomized complete block design (RCBD) in three replicates. Each experimental unit consisted of 20 plants, of which 10 plant samples were taken. To analyze general combining ability (GCA) or specific combining ability (SCA) influence of the variables, analysis of variance for diallel cross according to Griffing’s method 2 was used [11].

Estimation of GCA effects, 
\[ g_i = \frac{1}{n+2} \left[ \sum (Y_i + Y_{ii}) - \frac{2}{n} Y.. \right] \]  
(1)

Estimation of SCA effects, 
\[ s_{ij} = Y_{ij} - \frac{1}{n+2} \left[ \sum (Y_i + Y_j + Y_{ii}) - \frac{2}{(n+1)(n+2)} Y.. \right] \]  
(2)

Where gi is the general combining ability (gca) effect of ith genotype, sij is the specific combining ability (sca) effect of ixjth genotype. Yij is the mean of ixjth genotype, n is the number of genotype, Yi is the mean of ith genotype, Yii is the selfing value of ith genotype, Y.j is the selfing value of jth genotype, and Y.. is the total genotype value.

If the specific combining ability test is significantly different at 5% level F test means heterosis effects are eventuated. The value of heterosis is usually expressed as a percent (%). The value of hybrid heterosis was estimated by analyzing mid parent heterosis, while the value heterobeltiosis was estimated by analyzing best parent [7], as follows:

Heterosis = \[ \frac{\mu_{F1}-\mu_{MP}}{\mu_{MP}} \times 100\% \]  
(3)

Heterobeltiosis = \[ \frac{\mu_{F1}-\mu_{BP}}{\mu_{BP}} \times 100\% \]  
(4)

Where \( \mu_{F1} \) is the mean of progeny, \( \mu_{BP} \) is the mean of best parents, \( \mu_{MP} \) is the mean of mid parents [(P1+P2)/2].

3. Results and Discussion

3.1. Analysis of Combining Ability

The summary of analysis of variance testing the significance of SCA and GCA is given in Table 1.
Table 1. Significance test results of general combining ability (GCA) and specific combining ability (SCA), as well as coefficient of variance (C.V.), from analysis of variance following Griffing’s Method 2.

<table>
<thead>
<tr>
<th>No</th>
<th>Character</th>
<th>F-value</th>
<th>GCA</th>
<th>SCA</th>
<th>C.V. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Flowering date</td>
<td>8.36**</td>
<td>7.00**</td>
<td>9.43</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Harvesting date</td>
<td>16.29**</td>
<td>7.41**</td>
<td>5.76</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Fruit length</td>
<td>46.62**</td>
<td>3.58**</td>
<td>9.62</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Fruit stalk length</td>
<td>18.55**</td>
<td>1.59ns</td>
<td>8.26</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Weight per fruit</td>
<td>53.09**</td>
<td>2.16*</td>
<td>18.17</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Fruit diameter</td>
<td>157.06**</td>
<td>2.23*</td>
<td>8.99</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Fruit flesh thickness</td>
<td>35.22**</td>
<td>1.95*</td>
<td>12.94</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Number of total fruit</td>
<td>10.28**</td>
<td>1.79ns</td>
<td>33.60</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Total weight of fruit</td>
<td>5.79**</td>
<td>0.44ns</td>
<td>38.23</td>
<td></td>
</tr>
</tbody>
</table>

* and ** show significance at the 5 and 1% levels, respectively. ns shows there is significance at the 5% level.

The analysis of the GCA and SCA on flowering date, harvesting date, fruit stalk length, fruit diameter, fruit length, fruit flesh thickness, and number of total fruit indicated that combining ability of parents and their respective F1 genotypes were quite variable. The estimate of the GCA and SCA are given in Table 2. Table 2 shows that GCA value varies with negative and positive signs. IPB C-2 had the highest GCA value for variables flowering date, while IPB C-19 has the highest GCA value in the harvesting date presented in a negative sign. Negative sign is presented in flowering and harvesting date is defined as genotype, which has early maturity time. High GCA and SCA value on flowering and harvesting date presented in negative sign means that the genotype has early maturity time, while large positive sign indicates the genotype has late maturity.

Genotypes, which have the highest SCA value in flowering date and achieved by genotype 5 × 159, 2 × 111, 19 × 120, 2 × 159, and 19 × 111, respectively. IPB C-120 has the highest GCA value in fruit length and fruit stalk length, while the weight per fruit and fruit diameter achieved by IPB C-5. The highest SCA value on fruit length, fruit stalk length, weight per fruit and fruit diameter was achieved by genotypes 5 × 159, 5 × 111, 19 × 120, and 120 × 159, respectively.

GCA and SCA values of the fruit character showed various results. IPB C-5 had the highest GCA value on flesh thickness and total weight of fruit, while IPB C-111 has the highest GCA value on number of total fruit. The highest SCA value on number of total fruit and total weight of fruit was achieved by genotyping 111 × 120, while fruit flesh thickness was achieved by genotype 2 × 111.

The GCA and SCA varied greatly. A few of genotypes showed a positive and negative value. GCA values obtained from the combining capabilities of parents with the other parents. If the GCA value shows positive results, it indicates that the parents have a good combining ability or have the ability to join with other parent well [13]. If the GCA value shows positive results, then it indicates that the parents do not have a good combining ability with the other parents. In the other side, SCA value gained from the F1 genotypes performance compared with the other F1. If the F1 has a positive SCA value, then it indicates that the genotypes have a good ability to combine with particular genotypes (special). Otherwise, if the F1 has a negative SCA value, then it indicates that the genotypes are not able to combine well with particular genotypes (special). Negative sign on GCA and SCA values do not apply to flowering and harvesting date, because it has a better maturing time (early maturing). In the plant breeding program for the development of synthetic varieties, GCA value of parents is very important, whereas for the development of hybrid varieties SCA value of F1 is more emphasized [14]. Good hybrids generally obtained from parent crosses that have high GCA and SCA values, heterosis, and high heterobeltiosis [15]. A character, which has a significant GCA value indicating additive gene action and allows great genetic advance obtained in the intra-population selection. Parent who has a high combining ability is IPB C5. It can be used as a donor parent in high yield character.
### 3.2. Heterosis and Heterobeltiosis

Table 2. The estimates of GCA and SCA analysis of flowering date, harvesting date, fruit stalk length, fruit diameter, fruit length, fruit flesh thickness, number of total fruit and total weight of fruit.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Flowering date</th>
<th>Harvesting date</th>
<th>Fruit stalk length</th>
<th>Fruit diameter</th>
<th>Fruit length</th>
<th>Fruit flesh thickness</th>
<th>Number of total fruit</th>
<th>weight per fruit</th>
<th>Total weight of fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-2.17</td>
<td>-4.14</td>
<td>-0.13</td>
<td>2.28</td>
<td>-0.06</td>
<td>0.14</td>
<td>-9.44</td>
<td>1.43</td>
<td>0.52</td>
</tr>
<tr>
<td>5</td>
<td>-0.46</td>
<td>-1.31</td>
<td>0.18</td>
<td>2.99</td>
<td>-1.54</td>
<td>0.32</td>
<td>-3.96</td>
<td>1.75</td>
<td>41.30</td>
</tr>
<tr>
<td>19</td>
<td>0.46</td>
<td>-4.47</td>
<td>-0.11</td>
<td>2.53</td>
<td>-0.94</td>
<td>0.21</td>
<td>-15.23</td>
<td>1.64</td>
<td>3.06</td>
</tr>
<tr>
<td>111</td>
<td>-0.13</td>
<td>2.65</td>
<td>-0.29</td>
<td>-2.96</td>
<td>-0.47</td>
<td>-0.25</td>
<td>15.23</td>
<td>2.15</td>
<td>-19.11</td>
</tr>
<tr>
<td>120</td>
<td>-0.88</td>
<td>4.32</td>
<td>0.44</td>
<td>-1.81</td>
<td>3.81</td>
<td>-0.12</td>
<td>14.35</td>
<td>0.47</td>
<td>28.27</td>
</tr>
<tr>
<td>159</td>
<td>3.17</td>
<td>2.94</td>
<td>-0.09</td>
<td>-3.03</td>
<td>-0.80</td>
<td>-0.30</td>
<td>-0.94</td>
<td>-2.20</td>
<td>-54.03</td>
</tr>
<tr>
<td>SCA</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2x5</td>
<td>-2.09</td>
<td>-3.14</td>
<td>0.12</td>
<td>1.14</td>
<td>0.70</td>
<td>-0.22</td>
<td>3.03</td>
<td>1.00</td>
<td>11.81</td>
</tr>
<tr>
<td>2x19</td>
<td>0.99</td>
<td>2.02</td>
<td>0.16</td>
<td>-1.61</td>
<td>1.95</td>
<td>0.01</td>
<td>5.96</td>
<td>1.55</td>
<td>5.88</td>
</tr>
<tr>
<td>2x111</td>
<td>-3.76</td>
<td>-8.43</td>
<td>0.00</td>
<td>-1.20</td>
<td>0.52</td>
<td>0.27</td>
<td>-11.09</td>
<td>0.35</td>
<td>-13.78</td>
</tr>
<tr>
<td>2x120</td>
<td>-1.67</td>
<td>-5.77</td>
<td>-0.13</td>
<td>0.39</td>
<td>-1.54</td>
<td>0.24</td>
<td>-18.61</td>
<td>0.33</td>
<td>-24.98</td>
</tr>
<tr>
<td>2x159</td>
<td>-1.38</td>
<td>-1.39</td>
<td>0.07</td>
<td>-1.03</td>
<td>0.47</td>
<td>0.03</td>
<td>20.06</td>
<td>-0.01</td>
<td>50.98</td>
</tr>
<tr>
<td>5x19</td>
<td>-0.71</td>
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<td>0.09</td>
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<td>-0.19</td>
<td>-4.87</td>
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</tr>
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<td>0.35</td>
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<td>0.39</td>
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<td>-0.10</td>
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<tr>
<td>5x120</td>
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<td>-1.27</td>
<td>0.09</td>
<td>0.11</td>
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<td>-0.08</td>
<td>-9.49</td>
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</tr>
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<td>-0.33</td>
<td>-0.04</td>
<td>-8.85</td>
<td>0.29</td>
<td>-16.91</td>
</tr>
<tr>
<td>120x159</td>
<td>-0.34</td>
<td>-4.85</td>
<td>0.04</td>
<td>1.23</td>
<td>0.22</td>
<td>0.15</td>
<td>7.09</td>
<td>0.78</td>
<td>-2.31</td>
</tr>
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</table>

The value of heterosis and heterobeltiosis in all variables varied greatly and it is given in Table 3 - Table 7. Mean of parent line and hybrid and the value of heterosis and heterobeltiosis for flowering date and harvesting date were given in Table 3. All cross combination showed a negative value for flowering date and harvesting date. This fact shows that the hybrid could be flowering and harvesting earlier than average of both parents. Genotype 5 x 159 showed the lowest value of heterosis and heterobeltiosis for flowering date and 2 x 111 the lowest value of heterosis meanwhile 111 x 120 the lowest value heterobeltiosis for harvesting date.
Table 4. Mean of parent line and hybrid, value of heterosis and heterobeltiosis of Chili for the character of Fruit length and Fruit stalk Length

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Fruit Length</th>
<th>Fruit stalk Length</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P1</td>
<td>P2</td>
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<tr>
<td>2x5</td>
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<tr>
<td>5x19</td>
<td>8.84</td>
<td>10.51</td>
</tr>
<tr>
<td>5x111</td>
<td>8.84</td>
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</tr>
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<td>5x120</td>
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<td>5x159</td>
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<td>13.17</td>
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<td>19x120</td>
<td>10.51</td>
<td>22.19</td>
</tr>
<tr>
<td>19x159</td>
<td>10.51</td>
<td>10.66</td>
</tr>
<tr>
<td>111x120</td>
<td>13.17</td>
<td>22.19</td>
</tr>
<tr>
<td>111x159</td>
<td>13.17</td>
<td>10.66</td>
</tr>
<tr>
<td>120x159</td>
<td>22.19</td>
<td>10.66</td>
</tr>
</tbody>
</table>

The means of F1 fruit length ranged from 12.42 to 18.34 (Table 4). The highest mean was observed at genotype 111 x 120 which is 18.34 cm, but it had a negative value of heterobeltiosis which was -17.37 %. For heterosis values ranged from -6.14 to 51.32%, while the heterobeltiosis values ranged from -25.09 to 38.41%. The highest heterosis
and heterobeltiosis values ranged from -25.09 to 38.41%. The highest heterosis and heterobeltiosis values were in genotype 5 x 159 which was 51.32% and 38.41%. The highest heterosis and heterobeltiosis values were in genotype 5 x 159 which was 51.32% and 38.41% respectively. These high values indicated that genotype 5 x 159 had a fruit length mean higher than its parents fruit length mean and the best parent. This is accordance with the opinion that the high heterosis and heterobeltiosis value are not always followed by the high mean value in diallel cross [17].

Table 5 shows that the F1 mean on fruit flesh thickness ranged from 1.32 to 1.98 mm. The highest mean was in genotype 2 x 19 which was 1.98 mm. The highest heterosis value achieved by genotype 2 x 111 which is 33.17%, while the highest heterobeltiosis value achieved by genotype 2 x 111 which was 4.36 cm, but it had a negative value of heterobeltiosis which was 9.1. The highest heterosis value in this study was only 33.17%. It is 82.21% lower (115.38%), but this study had a higher mean value which was 1.98 mm than Pranita study which was only 0.28 mm.

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Total weight of fruit</th>
<th>Mid Parent Heterosis (%)</th>
<th>Heterobeltiosis (%)</th>
<th>Fruit Diameter</th>
<th>Mid Parent Heterosis (%)</th>
<th>Heterobeltiosis (%)</th>
</tr>
</thead>
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<td></td>
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<td>P2</td>
<td>F1</td>
<td>P1</td>
<td>P2</td>
<td>F1</td>
</tr>
<tr>
<td>2x5</td>
<td>8.18</td>
<td>9.1</td>
<td>11.10ab</td>
<td>28.51</td>
<td>21.99</td>
<td>18.27</td>
</tr>
<tr>
<td>2x10</td>
<td>8.18</td>
<td>8.67</td>
<td>11.54a</td>
<td>36.99</td>
<td>33.13</td>
<td>18.27</td>
</tr>
<tr>
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<td>8.18</td>
<td>2.53</td>
<td>6.55efgh</td>
<td>22.36</td>
<td>-19.91</td>
<td>18.27</td>
</tr>
<tr>
<td>2x15</td>
<td>8.18</td>
<td>4.61</td>
<td>8.22cdefg</td>
<td>28.55</td>
<td>0.49</td>
<td>18.27</td>
</tr>
<tr>
<td>5x19</td>
<td>9.1</td>
<td>8.67</td>
<td>11.04ab</td>
<td>24.33</td>
<td>21.37</td>
<td>18.09</td>
</tr>
<tr>
<td>5x120</td>
<td>9.1</td>
<td>4.61</td>
<td>8.42cdefg</td>
<td>22.89</td>
<td>-7.44</td>
<td>18.09</td>
</tr>
<tr>
<td>5x159</td>
<td>9.1</td>
<td>1.95</td>
<td>6.98defgh</td>
<td>26.35</td>
<td>-23.27</td>
<td>18.09</td>
</tr>
<tr>
<td>19x111</td>
<td>8.67</td>
<td>2.53</td>
<td>5.98ghi</td>
<td>6.81</td>
<td>-31.02</td>
<td>18.33</td>
</tr>
<tr>
<td>19x120</td>
<td>8.67</td>
<td>4.61</td>
<td>9.69abc</td>
<td>45.94</td>
<td>11.77</td>
<td>18.33</td>
</tr>
<tr>
<td>19x159</td>
<td>8.67</td>
<td>1.95</td>
<td>5.94ghi</td>
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</tr>
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<td>4.11ijkl</td>
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<td>2.86ijkl</td>
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<td>12.94</td>
<td>7.31</td>
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<tr>
<td>120x159</td>
<td>4.61</td>
<td>1.95</td>
<td>5.03hij</td>
<td>53.44</td>
<td>9.23</td>
<td>7.87</td>
</tr>
</tbody>
</table>

The mean of F1 fruit stalk length ranged from 2.89 to 4.36 cm. The highest mean was in genotype 5 x 120 cm which is 4.36 cm, but it had a negative value of heterobeltiosis which was -5.15%. This means that genotype 5 x 120 had the longest fruit stalk length compared with other genotypes but no longer than the best parent. The heterosis values ranged from -14.99 to 12.16% while the heterobeltiosis value ranged from -20.03 to 12.16% and 7.36%. High heterobeltiosis and heterosis values showed that this genotype had fruit stalk length mean higher than parents’ fruit stalk length mean and the best parent.

Table 5 shows that the mean of F1 weight per fruit ranged from 2.86 to 11.54 g. Heterosis values for weight per fruit ranged from 6.81 to 53.44% and heterobeltiosis values ranged from -31.45 to 33.13%. All heterosis values were positive, where the highest value achieved by genotype 120 x 159 which is 53.44%. The F1 highest heterobeltiosis value and the F1 highest mean were in genotype 2 × 19 which were 33.13% and 11.54 g, respectively. Quite high heterosis value on weight per fruit was also found in the study [18].

Table 6 shows that the F1 mean on fruit flesh thickness ranged from 1.32 to 1.98 mm. The highest F1 mean was in genotype 2 × 19 which is 1.98 mm. The highest heterosis value achieved by genotype 2 × 111 which is 33.17 %, while the highest heterobeltiosis value achieved by genotype 120 × 159 which is 13.34%. Compared to the study [13], the highest heterosis value in this study was only 33.17%. It is 82.21% lower (115.38%), but this study had a higher mean value which was 1.98 mm than Pranita study which was only 0.28 mm.
Table 6. Mean of parent line and hybrid, and the value of heterosis and heterobeltiosis of Chili for the character of fruit flesh thickness and number of total fruit

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Fruit flesh thickness</th>
<th>Number of total fruit</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Mid Parent Heterosis (%)</td>
</tr>
<tr>
<td>2x5</td>
<td>1.73</td>
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<tr>
<td>2x19</td>
<td>1.73</td>
<td>2.08</td>
</tr>
<tr>
<td>2x111</td>
<td>1.73</td>
<td>0.95</td>
</tr>
<tr>
<td>2x120</td>
<td>1.73</td>
<td>1.2</td>
</tr>
<tr>
<td>2x159</td>
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<tr>
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<td>2.52</td>
<td>2.08</td>
</tr>
<tr>
<td>5x111</td>
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<td>0.95</td>
</tr>
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<td>5x120</td>
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<td>1.2</td>
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<td>0.96</td>
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<td>0.95</td>
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<tr>
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<td>0.96</td>
</tr>
<tr>
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<td>1.2</td>
<td>0.96</td>
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</table>

Table 7. Mean of parent line and hybrid, and the value of heterosis and heterobeltiosis of Chili for the character of total weight of fruit

<table>
<thead>
<tr>
<th>Genotype</th>
<th>Total weight of fruit</th>
<th>Mid Parent Heterosis (%)</th>
<th>Heterobeltiosis (%)</th>
</tr>
</thead>
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<tr>
<td></td>
<td></td>
<td>P1</td>
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<td>190.80abcde</td>
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<td>125.72</td>
<td>148.97abcde</td>
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<tr>
<td>2x120</td>
<td>167.42</td>
<td>225.26</td>
<td>185.15abcde</td>
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<tr>
<td>2x159</td>
<td>167.42</td>
<td>69.08</td>
<td>178.81abcde</td>
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<td>271.91</td>
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<td>271.91</td>
<td>125.72</td>
<td>213.25abcde</td>
</tr>
<tr>
<td>5x120</td>
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<td>235.09abc</td>
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<td>162.09abcde</td>
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<td>225.26</td>
<td>69.08</td>
<td>153.27abcde</td>
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</tbody>
</table>
Total fruit weight or production per plant is an important factor in the production of chili to obtain genotype crosses that have high production potential. Table 7 shows that the F1 mean on total fruit weight ranged from 91.29 to 258.43 g. Heterosis and heterobeltiosis values on total fruit weight showed various results ranging from -17.57 to 51.21% and -44.99 to 14.73%, respectively. The heterosis and heterobeltiosis values that vary on the total fruit weight were also found in the study [20]. Various heterosis and heterobeltiosis values assumed because of the considerable genetic differences among parents involved in the crosses [19]. The highest mean and heterobeltiosis value achieved by genotype 111 × 120 which were 258.43 g and 14.73%. This genotype also had a relatively high heterosis value that is equal to 47.26%.

In general, the highest heterosis and heterobeltiosis value were obtained in the crosses of smooth chili pepper (IPB-C5) with wrinkled chili (IPB-C159 and IPB-C120) and semi-wrinkled chili (IPB-C111). Crosses of IPB-C5 and IPB-C159 showed the highest heterosis and heterobeltiosis on flowering date and fruit length. On weight per fruit and fruit diameter, the highest heterosis were obtained in the crosses of wrinkled chili pepper (with IPB-C120 and IPB-C159) and the highest heterobeltiosis was on fruit flesh thickness. On number of total fruit and weight of total fruit, crosses between semi wrinkled chili pepper (IPB-C111) and wrinkled chili pepper (IPB-C120) showed the highest heterosis and heterobeltiosis values.

In general, the highest value of heterosis and heterobeltiosis reached by the crossing of smooth chili (IPB-C5) with wrinkled chili (IPB-C159 and IPB-C120) and semi wrinkled chili (IPB-C111). Crossing IPB-C5 and IPB-C159 showed the highest value of heterosis and heterobeltiosis on floweringtime and fruit length. On parameter weight per fruit and fruit diameter, the highest heterosis values reached by crossing of wrinkled chili (IPB-C120 with IPB-C159) and the highest value of heterobeltiosis in the parameter fruit flesh thickness. In the parameter of fruit number and fruit weight of the crossing semi wrinkled chili pepper (IPB-C111) with wrinkled chili (IPB-C120) showed the highest value on heterosis and heterobeltiosis.

4. Conclusion

The highest value of SCA and heterosis achieved by cross combinations IPB C-111×IPB C-120 is the number of total fruit and total weight of fruit. IPB C-2 × IPB C-111 had the highest value of SCA and heterosis for harvesting date and fruit flesh thickness. IPB C-5 × IPB C-159 had the highest value of SCA and heterosis for fruit length and flowering date. IPB C-120 × IPB C-159 had the highest value of SCA and heterosis for weight per fruit and fruit diameter. The highest heterobeltiosis value was achieved by crosses IPB C-111×IPB C-120 for number of total fruit, total weight of fruit and harvesting date. IPB C-5 is the parent with the best GCA on weight per fruit, fruit diameter, fruit flesh thickness and total weight of fruit, while IPB C-120 on fruit length and the fruit stalk length.

Acknowledgements

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References

4th International Conference on Sustainable Future for Human Security, SustaiN 2013

Analysis of Shallot-Farming Risk & Food Security of Farm-Household in Bantul Regency, Yogyakarta Province

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¹Gadjah Mada University, Faculty of Agriculture – Bulaksumur Campus, Yogyakarta.55281, Indonesia
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Abstract

In Bantul Regency, in particular in the south area, many farmers are cultivating Shallot crop. Shallot as well known requires more funds for production compared to other crops. Moreover, the production risk of this crop is also high, as well as its price fluctuation which is very volatile throughout the year. Therefore, the capacity of Shallot farmers to bear the production risk is very interesting to be studied. Hence, the objectives of this study were to know: (1) factors that determine Shallot production; (2) Shallot farmers’ risk behavior; (3) factors that influence the production risk of Shallot farming, and (4) factors that determine the level of food security of farm household in Bantul Regency. The analyses used in this research were (1) regression analysis for the production function, (2) analysis of farmers’ behavior towards risk, (3) regression analysis to investigate the determinants factors of production risk and (4) Johnson dan Toole’s category for food security based on proportion of food expenditure and energy consumption. The results of the analyses show that (1) seed and fertilizer positively influence the Shallot production. (2) Most of the Shallot farmers behave as risk neutral; 21.4 percent of farmers are risk lover and none of the farmers behave as risk averter. (3) Addition of fertilizers and pesticides may reduce the risk of Shallots production, whilst the addition of seeds will increase the production risk, (4) Not all of farm households attain the food secure level.

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Keywords: production; food security; Shallot, risk behavior.

1. Introduction

Shallot is a horticulture crop growing in lowland area. People use Shallots as a traditional-dish seasoning. In addition, Shallot is also used as an herbal medicine for fever, diabetes and blood cholesterol, and some other diseases. As a seasonal crop, cultivating Shallot requires high production cost; farmers also bear unstable input and output prices, which will raise production and price risks. Based on these conditions, not all small holder producers have ability to plant Shallots.

Demand of Shallot is increasing in line with the development of food industry in Indonesia, but the domestic production has not meet to the demand yet. There are some constraints faced by farmers, such as lack of capability on land preparation; pest, diseases and weeds controls; commodity handling and marketing. Therefore, this article focuses on on-farm activity.

2. Characteristic of Shallot farming

Based on table 1, the age of Shallot farmers is in productive age, since majority farmers’ age is between 31-64 years and the average among 70 farmers is 48 years old. The Shallot farmers’ age is younger than the average age of rice farmers in the same area, which is about 60 years old. This provides advantage, since the younger farmers tend to be easier to learn and adopt the new technology.

Most of the Shallot farmers (78.28%) held middle level education. Though, their education is also higher than those of rice farmers in the same region, in which the rice farmers education is about 6 years formal primary-education. By holding higher education and younger age, Shallot farmers have higher ability to implement better management in their farming practices, because of that they may be more well prepared and more knowledgeable to cultivate Shallot which is high production risk.
Table 1. Characteristic of Shallot Farmers

<table>
<thead>
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<th>age (years)</th>
<th>Persons</th>
<th>%</th>
</tr>
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</tr>
<tr>
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</tr>
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<table>
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<td>no schooling</td>
<td>1</td>
<td>1.43</td>
</tr>
<tr>
<td>primary school</td>
<td>16</td>
<td>22.86</td>
</tr>
<tr>
<td>junior high school</td>
<td>25</td>
<td>35.71</td>
</tr>
<tr>
<td>senior high school</td>
<td>27</td>
<td>38.57</td>
</tr>
<tr>
<td>University</td>
<td>1</td>
<td>1.43</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Table 2. Characteristic of Shallot Farming

<table>
<thead>
<tr>
<th>acreage (Ha)</th>
<th>Persons</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>narrow: x&lt; 1.065</td>
<td>32</td>
<td>45.71</td>
</tr>
<tr>
<td>middle:1.065&lt;x&lt;2.810</td>
<td>24</td>
<td>34.29</td>
</tr>
<tr>
<td>wide: x&gt;2.810</td>
<td>14</td>
<td>20.00</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>irrigation system</th>
<th>Persons</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>fully technical</td>
<td>16</td>
<td>22.86</td>
</tr>
<tr>
<td>semi technical</td>
<td>5</td>
<td>7.14</td>
</tr>
<tr>
<td>rain fed</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pumped</td>
<td>49</td>
<td>70.00</td>
</tr>
<tr>
<td>Total</td>
<td>70</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Shallot farming which utilizes the narrow agricultural land is 45.71% and only 20% farmers employ the wide agricultural land. Shallot farming needs irrigation system especially in vegetative growth period. Lack of water may degrade the vegetative growth of Shallot but water oversupply will destroy the tuber of Shallot. Water pump machines are popular among Shallot farmers to irrigate the agricultural land since most of irrigation system in Bantul Regency had developed mainly to support rice farming rather than other farming.

3. Risks in Farming

Agriculture is a biological process in nature and influenced by weather and the natural environment, attributes which are normally beyond human ability to control [1]. Farmers in developing countries and mainly smallholder producers are thus exposed to agricultural risks, especially in rain-fed land. In addition, agricultural risks are covariates, as for example, meteorological or production risks (floods, drought, and windstorm) and price risks affect nearly all farmers simultaneously within a small rural community.

Risks in farming are (a) the production risk, risk in agricultural business is greater than in the non-agricultural one due to natural influences such as weather, crop pests and diseases, drought and flooding that may destroy the crop, (b) the costs of risk, caused by fluctuations in the price of inputs and output, and (c) the risk of technology, since farmers’ lack of innovated-technology knowledge and skill thus they often failed applying the technology [2]. Risk, uncertainty and learning play a number of distinct roles in the process of adopting new technologies. These distinct roles have often been blurred or treated incompletely in past research.

3.1 Production Analysis

The econometric analysis in this article illustrates how smallholders use inputs to enhance productivity and reduce yield variability. An important characteristic of agricultural production processes is that we can observe random production shocks only after input decisions. Hence, input levels influence both the expected level of output and the level of output risk. Although we expect all inputs to increase output, some inputs may reduce the level of output risk, whereas others may increase it [3].
Table 3. Determinant Factors of Shallot Production

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefisien</th>
<th>Standard Error</th>
<th>t-calc.</th>
<th>Prob. of error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln Constanta</td>
<td>-0.153565</td>
<td>0.632737</td>
<td>0.242700</td>
<td>ns</td>
</tr>
<tr>
<td>Ln Area (ha)</td>
<td>-0.152954</td>
<td>0.214049</td>
<td>-0.714577</td>
<td>ns</td>
</tr>
<tr>
<td>Ln Seed (kg/ha)</td>
<td>0.914192</td>
<td>0.163592</td>
<td>5.588231</td>
<td>***</td>
</tr>
<tr>
<td>Ln Fertilizer (Rp/ha)</td>
<td>0.100569</td>
<td>0.025087</td>
<td>4.008687</td>
<td>***</td>
</tr>
<tr>
<td>Ln Pesticide (Rp/ha)</td>
<td>-0.031359</td>
<td>0.023985</td>
<td>-1.307436</td>
<td>*</td>
</tr>
<tr>
<td>Ln Labor (HOK/ha)</td>
<td>0.288487</td>
<td>0.117309</td>
<td>2.459195</td>
<td>***</td>
</tr>
</tbody>
</table>

Sigma squared 0.403459
Gamma 0.994102

Factors significantly determining the Shallot production seed, fertilizer, pesticide and labor, while the acreage of agricultural land (area) do not significantly determine the production, since most of farmers occupy less than 0.20 hectares due to a high population density and the scarcity of agricultural land in Bantul Regency. Therefore, Shallot production may be improved by increasing the other production factors such as seed, fertilizer, pesticide and labor.

3.2 Production Risk Analysis

Production risk is described by differences between actual and estimated production. The square of production random-error is a proxy of risk production. $\varepsilon$ is a random error of Production function.

$$\ln \Pr = \ln \alpha_0 + \alpha_1 \ln Area + \alpha_2 \ln Seed + \alpha_3 \ln Fert + \alpha_4 \ln Pest + \alpha_5 \ln Labor + \varepsilon$$  (1)

$$\ln \varepsilon^2 = \ln \beta_0 + \beta_1 \ln Area + \beta_2 \ln Seed + \beta_3 \ln Fert + \beta_4 \ln Pest + \beta_5 \ln Labor + \nu$$  (2)

Table 4. Determinant Factors of Shallot Farming Risk

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefisien</th>
<th>Standard Error</th>
<th>t-calc.</th>
<th>Prob. of error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ln Constanta</td>
<td>1.276140</td>
<td>1.197325</td>
<td>1.065826</td>
<td>0.2905</td>
</tr>
<tr>
<td>Ln Area (ha)</td>
<td>-0.118335</td>
<td>0.117257</td>
<td>-1.009197</td>
<td>0.3167</td>
</tr>
<tr>
<td>Ln Seed (kg/ha)</td>
<td>0.322812</td>
<td>0.174107</td>
<td>1.854101</td>
<td>0.0683</td>
</tr>
<tr>
<td>Ln Fertilizer (Rp/ha)</td>
<td>-0.114891</td>
<td>0.039472</td>
<td>-2.910704</td>
<td>0.0050</td>
</tr>
<tr>
<td>Ln Pesticide (Rp/ha)</td>
<td>-0.102466</td>
<td>0.037170</td>
<td>-2.756725</td>
<td>0.0076</td>
</tr>
<tr>
<td>Ln Labor (HOK/ha)</td>
<td>-0.041957</td>
<td>0.160953</td>
<td>-0.260676</td>
<td>0.7952</td>
</tr>
<tr>
<td>R-squared</td>
<td></td>
<td></td>
<td></td>
<td>0.409116</td>
</tr>
<tr>
<td>Adjusted R-squared</td>
<td></td>
<td></td>
<td></td>
<td>0.362953</td>
</tr>
<tr>
<td>F-calculated</td>
<td></td>
<td></td>
<td></td>
<td>8.862461</td>
</tr>
<tr>
<td>Prob. of F-calc.</td>
<td></td>
<td></td>
<td></td>
<td>0.000002</td>
</tr>
</tbody>
</table>

Increasing the number of seeds per hectare will increase the risk of Shallot farming, while increasing value of fertilizers and pesticides will reduce the risk of farming Shallots. Increased seeds per hectare will lead to reduced space between plants and it has an impact on the possibility of fungus and other microbial outbreak. Therefore, Shallots will not grow optimally and cause crop failure. Increasing usage of pesticides per hectare will eradicate pests, while the addition of manpower ensures better crop management which in turn reducing the production risk.

The duration of Shallot farming is about 3 to 4 months. Farmers grow Shallot usually after harvesting paddy or at the second planting-season. Shallot farming income obtained by farmers is shown in the table below.

On average farmers employ 0.17 hectares agricultural land per season. There are 47% farmers utilize only their own land, 28% farmers utilize the land that obtained by renting and shared cropping and the rest (25%) use agricultural land which are owned by themselves and other land holders. Productivity obtained by farmers is 8.6 ton/ha, that is less than national productivity, ie. 9.57 ton/ha since some agricultural land used for Shallot farming in Bantul Regency are carried out in marginal land.
Table 5. Production, Revenue, Cost and Farm Income of Shallot Farming

<table>
<thead>
<tr>
<th>Item</th>
<th>Calculation</th>
<th>Per-farm household</th>
<th>Per-hectare</th>
</tr>
</thead>
<tbody>
<tr>
<td>Production (kg)</td>
<td>A</td>
<td>1,538.57</td>
<td>8,600.00</td>
</tr>
<tr>
<td>Production Price (Rp/Kg)</td>
<td>B</td>
<td>6,463.33</td>
<td>6,463.33</td>
</tr>
<tr>
<td>Revenue (Rp)</td>
<td>C=AB</td>
<td>9,935,423.33</td>
<td>55,633,275.38</td>
</tr>
<tr>
<td>Variable Cost (Rp)</td>
<td>D</td>
<td></td>
<td>6,746,270.95</td>
</tr>
<tr>
<td>- Seed</td>
<td>D1</td>
<td>1,095,293.78</td>
<td>6,746,270.95</td>
</tr>
<tr>
<td>- Fertilizer</td>
<td>D2</td>
<td>2,592,333.33</td>
<td>14,953,219.61</td>
</tr>
<tr>
<td>- Pesticide</td>
<td>D3</td>
<td>782,204.20</td>
<td>4,661,587.65</td>
</tr>
<tr>
<td>- Labor</td>
<td>D4</td>
<td>313,089.58</td>
<td>2,084,683.30</td>
</tr>
<tr>
<td>- Fuel</td>
<td>D5</td>
<td>1,488,516.67</td>
<td>10,718,434.33</td>
</tr>
<tr>
<td>Fix Cost (Rp)</td>
<td>E</td>
<td></td>
<td>2,101,407.74</td>
</tr>
<tr>
<td>Total Production Cost (Rp)</td>
<td>F=D+E</td>
<td>6,126,501.67</td>
<td>35,568,560.53</td>
</tr>
<tr>
<td>Farm Income (Rp)</td>
<td>G=C-F</td>
<td>3,808,921.66</td>
<td>35,568,560.53</td>
</tr>
</tbody>
</table>

The high portion of variable cost is contributed by seed and labor cost, since these input is substantial in Shallot farming. The fixed-cost consists of land rent and depreciation cost. Income of Shallot farming is Rp 35.5 million per hectare, which is higher than paddy and seasonal-crop’s farming income.

3.3 Behavior toward Production Risk

The attainment of food security normally involves the following components: (a) food availability, which refers to sufficient quantity and quality of food supplied through domestic production or imports; (b) food accessibility, which enables both households and individuals to obtain the appropriate food suitable for their dietary needs; and (c) food affordability, which allows individuals to be able to buy food in accordance with their respective socioeconomic conditions, cultural backgrounds and preferences [5]. The most important in the attainment of the second and third components of food security is the ability of individuals and households to have adequate, sustained incomes through sustainable employment opportunities.

Table 6. Distribution of Shallot Farmers’ Behavior toward Production Risk.

<table>
<thead>
<tr>
<th>K(S) Value</th>
<th>Risk Behaviour</th>
<th>persons</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>0&lt;K(S)&lt;0.4</td>
<td>Risk Lover</td>
<td>15</td>
<td>21.42</td>
</tr>
<tr>
<td>0.4&lt;K(S)&lt;1.2</td>
<td>Risk Neutral</td>
<td>55</td>
<td>78.58</td>
</tr>
<tr>
<td>1.2&lt;K(S)&lt;2.0</td>
<td>Risk Averter</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 6, distribution of Shallot farmers based on their behaviour towards risk stated that there is no farmer belonging averter risk, which is in line with the hypothesis that farmers who are growing commercial commodities such as Shallot tend to be not risk averter behaviour. There are 21.42 percent of Shallot farmers belonging to risk lover behaviour while the majority farmers (78.58 percent) are classified as risk neutral behaviour.

4. Food Security

The attainment of food security normally involves the following components: (a) food availability, which refers to sufficient quantity and quality of food supplied through domestic production or imports; (b) food accessibility, which enables both households and individuals to obtain the appropriate food suitable for their dietary needs; and (c) food affordability, which allows individuals to be able to buy food in accordance with their respective socioeconomic conditions, cultural backgrounds and preferences [5]. The most important in the attainment of the second and third components of food security is the ability of individuals and households to have adequate, sustained incomes through sustainable employment opportunities.

The dominant expenditure that is non-food is kid’s education and health. Proportion of food and non-food expenditure is quite equal. The table below shows food security level of Shallot farmers’ household.
Table 7. Distribution of Farm Household based on Food Security Level

<table>
<thead>
<tr>
<th>Food Security</th>
<th>Farm Household (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food secure</td>
<td>41.18</td>
</tr>
<tr>
<td>Food Vulnerable</td>
<td>14.71</td>
</tr>
<tr>
<td>Food Questionable</td>
<td>36.76</td>
</tr>
<tr>
<td>Food Insecure</td>
<td>7.35</td>
</tr>
</tbody>
</table>

The level of food security attained by farm household is concentrated in food secure (41.18%) and food questionable (36.76%). There is 7.35% farm household are still categorized in food insecure (7.35%). The implication policy of this result is farm household have to increase the food expenditure especially for the source of protein and fat.

5. Conclusion

- Increasing the number of seeds, fertilizer and labour increases the Shallot productivity, while the addition of value of pesticide will reduce the productivity of Shallot.
- The addition of fertilizers and pesticides may reduce the risk of Shallot farming, while the addition of seed will increase the risk.
- Most Shallot farmers have risk neutral behaviour; 21.4% of farmers behave risk lover and no farmers behave risk averter.
- Farm household attaining food-secure level is only 41.18% and the others are under the level of food secure.

6. Suggestion

1. To improve the productivity of Shallot, it is necessary to increase the number of seeds, fertilizers and pesticides per hectare, whilst pesticides should be reduced.
2. The role of extension service is expected to be increased; especially regarding to intensity of teaching about farming technology and appropriate technologies package for Shallot farming.
3. The crop insurance may be initiated by government to support horticulture farming, such as onion. Even though it is expensive; governments have not lived up to their expectations. There is scope for increased insurance of farm assets, of the life and health of rural people, and of some specific perils that affect crop and livestock yields. Such insurance could be efficiently provided by the private sector if governments were to remove some of the important constraints impinging on commercial insurers. The greatest challenge is to find ways of insuring low-income rural households against natural hazards on a financially sound basis [6].
4. Besides teaching farming technology, the extension service and local government have to teach food and nutrition needed by human being for daily life. The farm household is motivated to increase the food expenditure especially for the source of protein and fat.

Acknowledgements

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References

Trichoderma virens isolated from Cocoa plantation in Aceh increases viability and vigor of expired seed

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bJanahadra University, Faculty of Agriculture – Jalan Tentara Rakyat Mataram 55-57, Yogyakarta.55231, Indonesia

Abstract

This study aimed to determine the effect of different concentrations and long incubation of Trichoderma virens isolated from Cacao plantation in Aceh on viability and vigor of watermelon seeds that had been expired. Research was conducted in the Laboratory of Seed and Technology Science, Faculty of Agriculture, Syiah Kuala University. This study was arranged under a complete random design (CRD) 4x4 factorial with 2 factors, T. virens concentration factor (control, 5 g / ml, 10 g / ml, and 15 g / ml) and length of incubation (control, 1x24, 2x24, 3x24 hours). Parameters observed were Potential Growth (PGr), and Potential Germination (PGe) of seed while for the degree of vigorous growth, parameters were observed on the Growth Speed (GS), Simultaneous Germination of seed (SG), and Vigor of Sprout (VS). The results have shown that the concentration factor of T. virens had a very significant effect on GS, SG, and VS, but did not significantly affect PGr. Length of incubation had a significant effect on PGe, VS, SG, PGr, and GSs. There was no significant interaction between the factors of concentration and length of incubation of T. virens on all observed variables.

Keywords: Trichoderma virens; Aceh Cacao; viability; vigor; expired seed

Introduction

It may be possible to use plant seeds in the storage process even after a certain deadline by giving specific treatments before planting. One way that could be done as seed treatment before planting is physiological treatment that aims to improve seed quality, for example by means of techniques with biopriming.

One form of biological control agents such as Trichoderma virens is the fungal antagonist that acts to stimulate seed metabolism. Trichoderma serves to break the organic materials, such as N contained in complex compounds. Thus the nitrogen will be utilized by plants to stimulate growth[1]. Trichoderma species are microscopic fungi that are free living on the plant root and surrounding soil and beneficial to plants and ecosystems. This fungus has been studied widely in their ability to produce antibiotics, as parasites of other fungi, and microorganisms that compete with plant pests[7]. Trichoderma can be isolated from soil and all parts of plant. Sriwati at al have been isolated and identified some antagonistic fungi from cacao plantation rhizosphere, and identification was done at Microbiology Lab, USDA-ARS Beltsville, MD[17] . T. virens fungi from root of cacao plantation in east Aceh have potential for biological control of black pod disease. T. harzianum dose of 5 to 20 g / plant was capable to increase fruit weight. This was due to the increase T. harzianum in soil caused decrease of the activity and infection of Fusarium oxysporum and therefore resulted in increase of growth and crop production[12].

Among the species of Trichoderma, T viren, T. atroviride and T. harzianum can produce indole-3-acetic acid (IAA) and other substances related to auxin[3]. IAA was identified in 1934 as a natural compound that shows activity of auxin that drives the formation of adventitious roots. Auxin is one of the most widely studied hormones. Auxin is located at the tip of the stem and root ends, the function of the hormone auxin is helpful in accelerating the process of growth of both root and stem, speeding up germination, and helping in the process of cell division9. Seed germination of cucumber increased by the application of Trichoderma, which may be due to hormonal secretion like gibberellins, auxins[1]. T. virens was able to produce the indolic compounds, i.e. IAA and indole-3-ethanol, which may play roles in mediating plant growth promotion by this fungus. Also plant growth mechanisms by plant growth promoting fungi can

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E-mail address: rin_aceh@yahoo.com
be achieved by the production of plant growth regulators like auxins, gibberellins, and cytokinin[8]. Therefore seeds that are expired could be stimulated by using plant growth stimulator such as auxin and gibberellin.

The use of Trichoderma is expected to be biostimulator for watermelon seed germination, to obtain optimum crop yields. This study aimed to determine the concentration and long incubation effect of T. virens on viability and vigor of seeds of watermelon that expired.

Based on the above it is necessary to study about the role of T. virens on plant growth. Especially for watermelon seeds that expired, little is known yet about whether it is possible to apply biocontrol agent, how it can be effective in biopriming treatment, e.g., concentration and duration of incubation, so as to increase the viability and vigor of seed.

2. Materials and Methods

Research was conducted in the Laboratory of Seed Science and Technology and Laboratory of Plant Disease Faculty of Agriculture, Syiah Kuala University, from March to May, 2011. This study used a complete random design (CRD) 4x4 factorial with 2 factors:

2.1. Seed preparation

Expired seeds of watermelon had been stored for 2-years in the Auto-Dry Desiccators brand OSK BM 13 236, E-280 TDC models. Parts of them served for a preliminary experiment for seed germination by using 25 seeds to determine initial viability using the test paper method. After the viability was confirmed, in total 1200 seeds were used in this study.

<table>
<thead>
<tr>
<th>No.</th>
<th>Combination of Treatment</th>
<th>Concentration</th>
<th>Incubation period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>D₀I₀</td>
<td>Control</td>
<td>Control</td>
</tr>
<tr>
<td>2.</td>
<td>D₀I₁</td>
<td>Control</td>
<td>1 x 24 hour</td>
</tr>
<tr>
<td>3.</td>
<td>D₀I₂</td>
<td>Control Control</td>
<td>2 x 24 hour</td>
</tr>
<tr>
<td>4.</td>
<td>D₀I₃</td>
<td>Control</td>
<td>3 x 24 hour</td>
</tr>
<tr>
<td>5.</td>
<td>D₁I₀</td>
<td>5 gr/ml</td>
<td>Control</td>
</tr>
<tr>
<td>6.</td>
<td>D₁I₁</td>
<td>5 gr/ml</td>
<td>1 x 24 hour</td>
</tr>
<tr>
<td>7.</td>
<td>D₁I₂</td>
<td>5 gr/ml</td>
<td>2 x 24 hour</td>
</tr>
<tr>
<td>8.</td>
<td>D₁I₃</td>
<td>5 gr/ml</td>
<td>3 x 24 hour</td>
</tr>
<tr>
<td>9.</td>
<td>D₂I₀</td>
<td>10 gr/ml</td>
<td>Control</td>
</tr>
<tr>
<td>10.</td>
<td>D₂I₁</td>
<td>10 gr/ml</td>
<td>1 x 24 hour</td>
</tr>
<tr>
<td>11.</td>
<td>D₂I₂</td>
<td>10 gr/ml</td>
<td>2 x 24 hour</td>
</tr>
<tr>
<td>12.</td>
<td>D₂I₃</td>
<td>10 gr/ml</td>
<td>3 x 24 hour</td>
</tr>
<tr>
<td>13.</td>
<td>D₃I₀</td>
<td>15 gr/ml</td>
<td>Control</td>
</tr>
<tr>
<td>14.</td>
<td>D₃I₁</td>
<td>15 gr/ml</td>
<td>1 x 24 hour</td>
</tr>
<tr>
<td>15.</td>
<td>D₃I₂</td>
<td>15 gr/ml</td>
<td>2 x 24 hour</td>
</tr>
<tr>
<td>16.</td>
<td>D₃I₃</td>
<td>15 gr/ml</td>
<td>3 x 24 hour</td>
</tr>
</tbody>
</table>

2.2. Biopriming

Before biopriming was done, T. virens were diluted by sterile water. Five grams of T. virens was mixed into 45 ml sterile water, 10 grams mixed into 90 ml sterile water and 15 grams mixed into 135 ml sterile water, and then each mixture was stirred for 15 minutes until mixed. One ml suspension of Trichoderma was diluted in 9 ml sterile water. This dilution was repeated three times. Biopriming was done by incubating seeds in a solution of T. virens in a 280 ml container with a volume of water. To keep O₂ in solution remain available, the seed was aired by aerator during experiment. In total 1200 seeds were used.

2.3. Germination

Seeds were incubated for 1 x 24 hours, 2 x 24 hours and 3 x 24 hours as treatments, and those for control received no incubation. They then germinated in soil moisture medium. For each treatment 25 seeds were planted. The experiment was conducted in Laboratory of Seed Science and Technology Faculty of Agriculture, Syiah Kuala University under a constant condition at room temperature (27ºC) and humidity 60%.
2.4. Observation

2.4.1. Potential viability.

Potential Growth (PGr); Values obtained by observing the amount of seed that were growing with symptoms of root emergence from skin of seedlings. Observations were made on the 8th day after planting, and calculated using the equation:

\[
PGr(\%) = \frac{\sum \text{[seedlings that showed symptoms]}}{\sum \text{planted seeds}} \times 100.
\]

Potential Germination (PGe); Observed normal seeds that had germinated on day 4 and 8 after planting calculated by formula:

\[
PGe(\%) = \frac{\sum \text{[normal seeds on observations I + normal seeds on observations II]}}{\sum \text{planted seeds}} \times 100
\]

2.4.2 Degree of vigorous growth

Growth Speed (GS); Growing speed was tested to find out the percentage of increase in the normal seed which grows each day until the 8th stated in percent of normal seedling. It was calculated by using the formula:

\[
GS = \frac{\left( \text{percentage of normal seedling at day 1} \right) N1/D1 + N2/D2 + N3/N3 + \cdots + Nn/Dn}{\text{Number of days after planting.}}
\]

Description:
GS = Growth Speed
N1 ... = percentage of normal seedling at day 1, 2, .. n
D1 ... = Number of days after planting.

Simultaneous Germination of seeds (SG), Concurrency value to calculate the number of plants observed strong normal seedling, observed between the 4th and 8th (on day 6) expressed in percent, according to the formula:

\[
SG(\%) = \frac{\sum \text{normal sprout}}{\sum \text{planted seeds}} \times 100
\]

Vigor of Sprout (VS); Vigor test was to determine the ability of seedling to grow well with the structure of a normal seedling. Observations were made on the 8th day specified in percent. Seedling vigor can be calculated by using the formula:

\[
VS(\%) = \frac{\sum \text{seeds with strong vigor}}{\sum \text{planted seeds}} \times 100
\]

3. Results and Discussion

Parameter data obtained is shown in Table 2. In the following paragraphs they will be described and discussed.

Table 2 Summary of analysis of variance indicated concentrations of T. virens and time of incubation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration</th>
<th>Time of incubation</th>
<th>KK (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential Growth (%)</td>
<td>tn</td>
<td>*</td>
<td>16,3%</td>
</tr>
<tr>
<td>Germinate power (%)</td>
<td>*</td>
<td>**</td>
<td>23,5%</td>
</tr>
<tr>
<td>Growth velocity (%) / etmal</td>
<td>**</td>
<td>*</td>
<td>20,9%</td>
</tr>
<tr>
<td>Growing synchrony (%)</td>
<td>**</td>
<td>**</td>
<td>15,2%</td>
</tr>
<tr>
<td>Seeding vigor (%)</td>
<td>**</td>
<td>**</td>
<td>21%</td>
</tr>
</tbody>
</table>

** = Very Significant; * = Significant; tn = Not Significant

3.1. Concentration effect of Trichoderma virens

The results of the analysis of variance F test showed that the concentration factor of T. virens had very a significant effect on growth speed (SG), simultaneous germination (SG), and vigor of sprout (VS), but did not significantly affect growing potential (PGr).
Research conducted by Harvey on cucumber plants inoculated with Trichoderma harzanium showed that T. virens may improve the viability and vigor of watermelon seeds; both of them were significantly different when T. virens was applied than controls, considering observation-based benchmarks, i.e., PGr, PGe, GS, SG and VS.

The highest percentage of the potential growth and vigor viability was found in treatment with highest concentrations of 15 g/ml (D3), while the lowest percentage on without T. virens (D0). This may be due to the addition of T. virens that improved the metabolism of the seed and plant vigor, allowed retrieval of nutrients and stimulated the transport of nutrients to be smooth when the population was abundant in plant roots. With adequate nutrient requirements, metabolic processes in plants would work well, including photosynthesis process to produce carbohydrates that will be parsed into glucose[18].

Table 3. The average value of Potential Growth, Power Germinate, Growth Speed, simultaneity growing and Vigor seed germinate of watermelon in each treatment of concentration T. virens.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Concentration of Trichoderma virens (gr/ml)</th>
<th>BNJ0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>D0</td>
<td>D1</td>
</tr>
<tr>
<td>PGr (Arc sin√p)</td>
<td>40.11</td>
<td>44.99</td>
</tr>
<tr>
<td>%</td>
<td>(41.50)</td>
<td>(49.98)</td>
</tr>
<tr>
<td>PGe (Arc sin√p)</td>
<td>35.77a</td>
<td>44.89b</td>
</tr>
<tr>
<td>%</td>
<td>(34.16)</td>
<td>(49.80)</td>
</tr>
<tr>
<td>GS (Arc sin√p)</td>
<td>28.42a</td>
<td>36.79b</td>
</tr>
<tr>
<td>%</td>
<td>(22.65)</td>
<td>(35.86)</td>
</tr>
<tr>
<td>SG (Arc sin√p)</td>
<td>29.64a</td>
<td>33.57b</td>
</tr>
<tr>
<td>%</td>
<td>(24.45)</td>
<td>(30.57)</td>
</tr>
<tr>
<td>VS (Arc sin√p)</td>
<td>29.25a</td>
<td>37.32cd</td>
</tr>
<tr>
<td>%</td>
<td>(23.87)</td>
<td>(36.75)</td>
</tr>
</tbody>
</table>

Note: Values followed by the same letter in the same row are not significantly different at 0.05 HSD test

Description: ( ) = value before transformation; PGr = Potential Growth; PGe = Potency Germination; GS = Growth Speed; SG = Simultaneous Germination of seed; VS = Vigor Seed

The potential growth (shown by PG) was not significantly different at all concentration levels, although it was highest at the concentration of 15 g/ml (D3), being equal to 55.58%. Germination did not significantly changed according to T. virens concentration: 55.05% at the concentration of 15 g/ml (D3), 49.80% at the concentration of 5 g/ml (D1) and 47.05% at the concentration of 10 g/ml (D2); but was significantly different from control treatment without T. virens (D0) of 34.16%. Speed of growth was significantly affected by the concentration of T. virens, as high as 40.08% at 15 g/ml (D3), which was significantly different from all other treatment: 22.65% in control, 35.31% at 10 g/ml (D2) and 35.86% at 5 g/ml (D1). Simultaneous germination of seedlings were not significantly different between two treatment with high concentrations of T. virens 37.67% at 10 g/ml (D2) and 36.38% at 15 g/ml (D3), but they were significantly different from lower T. virens concentration (32.53% at 5 g/ml (D1) and 24.78% without T. virens). Vigor of sprout was not significantly different among treatments with different concentration of T. virens (38.19% at 15 g/ml (D3), 33.12% at 10 g/ml (D2), 36.75% at 5 g/ml (D1)), which was significantly different from treatment without T. virens (23.87%).

Thus the treatment using T. virens may improve the viability and vigor of watermelon seeds; both of them were significantly higher when T. virens was applied than controls, considering observation-based benchmarks, i.e., PGr, PGe, GS, SG and VS.

In other addition, other report stated that T. virens controls soil-borne pathogens with mechanisms of parasitism, competencies, generating broad-spectrum antibiotics such as gliotoxin and viridin, and producing enzymes like endoglucanase, cellulase and chitinase that can kill a variety of soil-borne pathogens, so as to improve root growth. Especially on a watermelon seed that had expired when the seed is prone to be attacked by fungus and disease[11].

Mechanism of how Trichoderma species increased plant growth and development was determined through response of Arabidopsis seed inoculated with two species of Trichoderma, T. harzanium and T. virens. Both of these fungi stimulate Arabidopsis seedling growth under favourable conditions. Stimulation of plant growth caused by a fungus correlates with the formation of production of lateral roots. T. virens showed a very important role in auxin signalling and stimulating plant growth[13]. Research conducted by Harvey on cucumber plants inoculated with Trichoderma showed an increase in better root growth and root fresh weight two times heavier than the controls[7].
3.2. Effect of Incubation Time

Results of the analysis of variance F test showed that incubation time factor had a very significant effect on germination, seedling vigor, potential growth, and speed of growth. The average value of potential growth (PGE), potential germination (PGE), growth speed (GS), simultaneous seed germination (SG) and vigor of sprout (VS) for each treatment and each incubation time are shown in Table 4.

Table 4. The average value of Potential Growth, Power Germinate, Speed Growth, simultaneity growing and vigor seed germinate of watermelon in each treatment of long incubation

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Incubation time (hour)</th>
<th>BNF0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I0</td>
<td>I1</td>
</tr>
<tr>
<td>PGE (Arc sin p)</td>
<td>49.56*</td>
<td>40.55a</td>
</tr>
<tr>
<td>%</td>
<td>(57.92)</td>
<td>(42.26)</td>
</tr>
<tr>
<td>PGr (Arc sin p)</td>
<td>53.66*</td>
<td>36.87a</td>
</tr>
<tr>
<td>%</td>
<td>(64.88)</td>
<td>(36)</td>
</tr>
<tr>
<td>GS (Arc sin p)</td>
<td>41.46ab</td>
<td>31.83a</td>
</tr>
<tr>
<td>% / etmal</td>
<td>(43.83)</td>
<td>(27.81)</td>
</tr>
<tr>
<td>SG (Arc sin p)</td>
<td>37.85c</td>
<td>32.75ab</td>
</tr>
<tr>
<td>%</td>
<td>(37.65)</td>
<td>(29.61)</td>
</tr>
<tr>
<td>VS (Arc sin p)</td>
<td>40.92d</td>
<td>29.79a</td>
</tr>
<tr>
<td>%</td>
<td>(42.90)</td>
<td>(24.68)</td>
</tr>
</tbody>
</table>

Note: Values followed by the same letter in the same row are not significantly different at 0.05 HSD test

Description: ( ) = value before transformation; Figures prior to transformation; PGr = Potential Growth; PGE = Potential germination; GS = Growth speed; SG = Simultaneously growth; VS = Vigor speed

The potential to grow was significantly affected by incubation time: no incubation (I0, control) caused 57.92% while long incubation caused lower potential, i.e., 1x24 (I1), of 42.26%; 3x24 hours (I3), 44.53%; and 2x24 (I2), 51.37%. Germination was also significantly affected by incubation time: no incubation (I0) caused 64.88% which was significantly different from that resulted from long incubation, i.e., 1x24 (I1), 36%; 3x24 (I3), 37.81%; and 2x24 (I2), 47.19%.

The highest growth rate was observed in the treatment without incubation (I0) of 43.83%, but this was not significantly different from that after incubation: 1x24 (I1) of 27.81%, 3x24 hours (I3) of 30.11% and 2x24 hours (I2) of 31.88%. Synchrony growth was at high rate in treatment without incubation (I0, 37.65%), which was significantly different from the others: 2x24 (I2) of 28.71%, 1x24 (I1) of 29.26% and 3x24 hours (I3) of 31.67%. Similarly, seedling vigor was affected by incubation time; no incubation (I0) resulted in 42.90%, which was significantly different from long incubation, 1x24 (I1) of 24.68%, 3x24 hours (I3) of 29.79% and 2x24 (I2) of 34.71%.

From these results of the analysis of variance, incubation time factor had a significant effect on germination, seedling vigor, simultaneity grow, potential growth, and speed of growth. Seeds that received T. virens without incubation (I0) in the aerator, soaked in a solution for 5 minutes and immediately planted showed a higher yields; this may be because the seeds that had been touched with T. virens reacted faster when seeds germinate in soil media. Trichoderma can grow well if the soil is in a preferable conditions, for example, with enough humidity. However, two-day incubation showed an increase in germination, which may be due to the influence of the spores of T. virens and substances contained in T. virens that affect watermelon seed.

As for the result that period seed incubation (3x24 hours) decreased germination, the longer the soaking time, the better the chance of Trichoderma solution to get in contact with the seed. This means, soaking the substances longer may initially have positive effects on the seed, but might turn into negative for the seeds. In these conditions toxic substances that exist in T. virens may come out and become poison to the seed. Auxin produced by Trichoderma was allegedly increased thereby inhibiting seed germination of watermelon. Some researcher stated that the soil fungus Trichoderma, for which the conditions are favorable, can produce auxin that is useful for the plant growth[19]. According to Srivastava, a low concentration of auxin can trigger the growth of the radicle in the seed, whereas high concentrations of auxin can inhibit the germination of the seed[20].
4. Conclusion

1. Concentration of *T. virens* significantly affect growth speed, simultaneous seed germination, vigor of sprout, and germination, but did not on potential growth.
2. Time of incubation had a very significant effect on germination, seedling vigor, simultaneous seed germination, potential growth, and speed of growth.
3. There was no interaction between *T. virens* concentration and incubation time.

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