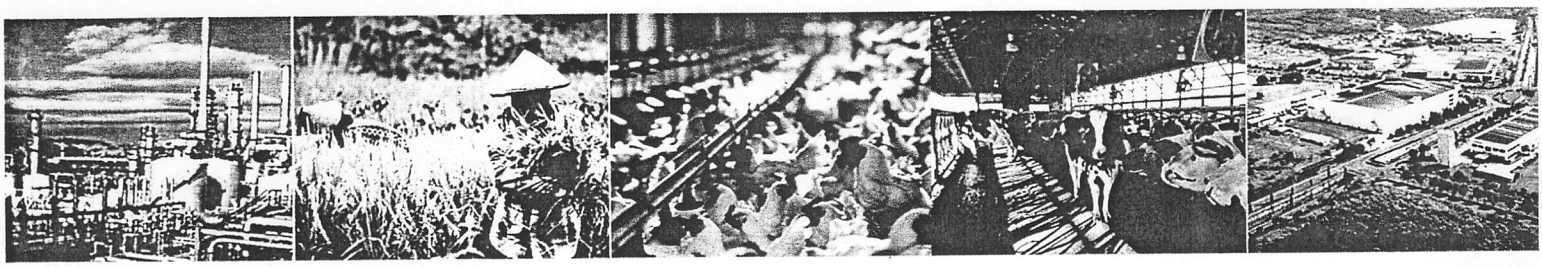
PROCEEDINGS

2015 3rd International Conference on Adaptive and Intelligent Agroindustry (ICAIA)

ICAIA 2015



August 3rd - 4th, 2015
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Department of Agroindustrial Technology

Bogor Agricultural University

Bogor, Indonesia

Welcome Message from The General Chairs of ICAIA 2015

On behalf of the organizing committee, it is our pleasure to welcome you to International Conference on Adaptive and Intelligent Agroindustry, Bogor, Indonesia. This is the 3rd conference on the topic that is held by the Department of Agroindustrial Technology, Bogor Agricultural University, Indonesia.

The conference is expected to provide excellent opportunity to meet experts, to exchange information, and to strengthen the collaboration among researchers, engineers, and scholars from academia, government, and industry. In addition, the conference committee invited five renowned keynote speakers, i.e. Prof Irawadi from Bogor Agricultural University; Prof Kenneth De Jong from George Mason University, USA; Dr Yandra Arkeman from Bogor Agricultural University; and Dr Guillermo Baigorria from University of Nebraska-Lincoln, USA.

The conference committee also invited Prof Noel Lindsay from University of Adelaide, Australia; Kiyotada Hayashi from National Agricultural Research Center-Tsukuba, Japan; Prof Margareth Gfrerer from Islamic State University of Jakarta, Indonesia; Dr Barry Elsey from University of Adelaide, Australia; Dr Gajendran Kandasamy from Melbourne University, Autralia; and Imperial College London-British, Prof Allan O'Connor from University of Adelaide, Australia; Dr Wisnu Ananta Kusuma from Bogor Agricultural University ,Indonesia; and Dr Frank Neumann from University of Adelaide, Australia, as invited speakers.

This conference was organized by Department of Agroindustrial Technology, Bogor Agricultural University and Asosiasi Agroindustri Indonesia, and technically sponsored by IEEE Indonesia Section. Furthermore, it was supported by Departement of Computer Science, Bogor Agricultural University; Surfactant amd Bionegergy Research Center; PT Bogor Life Science and Technology; Indonesian Ministry of Industry; PT Pachira Distrinusa; and PT Kelola Mina Laut.

I would like to take this opportunity to express my deep appreciation to the conference's committee members for their hard work and contribution throughout this conference. I would like to thank authors, reviewers, speakers, and session chairs for their support to participate in the Conference. Lastly, I would like to welcome you to join ICAIA 2015 and wish you all an enjoyable stay in Bogor.

Sincerely,
Dr Yandra Arkeman
General Chairs, ICAIA 2015

WELCOMING ADDRESS

Prof. Dr. Ir. Nastiti Siswi Indrasti
Head of Agroindustrial Technology Department
Faculty of Agricultural Engineering and Technology
Bogor Agricultural University

on

3rdInternational Conference on Adaptive and Intelligence Agroindustry (3rd ICAIA)

Bogor, August, 3 – 4, 2015

Assalamu'alaikum Warohmatullahi Wabarokatuh
In the name of Allah, the beneficent and the merciful,

Distinguish Guest, Ladies and Gentlemen
Let me first thank you all for accepting the invitation to participate in this 3rd International Conference on Adaptive and Intelligence Agroindustry (ICAIA). In particular I would like to thank Rector of IPB (Institut Pertanian Bogor/Bogor Agricultural University) Prof. Herry Suhardiyanto for supporting this event as part of the series academic event in celebrating the 52nd Anniversary of Bogor Agricultural University.

We are certainly proud to have been able to assemble this event in IPB, Bogor. The range of participants and audience at this conference is precisely something I would like to stress. Participants who followed the event more than 150 people, coming from various countries including the USA, Australia, Japan, Vietnam, Philippine, Germany and Indonesia. The main goal of the conference is to provide an effective forum for distinguished speakers, academicians, professional and practitioners coming from universities, research institutions, government agencies and industries to share or exchange their ideas, experience and recent progress in Adaptive and Intelligent Agroindustry.

The 2015 3rd International Conference on Adaptive and Intelligent Agro-industry (ICAIA) is the third forum for the presentation of new advances and research results on various topics in all aspects of innovative agro-industry that highlights the development and improvement for today and tomorrow's global need for food, energy, water and medicine. The aim of the conference is to stimulate interaction and cohesiveness among researchers in the vast areas of innovative agro-industry. Innovative Agro-industry has the ability to adapt intelligently to future global challenges, i.e. food, energy, water, and medical. Global challenges needs a new breed of Agroindustry which could produce innovative products to fulfill the needs through advanced processing technology, production systems and business strategy supported by cutting-edge information and communication technology.

The topic for this event is "Empowering Innovative Agroindustry for Natural Resources, Bioenergy and Food Sovereignty". The topics clustered into four main parts:
Track 1 : Innovative Agroindustrial and Business System Engineering

Track 2 : Frontier Approaches in Process and Bioprocess Engineering
Track 3 : Frontier Approaches in Industrial Environmental Engineering
Track 4 : Intelligent Information and Communication Technology for Adaptive Agroindustry of the Future

This event also hosts four (4) workshops: (1) Strategies for Agroindustry Development (2) LCA for Agroindustry (3) Innovation and Technopreneurship for Agroindustry and (4) Agroindustry Informatics.

Distinguish Guest, Ladies and Gentlement,
Agroindustry transforms agricultural commodities into high value-added products. Agroindustry is industry that process agricultural products to increase their value added significantly by using technology and by considering environmental aspect and sustainability. However, with changing global demand and technology advancement, innovative agroindustry is needed in order to be competitive as well as sustainable. The challenge of future agroindustry is not merely efficiency and productivity anymore, but also the challenge to appropriately apply frontier technology as well as meeting future global demands.

Agroindustry needs to deal with the application of advance technologies and cope future global issues. Current global issues which arise and expected to exist in the future are food sovereignty, renewable energy, sustainable water management and pharmacy. The ability of agro-industry to respond the future global issues and the undoubtedly substantial increase in demand in future decades will be highly dependent on the increased application of existing technologies as well as the exploitation of new and innovative technologies.

The emergence of high technology could be applied in the agro-industry are: nanotechnology, biotechnology, bioinformatics, food processing, food packaging-waste, state-of-the-art computation and many others. The aforementioned high-technology along with computation technology could greatly advance agro-industry from a traditional system into a smart-intelligent and innovative technology. Therefore, in the new millennia, adaptive-intelligent and innovative agro-industry will contribute to solutions to global problems and brings agriculture into perfection.

Hope this conference will also discuss this issue in more detail as it is an important matter for all of us. We should no more think just how to produce high value product but it is also necessarily important how to keep our live in good quality by understanding following old saying... "You do not live at once. You only die once and live every day".

I do not to take up any more of your time with these opening remarks. Let me simply thank you once again for sharing your thoughts with us. Here's wishing every success for the conference. May Allah bless all of us.

Thank you for your kind attention,
Wassalamu'alaikum Warohmatullahi Wabarokatuh

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AGENDA

Time	Activities
Monday, August 3rd 2015	
08.00 - 09.00	Registration
09.00 - 10.00	Opening Ceremony • Welcoming Address: Prof. Nastiti Siswi Indrasti (Head of DAT, Fateta, IPB) • Welcoming Speech Head of Bogor Regency • Conference Opening: Prof. Herry Suhardiyanto (Rector of IPB) • Opening Speech and Conference Opening : Minister of Industry Indonesia * • Launching Expose International program DAT
10.00 – 10.05	*Photo Session*
10.05 - 10.15	*Coffee break*
10.15 - 10.45 10. 45 - 11.30 11.30 – 12.00 12.00 – 12.30	Keynote Speech : 1. Prof Irawadi (Bogor Agricultural University, Indonesia) 2. Prof. Kenneth De Jong (George Mason University, USA) 3. Dr. Yandra Arkeman (Bogor Agricultural University, Indonesia) 4. Dr. Guillermo Baigorria (University of Nebraska, Lincoln, USA)
12.30 – 13.30	Lunch break
13.30 – 13.50 13.50 – 14.10 14.10 – 14.30 14.30 – 14.50 14.50 – 15.10 15.10 – 15.45	Plenary Session 1 : Prof. Noel Lindsay (University of Adelaide, Australia) Dr. Kiyotada Hayashi (National Agricultural Research Center, Tsukuba, Japan) Prof. Margareth Gfrerer (Islamic State University of Jakarta, Indonesia) Dr. Barry Elsey (University of Adelaide, Australia) Ir. M. Novi Saputra (Marketing Director KML Food Group) *Discussion*
15.30 – 15.45	*Coffee break*
15.45 – 18.00	Parallel session A, B and C
18.00 – 21.00	Welcome Dinner

Time	Activities
Tuesday, August 4rd 2015	
08.30 – 09.00	Registration
	Plenary Session 2 :
09.00 – 09.20	Dr. Gajendran Kandasamy (PhD in Physic, Melbourne University ; PhD in Innovation Imperial Collage, London)
09.20 – 09.40	Prof. Allan O'Connor (University of Adelaide, Australia)
09.40 – 10.00	Dr. Eng. Wisnu Ananta Kusuma, ST, MT (Bogor Agricultural University, Indonesia)
10.00 – 10.20	Dr. Frank Neumann (University of Adelaide, Australia)
10.20 – 10.45	*Discussion*
10.45 – 13.00	Parallel Session A, B and C
13.00 – 14.00	Lunch break
14.00 – 15.30	Parallel Workshop • Strategies for Agroindustry Development • LCA for Agroindustry • Innovation and Technopreneurship for Agroindustry • Agroindustrial Informatics
15.30 – 15.45	Coffee Break
15.45 – 16.15	Closing remark

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Green Supply Chain Management Innovation Diffusion in Indonesian Crumb Rubber Factories: Designing Strategies towards Implementation

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Abstract— **Green supply chain management (GSCM) is a new technical innovation that has been touted to improve supply chain performance as well as minimize the environmental impacts. Unfortunately, this concept has not been entirely implemented in Indonesian rubber industries. The primary objectives of this research were to suggest the model that is relevant with the crumb rubber supply chain and formulate green approach as well as prioritize strategies to accelerate GSCM implementation in Indonesia's crumb rubber factories (CRFs). The case studies were conducted in two private CRFs. The data were collected through semi-structure interviews, field observation, and examination of QMS documents. The GSCM model for CRFs was constructed and the rooms for improvement were judged through comparing the current condition with the model. In addition, the Analytical Hierarchy Process was employed to prioritize the strategies. The results showed that green procurement which emphasizes on educating farmers and increasing the quality of raw material are the prioritized green approaches. The practical results of this research provide valuable insights and guidelines for CRFs to integrate the green concepts into operational business strategy.**

I. INTRODUCTION

Crumb rubber industry (CR) is a featured export rubber product in Indonesia which has a significant role in national economic development and poverty alleviation. These industry supplies about 28% of CR demand in the world (IRSG, 2014). Recently, the negative environmental impacts have become a highlighted issue in the growth of CRFs. Based on the last annual assessment conducted by Ministry of Environment, about 200 of 218 CRFs are categorized as *"red label performance"*. This means that the waste management including hazard and toxic material, water, solid, gas emission generated from the CR production processing has not fulfilled the government regulation standards.

The issue of environmental pollution accompanying industrial development ought to be addressed by the supply chain management which considers the material, and information flows as well as the networking of certain industries to be environmentally friendly [1-3]. Some manufacturing companies in Taiwan, India, China, and Brazil have initiated proactively adopt the GSCM such as electronic, pharmaceutical, logistic, textile industries [4]. However, the adoption in agricultural industries has not been explored widely because the supply chain mechanism of agro-industry being complex and highly uncertain. In this case, the Indonesian CR supply chain is unique and has different dynamic behavior as a result of perishable characteristics of latex, seasonal for harvesting and voluminous [5, 6].

The previous studies related to environmental issues in CRFs only focus on the upstream activities of the supply chain, rubber block and RSS [7]. Research on innovation adoption of GSCM is not broadly developed and the implications regarding diffusion the various GSCM practices are not well understood [3].

II. LITERATURE STUDY

A. Green Supply Chain Management

Green issues that have risen from pressures of regulations, markets, NGOs, and suppliers become a crucial part of the business strategy. Therefore, the integration of green approach into business activities is urgent to sustain the competitiveness in the market[3, 8]. Compared to the traditional supply chain, the GSCM allows collaboration among the members non-linearly to share information and materials [3]. This

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collaboration leads supply chain members to works effectively to achieve higher level of green practice.

The urgency of GSCM implementation has many considerations. However, Diabat and Govindan [12] reported that the decisive reason is the ambition of gaining a sustainable competitive advantage. The advantages include enumerates cost reduction, enhanced value to customers, increased sales, positive media attention, greater operational efficiencies and positive ratings from investment firm [1, 3, 13].

Various models of GSCM, which based on the industry type exist in the literature [3, 14, 15]. To illustrate, Ho, Shalishali [2] define GSCM as a range from purchasing, production, inventory, distribution, marketing, and reverse logistic. While, Srivastava [3] suggested the green product design should be in that model. In this study, the GSCM model has been constructed specifically for CRFs, the model is justified as shown in Figure 2.

B. *Innovation Diffusion Theory*

Innovation includes practices that are new to organizations, such as equipment, products, services, processes, policies, and projects. While, diffusion is the *"process by which innovation is communicated through certain channels overs time among the members of social system"* [17]. He emphasizes the essential stage is between knowledge and implementation, in which the decision to adopt or reject occurs.

Adopting green practices involves implementing new or modified process, techniques and systems to be more environmentally friendly[18], this adoption behavior can be categorized as a technical innovation process [14]. The green adoption changes fundamentally not only in the internal business operation but also other areas, such as suppliers, customers, business partners, even government as the regulators and policy makers [2]. Based on Rogers's model of innovation decision process, the existence of practice or operation is one of the crucial factors to implement the innovation successfully [17]. Since the GSCM is relatively new to the rubber industries, evidence of alternatives and approaches on how to accelerate this adoption is considerably limited.

C. *Analytical Hierarchy Process*

AHP is one of the techniques to solve the multi-criteria decision-making problem [19]. The principle is decomposing the complex and unstructured problem into a hierarchical structure. The structure consists of focus or objective, criteria or dimensions and the alternatives [5, 19, 20]. The primary operational technique in the AHP is the pair wise comparisons. This derives the relative importance of the variable in each level and appraises the alternatives in the lowest level in order to make the best decision among alternatives [5, 20].

The using of AHP as a selection method to formulate strategy has been widely used, particularly in agro-industry supply chain [6]. It has been used effectively to investigate GSCM practices such as selecting the green supplier and formulating strategy to adopt GSCM.. AHP has a supplemental power of being able to mix quantitative and qualitative factors into a decision. However, Vaidya and Kumar [20] reported some limitation such as strict hierarchical structure, interdependent relationship within a cluster of factors, and also comparison in a wide range number that tend to produce inconsistency. Thus, in this research, the semi-structure interview, and thematic analysis was conducted to get the better understanding and give veracity of the result of AHP.

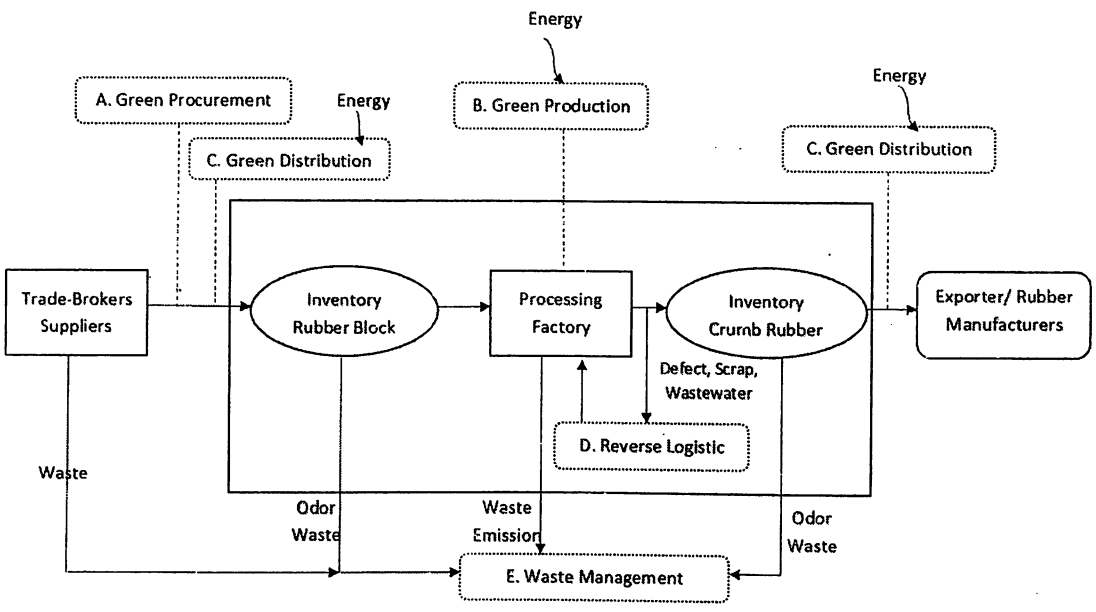

Figure 1 Suggested GSCM Model for Crumb Rubber Factories (Adopted from [1, 3, 7, 10, 21-23])

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III. RESEARCH METHOD

A. Data Collection

The research was conducted through a case study methodology with the qualitative approach, case of CRFs in South Sumatera, the highest crumb rubber producer province in Indonesia.

Purposive samples which are company A and B were selected. The companies have been operated for almost 35 years and produced approximately 400-ton crumb rubber monthly. They are classed in *"red level performance"*.

An interview script that had open-ended questions was used. The semi-structured interviews were conducted and recorded, mostly about 30-60 minutes for each respondent; a series of notes was made during the interviews. The respondents were the head of divisions and directors of each company. Data of field observation were also collected. This data were beneficial for comparing and matching between the result of the interview & examination of QMS document.

B. Data Analysis

Thematic analysis was used to analyze the result of the interviews. Firstly, all interviews were audio recorded on tape, then listen repeatedly, transcript and coded as proposed by Creswell [24]. After the coding of the material, some nodes were created and categorized following the already established framework from the literature reviews [25].

The AHP was employed by using Expert Choice Software. The hierarchy structure was constructed through study most cited journals, analyze the current system of CRFs, and discuss with experts. The experts are two doctors who are the senior researcher in rubber technology, head of rubber Research Centre, secretary rubber association in Palembang, and two directors CRF. The pair-wise comparison matrix was judged by six experts. Consistency index (CI) which is embedded in the software was calculated to control the consistency of experts' opinion.

IV. RESULTS AND DISCUSSION

A. Current Green Practices in CRFs

To give a better understanding of the dimensions of the environmental endeavors in each company, Table 1 shows the main efforts in terms of executed and continuous practices in order to be green. None of the examined firms used the term "GSCM" for their strategies. The data have been categorized based on the proposed GSCM model implementation in CRF (As shown in Figure 2). Some specific phrases from respondents are in quotation marks, and these give veracity to the research results.

TABLE 1
CURRENT GREEN PRACTICES IN CRFs

Activities	Company A	Company B
Environmental Management	- Integrating the environmental vision into the Quality Management System. "Passionately, We drive possibilities to be the Green Rubber Company."	- Appointing a person who is responsible to monitor and control the environmental performance in the company.
Green Procurement	NA	
Green Production	- Use renewable fuel "palm oil shell as a substitute for coal and gas."	- Redesign the process "modify the dryer to transfer the excess heat to the hanging chamber."
Green Distribution	- Consider the route and energy consumption by using "barge". - Reuse pallets. - Make to order system.	- The location for unloading raw material from the supplier is nearby the processing plant. - Reuse pallets - Make to order system.
Reverse Logistic	– Reuse the wastewater	- Reuse the wastewater
Waste Management	- Compost the waste to be fertilizer instead of discharge. - Adopt new technology in wastewater treatment "huge money to install the active sludge system". - Using non-hazardous chemicals "*deorub*" to minimize the odour." - Control and monitoring pollution	- Recycle by-products - Sell the rubber scrap - Control of pollution - Using non-hazardous chemicals "*deorub*" to minimize the odour."

B. The Hierarchy of GSCM Implementation

The hierarchy was constructed on three levels. The first level is the focus "Green practices selection for GSCM Implementation in CRFs". The second level is the dimension or activity which consists of Green Procurement, Green Production, Green Distribution, Reverse Logistic, and Waste Management. The last level are alternatives or green approached and finally, level 3 alternatives are the green approaches, these were formulated based on analysis of current system and the GSCM model.

As shown in Table 2, the results of local and global weights determined the relative importance of green activities and approaches respectively. In addition, ranking indicates the priority of practices on which organizations should commit and work throughout the process of GSCM implementation. The local weight is derived from judgment with respect to single criterion while the global weight is derived from multiplication by the weight of the criteria. The consistency index for

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each pair-wise comparison matrix ranges between 0.0034 – 0.0104 which can be used as reliability indicator for decisions maker.

Based on the AHP result, it is evident that green procurement (0.347), green production (0.266), and waste management (0.183) are the three most important activities to start implementing GSCM. Considering the global weights in Table 2, it is evident that the three prioritized approaches, namely 1) establish the higher standard of rubber block, 2) educate supplier and farmer and 3) reuse wastewater. The findings affirmed the procurement activities in the crucial role, particularly in supplier management relationships like supplier selection and raw material quality. The interpretation of interviews through thematic analysis was used to elucidate the AHP results.

C. Strategies for Greening the Supply Chain

1) Green Procurement

In accordance with the prioritized approaches based on AHP, it is likely consistent with the responses of the respondents. They noticed that the rubber block (raw materials) that purchased from farmers and collectors was the source of waste problems. The lower grade of rubber block cause the higher water and electricity consumption during the production process in CRFs, this leads to generate more wastewater and solid waste. Accordingly, Wibawa, Hendratno [11] reported that about 90% of production cost is raw material procurement. In fact, the production process of rubber block type D, which is the worst grade, causes the increasing of operational cost. It is calculated that the production cost is about as twice as type A, and the waste discharge is approximately as four times as the good grade [10].

The companies have established strict criteria for raw materials standards which is based on quality, delivery and consistency. However, the low grade is still being accepted. This is because the companies experience a lack of raw materials in some seasons, and they may also drop the prize when the quality is too bad and farmers agree without any argument. The rubber block quality is determined by the coagulant used and the amount of impurities[7]. It is found that farmers tend to add impurities such as sand, soil, crumb or other materials to increase the weight [10, 11]. These findings support the AHP results for improve the quality of rubber block, through educate the farmers about the disadvantage of add some impurities in rubber block. Therefore, external factors like the government may support this program.

TABLE 2
THE AHP RESULT OF STRATEGY SELECTION FOR GSCM IMPLEMENTATION IN CRFs.

Activities	Local Weight *	Green Approaches/ Practices	Local Weights	Global Weights **	Ranking
A. Green Procurement	0.347	A1. Substitute hazardous material	0.082	0.028454	14
		A2. Educate suppliers and farmer	0.354	0.122838	2
		A3. Establish higher standard for rubber block	0.564	0.195708	1
B. Green Production	0.266	B1. Adopt new technology	0.147	0.039102	10
		B2. Use alternative energy	0.151	0.040166	9
		B3.Recover excess energy	0.253	0.067298	4
		B4. Redesign process	0.165	0.04389	8
		B5. Improve efficiency machine	0.076	0.020216	16
		B6. Reduce the time of pre-drying process	0.208	0.055328	6
C. Green Distribution	0.106	C1. Use reusable packaging/ pallet	0.085	0.00901	21
		C2. Reduce stock rubber block	0.234	0.024804	15
		C3. Reduce time storage of rubber block	0.348	0.036888	13
		C4. Choose the best transportation mode	0.158	0.016748	19
		C5. Manage the route of truck	0.175	0.01855	18
D. Reverse Logistic	0.098	D1. Recycle the scrap	0.205	0.02009	17
		D2. Reuse the wastewater	0.687	0.067326	3
		D3. Remanufacture the defect product	0.108	0.010584	20
E. Waste Management	0.183	E1. Control of toxic & hazardous chemical	0.204	0.037332	11
		E2. Control emission	0.202	0.036966	12
		E3. Install active sludge wastewater treatment	0.308	0.056364	5
		E4. Use *deorub* to control odor	0.286	0.052338	7

2) Green Production

Initially, it is predicted that green production was the significant activities due to the current efforts in technology process is not working well. However, the result of AHP calculation revealed that the green approaches in production activities have lower priority than the purchasing area. According to the respondents, approaches like install active sludge for wastewater treatment, adopt new technology process and redesign process need an amount of capital investment and skillful human resources. They acknowledged that as emerged barriers to adopting some green approaches. Apart from that, it is found that the source problem of environmental problems in CRFs is in the low quality of rubber block [10, 11]. Surprisingly, the production activities are the significant area to initiate GSCM implementation in manufacturing and assembling [1, 13], not agricultural

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based industries like CRFs that has a highly dynamic raw material supply chain.

The evidence of the AHP results implies that the green approaches are interrelated within the CRFs. The application of these best practices should be multifaceted, not limited only to highly prioritized practices but also considering the significant factors on GSCM adoption. In addition, the green approaches to greening the waste management, distribution, and reverse logistic should be organized and synchronized with the current production system. The multiple greening approaches along with the high organization commitment results more beneficial for improving efficiency supply chain cost and enhance the environmental performance [12, 13, 26, 27].

3) Waste Management

The results of AHP show that the practices in the waste management are the third main activities in succeeding GSCM adoption. The recommended best practices are mostly the strategy of end of pipe system. CRFs were suggested to treat the wastewater and solid waste rather than implement source-reduction or pollution-prevention strategy. The green practices in AHP results do not emphasize on designing the zero-waste process and optimize the consumption of raw materials and energy because their resistance to change the processing system. Nevertheless, the waste treatment and disposal have been compelling problems like CRFs need to invest in technology and machinery [3, 28]. The other finding suggests controlling the amount of toxic and hazardous chemicals in the production process so that CRFs should have a different warehouse to store it. As a common waste management system, the green practices also include the pollution control from stack emission and the odor from rubber block during storage.

4) Green Distribution

The suggested green practices in GSCM adoption are improvement for logistics system of rubber block and packaging of crumb rubber. Based on the field observation and interviews, it could be said that he current logistic system is intricate from the plantation area to processing plant, particularly the delivery route is less integrated along the rubber block supply chain. This is because the complexity of the rubber block supply chain [9]. The results recommend some practical guidance such as using of alternative transportation modes, minimize travel distances and design the effective routing system. These practices were also suggested in integrating the ecological mindset in either processing or assembling industries [15, 29, 30]. Furthermore, based on experts' opinion, the green warehouse could be achieved by designing an efficient inventory system for both raw materials and crumb rubber product. The design should consider the warehouse capacity, the raw material consumption, the production schedule, and the demand of crumb rubber. Consequently, that design needs to be taken account in production planning.

5) Reverse Logistic

The respondents implies that collecting crumb rubber returns from the rubber manufacturers or exporters is very hardly happened as they mostly accept the product (negotiate for the lowest price if the quality is not as good as the standard). Thus, the experts concluded that internal logistics should be concerned in GSCM adoption. The CRFs have implemented life cycle concept in managing the waste such as consider recycle, reuse, and remanufacture waste as well as the defect product. However, it is found that the implementation of reverse logistics concepts in CRFs is not only for environmental sound but also opportunities financially sound organizational operational. This finding is in accordance with the research results that prioritize profit generation firstly rather than being green consciousness [1, 29]

Surprisingly, reuse the wastewater is the third ranking strategy. This green strategy is proven could minimize the water consumption during the production process and also minimizes wastewater discharge. Furthermore, recycling the scrap and remanufacture the defect product may be less prioritized due to the impact of the strategy is considerably low.

Based on the results and discussion, it implies that the identified green approaches are interrelated within CRFs. The application of these best practices should be multifaceted, not limited only to highly prioritized practices but also considering the significant factors on GSCM adoption. In addition, the green approaches to greening the waste management, distribution, and reverse logistic should be organized and synchronized with the current production system. In order to succeed the GSCM implementation, the company should have a high organization commitment to apply multiple greening approaches. Thus, the advantages of adopting GSCM like increasing efficiency of the supply chain, reducing the production costs, minimizing the waste, and improving the environmental performance could be obtained [12, 13, 26, 27].

V. CONCLUSION AND RECOMMENDATION

The results indicate that CRFs might have been aware of the need to be environmentally friendly but only a few effort and strategies have been integrated into the business strategies. Their commitment, motivation and responsiveness of being green may be oriented in more profitability rather than to be more ecologically. This research may recommend for the CRF managers to use the existing production system as a foundation to synchronize the green awareness with CRFs' operational strategies. Therefore, the adoption of GSCM need not be an experience of radical changes in the organization, but become a part of continual improvement in their quality management system.

The prioritized strategies to accelerate the GSCM implementation are mentioned as follows, a) establish

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the higher quality of rubber block, b) educate the farmers, and c) reuse the wastewater. The research suggests that CRFs management should be proactively managing the supplier relationship through educating the farmers in order to get higher quality of rubber block.

The sample in this study was limited which leads to result in a typical finding due to it is difficult to be generalized to other industries. However, the result would be valuable not only for practical guidance for CRFs managers but also serve as the base for further research in exploring GSCM implementation for other industries sectors.

To enhance the robustness of the findings, it is suggested to conduct the research on a larger scale with more various respondents and stakeholders. In addition, evaluation of GSCM performance with objective data, and use the other perspective such as Ecological Modernization Theory [18] or theory of environmental flow would be valuable in exploring the diffusion of innovative environment management practices. Moreover, regarding the limitation of AHP, it would better to utilize analytical networking process in terms of feedback systematic and interdependency property.

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