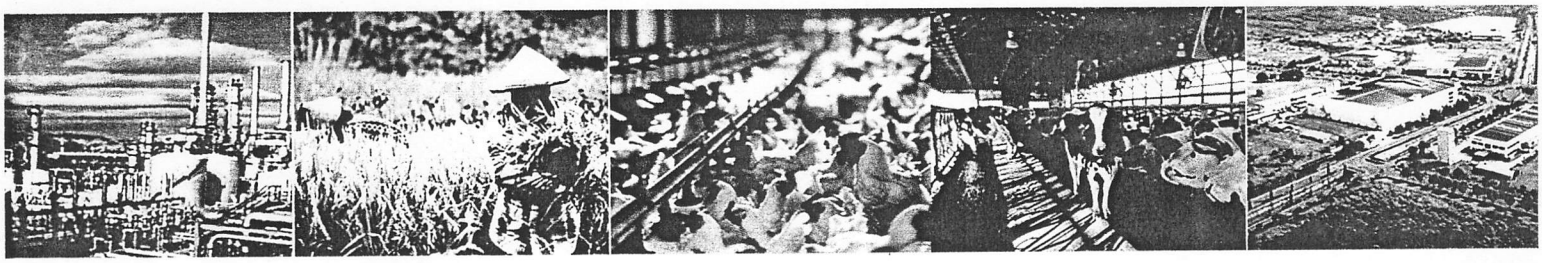
PROCEEDINGS

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

ICAIA 2015



August 3rd - 4th, 2015
IPB International Convention Center
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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
09.00 – 09.20	Plenary Session 2 : 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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An Empirical Investigation of the Barriers to Green Practices in Yogyakarta Leather Tanning SMEs

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***Abstract*—** This study identifies factors that inhibit green practice implementation in the leather tanning SME industry in Yogyakarta, Indonesia. These external and internal barriers were identified during interview with representatives from a number of leather tanning SMEs and industry experts. The results show that SMEs in this sector adopt only a limited level of environmental practices. Internal barriers to green adoption included insufficient resources and infrastructure, low-skilled human resources, poor financial capability, low awareness, and poor organizational strategies. The external barriers are significant; however, inadequate law enforcement and government support, a small and limited market segment, and the lack of green chemicals contribute also toward these poor practices. To deal with these problems, this research proposes eight strategies to tackle the obstacles that prevent the implementation of leather tanning green practices.

I. INTRODUCTION

Yogyakarta is a provincial region in Indonesia located on Java Island. The economic structure of Yogyakarta is dominated by trade (21%), services (18%) and agriculture (16%). Yogyakarta's development is significant and includes two leading industries - leather manufacturing and wood processing. These two industries contribute significantly toward the GDP, employment, investment, and development potential of the Province with multiplier effects to related industries in other provinces. The focus of this research is on leather tanning. Although this industry is well developed, there are significant waste management environmental problems.

According to the Indonesian Tannery Association, around 75% of the leather industry firms are small and medium enterprises (SMEs). These SMEs have limitations which hinder their waste management environmental protection efforts. Previous studies have found that SMEs tend to be more harmful to the environment compared to larger corporations due to their poor production techniques [7]. Other studies have found that leather tanning SMEs in developing countries face significant solid waste disposal problems with many being closed for not meeting the required standards [8]. This situation is similar in Indonesia where there is a low level of adoption of leather tanning green practices ("Badan Lingkungan Hidup" (BLH)).[1]

Increasing Indonesian consumer environmental awareness has begun to pressure the leather tanning industry to be more responsible. In this regard, the Indonesian Government is looking to clean up "dirty" industries by introducing industry green policies (e.g., National Regulation 3, 2014).[2] Consequently, leather tanning SMEs need to upgrade their existing practices and find better ways to solve their challenges while developing better competitive advantages. Many Yogyakarta SMEs, however, claim that they are challenged in implementing green practices, though there is no empirical evidence to support these claims.

In response to this lack of empirical evidence, this research aims to reveal the barriers that inhibit green practice implementation in Yogyakarta leather tanning SMEs and formulates strategies to tackle these barriers for better implementation of green practices.

II. LITERATURE REVIEW

A. *A glimpse of the Indonesian leather industry*

Leather is a most promising Indonesian industry as evidenced by the upward trend of international demand toward its leather products (Table 1). Yogyakarta SMEs generate significant export and local tourism sales.

Although the economic benefits of the industry are important, it has a negative environmental impact [16]. During the manufacturing process, pollution occurs through the generation of toxic liquids and solid wastes which emit repulsive smells. Only one-fifth of the raw hides/skins are converted to products; the rest are

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[1] The BLH is an environmental agency in Yogyakarta which has identified that most leather tanning SMEs have not met the required environmental standards.

[2] A green industry is defined as an industry which prioritizes efficiency and effectiveness in the resource utilization of its processes to align industrial development with the preservation of the environment while providing benefits to the community.

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discharged as waste or by-products. The tanning process produces 45-50m^3 of waste water per ton of raw hides/skins [8]. Tanning wastewater is a serious threat to the environment due to its content of strong alkali, bio-waste, and heavy metals.

Table 1. Export value of leather products 2009-2013
Source: Indonesian Ministry of Trade

Year	Export value (million USD)	Destination country
2009	178,4	US, Japan, Germany, Italy, Malaysia, Belgium, UK, Russia Federation, Egypt, Morocco, India, Taiwan, Canada, Australia, Georgia, Singapore, Algeria, Ecuador, France, South Africa
2010	246,4	
2011	292,1	
2012	324,7	
2013	338,1	

B. SME barriers to green practice implementation

SMEs are focused on generating profits to keep their businesses operating. They are preoccupied with reducing resource use and waste in order to achieve short term goals; however, this is not a priority if they do not gain associated benefits [4]. SMEs see environmental innovation as a financial burden and they do not recognize the contribution to performance of environmental best practice [21]. Thus, poor environmental practices exist because SMEs tend to focus on day-to-day activities [19] with their resources restricted to issues related to the business core [2] rather than green practices. Therefore, SMEs tend to be more reactive in tackling environmental problems. It is the larger companies that tend to be more proactive [1], [7]. SME reactive strategies focus more on compliance than sustainability [7]; they are not willing to contribute voluntarily. However, SME non-compliance is acknowledged and considered serious only if there is a threat of prosecution [21].

A range of studies have examined the barriers to green practice implementation. Most of these classify barriers into internal and external (refer Tables 2 and 3). There have been none that focus on leather tanning in Yogyakarta. For this reason, we investigate the Yogyakarta leather tanning industry and generate the propositions that appear in Table 4.

A. Strategy formulation using SWOT analysis

A SWOT analysis is commonly used as a means to diagnose the internal and external environments of an organization. It summarizes the most important factors in both environments as a base of the strategic formulation for the organization's future [9]. In this study, a SWOT analysis informed by previous research is used as the key tool to develop strategic plans for improved environmental performance of leather SMEs in Yogyakarta.

A variety of studies have identified various recommendations. For example, reference [20] found that better environmental practices can be achieved through more extensive environmental education and training, stronger regulatory frameworks, financial assistance, and better management guidance from stakeholders. Other study also proposed training and communication as key to addressing SME green practice barriers [24]. Government and policy makers also need to play a role in policing environmental regulatory breaches [17]. For example, reference [18] found that enhancing technical progress and applying stricter environmental regulations are crucial. In addition, previous study argued that SMEs are capable of making themselves greener by making strategic and organizational changes [10]. Based on these studies, additional propositions were developed (refer Table 5).

Table 2. Identified *internal* barriers

Internal barriers	Authors
Insufficient resources and infrastructure	Rojsek (2001); Brammer, Hoejmose & Marchant (2012); Tilley (1999); Murillo-Luna, J. L., Garcés-Ayerbe, C., & Rivera-Torres, P. (2011)
Inadequate technical knowledge and skills (human factor)	Hillary R. (2004); Rojsek (2001); Zilahy, G. (2004); Moors, E. H., Mulder, K. F., & Vergragt, P. J., 2005; Murillo-Luna, J. L., Garcés-Ayerbe, C., & Rivera-Torres, P. (2011)
High cost of environmental technologies (financial factor)	Hillary R. (2004); Rojsek (2001); Tilley (1999); Shi, H., Peng, Liu, & Zhong, (2008); Zilahy, (2004), Murillo-Luna, Garcés-Ayerbe, & Rivera-Torres, (2007); Zutshi, & Sohal, (2004); Moors, Mulder & Vergragt, 2005; Massoud, Fayad, El-Fadel, & Kamleh, (2010); Murillo-Luna, Garcés-Ayerbe, & Rivera-Torres, (2011)
Low awareness	Wilson, Williams & Kemp (2012); Tilley (1999); Zilahy, (2004).
Lack of organizational strategy	Murillo-Luna, Garcés-Ayerbe, & Rivera-Torres, (2007); Zilahy (2004), Moors, Mulder, & Vergragt, 2005; Massoud, Fayad, El-Fadel, & Kamleh, (2010)
Aversion to innovation	Murillo-Luna, Garcés-Ayerbe, & Rivera-Torres, (2011)

Table 3. Identified *external* barriers

External barriers	Authors
Market segment for green product is too small	Rojsek (2001); Zilahy (2004)
The 'green' supplier support is insufficient	Rojsek (2001); Murillo-Luna, Garcés-Ayerbe, & Rivera-Torres (2011)
Poor environmental legislation	Rojsek (2001); Wilson, Williams & Kemp (2012); Brammer, Hoejmose & Marchant (2012); Shi, Peng, Liu, & Zhong (2008); Revell & Rutherfoord (2003); Moors, Mulder, & Vergragt (2005)
Limited government support	Massoud, Fayad, El-Fadel, & Kamleh (2010)

Table 4. Proposition 1 details

RQ: What are the barriers that inhibit the implementation of green practices in Yogyakarta leather SMEs?
Proposition
Internal barriers
Proposition 1a: Insufficient resources and infrastructure
Proposition 1b: Human factor
Proposition 1c: Financial factor
Proposition 1d: Low of awareness
Proposition 1e: Organizational strategy factor
Proposition 1f: Aversion to innovation
External barriers
Proposition 1g: Market segment is too small
Proposition 1h: Insufficient "green" supplier support
Proposition 1i: Poor environmental legislation
Proposition 1j: Limited government support

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Table 5. Proposition 2 details

What strategies can be proposed to tackle existing barriers?
Proposition 2a: Intensifying education and training program
Proposition 2b: financial assistance
Proposition 2c: Provide environmental management guidance
Proposition 2d: Stricter environmental regulation
Proposition 2e: Encouraging the organizational change process

III. RESEARCH METHOD

Data was collected using interviews with select academic, business, and government representatives, supplemented by observational evidence. Interview durations ranged between 45-90 minutes. All interviews were recorded and transcribed for analysis. The participants were purposively sampled based on their experience and knowledge:

a. Participant A (RA): The owner of AA enterprise, Yogyakarta leather SME
b. Participant B (RB): The owner of BB enterprise, Yogyakarta leather SME
c. Participant C (RC): Head of Division, Centre for Leather, Rubber and Plastics (CLRP), Yogyakarta
d. Participant D (RD): Head of the Indonesian Tanneries Association
e. Participant E (RE): Lecturer in the Academy of Leather Technology, Yogyakarta

Table 6 provides details of the participant SMEs.

Table 6. Profile of SME company participants

AA enterprise
Production capacity: 40.000-60.000 sqft/month *Number of workers*: 50 *Products* : Finished leather *Process*: Starts from pickle, not rawhide/skin *Established*: 1991 *Customers*: Most local with some demand from Japan, USA, etc
BB enterprise
Production capacity: 10.000-20.000 sqft/month *Number of workers*: 20 *Products*: Finished leather and leather products *Process*: Starts from pickle, not rawhide/skin (majority) though is a limited process that starts from beamhouse *Costumers*: Most local with some demand from other countries

Data was analysed using descriptive and interpretive analyses. A SWOT analysis was used as the basis for the strategy formulation.

IV. FINDINGS AND DISCUSSION

A. Characteristics of Yogyakarta leather SMEs

Typically, the Yogyakarta SME leather tanning process starts with "pickling" not from raw hide/skin treatment. The industry argues that commencing the process with pickling is more efficient and can reduce waste and odours and sludge. For example, participant B said, *"The reason (for starting with pickling) is environmental. This location is already configured as a leather factory site but it is still close to population centers. And their focus is the smell of the waste"*. Also, in the words of participant A, *"If you don't want to have a longer process, and don't want to have a problem with the community, don't start the process from processing the raw hides/skins"*. However, while there is a realization that environmental considerations will be a challenge in the future, these are not a priority because there is little pressure from regulatory bodies or customers to comply. For example participant A said, *"It will affect the environment if the effluent is not treated."* However, participant A also said, *"As long as there are no complaints .... I do not think there is a problem"*. While participant B declared, *"Personally, I do not want to deteriorate the environment. But, a consequence of the industry is to generate waste. I have tried to minimize the waste but as long as the cost is reasonable"*.

These types of comments suggest that the Yogyakarta SME environmental leather problems are unresolved. These SMEs have no special treatment for solid and gas waste, nor for waste water. Critically, they do not regularly monitor and/or evaluate treatment results. Regulatory enforcement is an issue because of insufficient staff to enforce laws and there is customer apathy toward green practices since most customers are local and focus on quality and price - not environmental issues. Thus, SMEs do not focus on preventive pollution management.

B. Identification of green practice barriers

This study reveals a number of barriers that impede Yogyakarta leather SMEs from adopting green waste management practices. These barriers, based on participant responses, appear in Tables 7 - 16.

Table 7. Proposition 1a Internal Barriers

Sub Topic
Insufficient resources and infrastructure
Participant Quotes
RB: There is a technological problem. I use my own ways to treat waste; maybe it has not perfect yet. In our treatment, we do not use aeration. We just put the waste into the basin and hope that the effluents have been neutralized. **RD**: There is a plan to build an integrated waste treatment. But inadequate government infrastructure becomes an impediment. **RE**: Cost constraints, equipment and land are impediments.

Some participants considered "insufficient resources and infrastructure" as one factor that hinders green practices. This is consistent with previous research [3], [14], [18], [20]. Limited infrastructure and resources negatively impact efforts to protect the environment. Most of the SMEs use only simple treatments, simple chemicals, and no biological treatments for waste. With limited staffing, they cannot focus on environmental aspects only day-to-day activities [19].

Table 8. Proposition 1b Internal Barriers

Sub Topic
Human factors
Participant Quotes
RA: The barriers are technology and financial; the competency of human resources is low **RB**: SMEs have limited knowledge about waste. Therefore, if there is special training and assistance for SMEs it would help **RC**: They have not mastered how to manage the waste. They do not capable to treat the waste. The point is that they do not know how to operate waste treatment processing. Competency of the operator in the waste treatment unit is still low. **RD**: They have very limited human resources. But, I believe that if there is a requirement that forces them, they would be able to adapt quickly.

Most participants identified staff as a key factor that hinders green practice implementation. This is consistent with prior studies [6], [14], [18]. Low-skilled human

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resources have prevented positive organizational change. A previous study found that human factors are one of the most cited SME barriers to adopting green management and that green businesses require high levels of human resource competency because of the need to develop innovation-focused environmental initiatives [10]. Thus, the enhancement of human resource competency should be investigated in Yogyakarta leather SMEs.

Table 9. Proposition 1c Internal Barriers

Sub Topic
Financial factors
Participant Quotes
RA: Barriers are technology and financial. And the competency of the human resources is low.
RB: We considered building large pipelines to separate the waste ... but it was costly needing billions of dollars for 3 km.
RC: The problem is related to the cost of the waste processing. If these costs are included, it will reduce profits
RD: Financial factors hinder SMEs; therefore, they need communal waste treatment
RE: Cost constraints, equipment and land are impediments.

Participants agreed that financial factors are an important barrier; thus, it is a challenge for SMEs to innovate [5]. Environmental innovation is seen as a financial burden [21] and is not considered a priority [4].

Table 10. Proposition 1d Internal Barriers

Sub Topic
Low awareness
Participant Quotes
RB: Personally, I don't want to deteriorate the environment. I'll try to eliminate the waste, but it should be reasonable.
RC: SMEs are aware ... they treat the waste to avoid complaints from the locals but they have not used the best waste treatment
RD: SMEs have not considered environmental management as important. But, they realize there will be an obligation for them someday to take part in environmental protection efforts.
RE: They focus on customer demand, ignoring the environment.

Consistent with previous study, SME awareness varies with some not seeing green as important [20].

Table 11. Proposition 1e Internal Barriers

Sub Topic
Organizational strategy factors
Participant Quotes
RA: If I need to comply with the environmental requirements, I will look for a way to comply. But, for now, I do not want to. As long as there is no problem from customers, it will be fine ... No need for additional costs, additional human resources.
RB: We do not want to be bothered. If there is integrated waste processing which is handled by the government, we will pay for it. It would greatly relieve us than to treat our own waste.
RC: This really depends on their customers. SMEs are happy as long as they get profits.
RE: As long as there is a requirement from customers, there is no other choice for SMEs. For example, what SMEs have done to avoid complaints from the community, they start to be aware about environmental issues

Table 11 results confirm previous studies that SMEs adopt reactive strategies rather than proactively contribute to environmental protection efforts [2] and focus on compliance rather than sustainability [7].

Table 12. Proposition 1f Internal Barriers

Sub Topic
Innovation factors
Participant Quotes
Although the level of SME innovation is low, no participant considered this factor a principal barrier

Table 13. Proposition 1g External Barriers

Sub Topic
Market segment is too small
Participant Quotes
RB: Most of our customers are locals
RC: There is a demand for green products from customers abroad but local customers only consider price and product appearance
RD: The issue of green products has not been relevant yet with SMEs because most of their customers are local.

Table 13 results suggest that SMEs focus on customer requirements. Since most customers are local which do not require any environmental aspects and only focus on the appearance and price, SMEs feel that it is not necessary to implement green practices. This finding is consistent with previous study [18], [23].

Table 14. Proposition 1h External Barriers

Sub Topic
Insufficient "green" supplier support
Participant Quotes
RD: In order to achieve the criteria related to green product customers, we have to use chemicals mostly from Europe. Local suppliers provide only common chemicals.
RE: We depend so much on the imported chemicals for both, the common and environmentally-friendly chemicals

Raw material prices are a sensitive issue for SMEs. If they have a choice between the environment and the economics, the economics dominate. With limited finances, SMEs ignore environmental considerations. Most of the imported green chemicals are more expensive compared to the local chemicals that are commonly used. In the words of participant D, "*The consequence of producing green products ... is a significant price increase.*" This is consistent with previous research [14], [18].

Table 15. Proposition 1i External Barriers

Sub Topic
Poor environmental legislation
Participant Quotes
RC: Supervision from the BLH environmental agency needs to be improved - there is no strict punishment applied. Therefore, the industry does not need good environmental management.
RE: The government needs to provide either punishment or solutions. If they give SMEs strict regulation without a solution, it will be turned into a problem such as unemployment.

According to previous study, pollution preventive management and waste management to protect the environment have not worked in many countries [11]. The reasons are poor regulation and an industry view that environmental protection is an added cost. In Indonesia, a developing country, the regulations are not strictly enforced. This causes SMEs to have no obligation to adopt green practices. This is consistent with study which found that SMEs have poor awareness of compliance issues [21].

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Table 16. Proposition 1j External Barriers

Sub Topic
Limited government support
Participant Quotes
RB: We need training about leather industry but the training is not intended to judge the industry. **RC**: Unlike Garut and Magetan, in Yogyakarta, there is no integrated waste treatment installation for the leather industry **RD**: There is a plan to build integrated waste treatment .. but inadequate infrastructure from the government is an impediment. **RE**: The most effective and efficient solution is government needs to take over all of the environmental management

The Table 16 results are consistent with a previous study [12]. Most participants considered that SMEs need government support related to communal waste water treatment installation.

C. *Strategy Process Development*

Strategy development was aligned to the previous results and those identified in Tables 17-19.:

Table 17. Proposition 2

What strategies can be proposed to tackle the existing barriers?
Sub topic
Intensifying education and training program
Participant Quotes
RA: We need training but with real experts in the field **RB**: SMEs have limited knowledge about waste. Therefore, if there is a special training and assistance for the SMEs it would help a lot **RC**: Give them knowledge through training **RE**: I think it is necessary to promote green technology to the industry
Sub topic
Financial assistance including the provision of infrastructure
Participant Quotes
RA: We need free waste water treatment installation from the government. As long as there are no complaints from the community and customers there is no need to add the cost related green facilities. **RB**: The industry really does not want to be bothered. If there is an integrated waste processing plant which is handled by government ...it will greatly relieve the factories **RC**: Government need to provide communal waste treatment facilities **RD**: The industry expects support from the government **RE**: The most effective and efficient solution is government to take over the environmental management.
Sub topic
Provide environmental management guidance
Quote
RB: Industry needs guidance from the CLRP or BLH to assist the industry on best waste management practices **RC**: Strengthen the environmental management system so SMEs can analyze the impact of their processes.
Sub topic
Stricter environmental regulations
Quote
RC: Supervision from the BLH needs to be improved due to there being no strict punishment applied. **RE**: Government needs to provide either punishment or solution.
Sub topic
Encouraging the organizational change process
Quote
RC: Give them a reward program such as PROPER. **RD**: It needs stakeholder participation such as CLRP to give SMEs information about the problem and how to solve it. It is difficult if we wait for SMEs because there is no requirement from their customers

Using the participant interviews, a SWOT analysis was conducted to identify possible strategies to tackle the barriers to current environmental practices (Table 18). Strategies formulated appear in Table 19.

Table 18. SWOT analysis

STRENGTHS
(S1) Have a localized land area for leather tanning
(S2) Competent and experienced in producing good quality products
WEAKNESSES
(W1) Inadequate data and low-skilled human resources in environmental management (low in competency, knowledge, and commitment)
(W2) Inadequate facilities, machinery, and funding
(W3) A focus on end-of-pipe treatment c.f. preventive management
(W4) Limited access to more environmentally-friendly chemicals
OPPORTUNITIES
(O1) Increasing trend of leather product demand
(O2) Availability of actors concern with the leather industry such as government(CLRP), association (APKI) and academician (ATK)
(O3) Substitution products of chromium as a tanning agent
THREATS
(T1) Future demands directed to green products
(T2) Environmental regulations will be increasingly strictly enforced
(T3) Have not found cost-effective environmentally-friendly technology

The details of the SWOT analysis are as follows:

S1: The government has provided a localized land area for the leather tanning industry that is located in Sitimulyo, Yogyakarta. This area is intended to integrate the waste management for the industry, especially to help the SMEs which have a financial limitation to minimize the impact of the process to the environment.

S2: Although most of the customers are locals, the SMEs are proven have enough experience to produce a good quality of product to fulfill the demand from other countries such as Japan, USA, etc.

W1: Human resources is the most cited SME barriers to adopting green management [10]. It prevents positive organizational changes due to inadequate knowledge, competency and commitment to contribute to the environmental protection efforts.

W2: Although the government provided localization area, the SMEs still limited in the facilities and machinery and needed to be supported.

W3: Focus of the SMEs still on the treatment after generated the waste. A prevention management needs to be developed.

W4: Indonesia leather tanning industry depends on the imported chemicals. Local suppliers are limited to provide green chemicals. In addition, the SMEs focus on profit that leads them to minimize production cost by avoiding higher price for environmentally friendly chemicals.

O1: Export demand for leather products has continuously increased each year (table 1). Aware of the emergence of green consumerism can be a good step forward to capture a new market segment.

O2: Availability of other stakeholders in Yogyakarta in greening the environment is a good opportunity for the SMEs. Some previous study have found that SMEs need stakeholder support to green their businesses since the use of stakeholders enhance environmental management practices is crucial [20], [22].

O3: There is an opportunity to produce substitution products to replace the predominance of chrome as a tanning agent. A lot of studies have been conducted and found new tanning agent although still cannot compete chrome as a superior tanning agent.

T1: It cannot be ignored that the emergence of green consumerism has begun, i.e., European countries. It can be a serious threat for the SMEs in the future, if they ignore this market trend.

T2: As a developing country, the regulation is not strictly enforced. But there is a tendency an increased green product demand from the customer.

T3: A range of studies has been conducted to found a better technology in the leather tanning process. But, in industrial scale, the environmentally friendly process need more expensive chemicals during the process which increases production cost.

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Table 19. Strategy formulation

SO strategies (use strength to take advantage of opportunities)
1. (S2O1) Product development in meeting future market demand
2. (S2O2) Develop stakeholder partnerships to enhance SME competency
3. (S2O3) Develop low-cost green technology through R&D activities
WO strategies (take advantages of opportunities by overcoming weaknesses)
1. (W1O2) Develop stakeholder partnerships to enhance SME competency
2. (W1O2) Promote best practice to increase environmental performance
3. (W2O2) Collaborating with stakeholders, provide facilities/machinery
4. (W3O2) Promote the adoption of proactive and innovative strategies
5. (W3O2) Develop best practice guidance
6. (W4O2) Working with government, identify green chemical suppliers
ST strategies (use strength to avoid threats)
1. (S2T1)&(S2T3) Collaborate with stakeholders to support research activities associated with innovative environmentally-friendly technology
2. (S2T2)&(S2T4) Facilitate stakeholder networks to assist developing good environmental management systems
WT strategies (minimize weaknesses and avoid the threats)
1. (W1T1) & (W3T1) Intensify knowledge transfer of good environmental management (through training, guidebook, technological assistance)
2. W2T1) & (W2T2) Develop environmental assistance partnerships with government, academia, and the local industry association
3. (W2T3) Collaborate with government: Integrated waste treatment facility
4. (W4T1) Collaborate with government: Local green chemicals suppliers

Table 20 summarizes the strategies developed. These are classified into internal and collaborative. Table 21 discusses these in more detail. Collaborative strategies suggest that SMEs need stakeholder support to green their businesses since the use of stakeholders enhances environmental management practices [20]. However, stakeholders are not always ready to assist [13]. Thus, for greater effectiveness, both internal and collaborative strategies should be adopted.

Table 20. Strategy Classification

Internal strategies
1. Encourage product development process
2. Promote proactive and innovative strategies within SMEs
Collaborative strategies
1. Develop low-cost green technology through R&D activities
2. Develop best practice guidance and promote implementation
3. Provide adequate facilities and machinery
4. Provide green suppliers to supply the green chemicals
5. Intensify knowledge transfer of good environmental management
6. Establish a punishment and reward system

Table 21. More detailed discussion of strategies

Strategy 1 *Encourage product development processes*: The issues of pollution prevention, waste minimization, and pollution control require an innovative approach to production processes and product development becoming greener[5]. It is inevitable that SMEs must become aware of the emergence of green consumerism.
Strategy 2 *Promote proactive and innovative strategies*: SMEs need to shift from reactiveness to proactiveness and develop innovative strategies. SMEs with high innovation capabilities are associated with progressive green management practices (Noci and Verganti 1999).
Strategy 3 *Develop low-cost green technology through R&D activities*: Technological innovation is challenging. There needs to be collaboration between SMEs, government, and research institutions [10].
Strategy 4 *Develop best practice guidance and promote its implementation*: SMEs can make themselves greener through organizational change[10]. There should be collaboration, with the government providing guidance on best practice [20].
Strategy 5 *Provide adequate facilities and machinery*: Government should investigate providing communal waste treatment facilities.
Strategy 6 *Provide suppliers to supply green chemicals*: Internal and external stakeholders to enhance green management practices are essential. Local suppliers to be encouraged to provide green chemicals.
Strategy 7 *Intensify knowledge transfer of good environmental management*: Environmental training programs should be conducted to assist SMEs change their attitudes and behaviors toward green practice.
Strategy 8 *Establish a punishment and reward system*: A stricter environmental regulation approach needs to be enforced [18].

D. *Limitations and future research directions*

A limitation of this pilot research is related to the small sample size and the purposeful sampling adopted. Thus, caution should be exercised in generalizing the results of this research. Future studies may consider embracing a larger and more randomly selected sample.

E. *Summary*

This study used purposeful sampling to examine waste management problems associated with Yogyakarta leather producing SMEs. These SMEs face a range of limitations and need assistance to adopt green management practices.

REFERENCES

[1] Bianchi, R & Noci, G 1998, '" Greening" SMEs' Competitiveness', *Small Business Economics*, vol. 11, no. 3, pp. 269-281.

[2] Biondi, V, Frey, M & Iraldo, F 2000, 'Environmental Management Systems and SMEs', *Greener Management International*, 29, 55.

[3] Brammer, S, Hoejmose, S & Marchant, K 2012, Environmental management in SMEs in the UK: practices, pressures and perceived benefits, *Business Strategy and the Environment*, 21 (7), 423-434.

[4] Esty, D & Winston, A. 2009, *Green to gold: How smart companies use environmental strategy to innovate, create value, and build competitive advantage*, John Wiley & Sons.

[5] Hart, S., 2005, Innovation, creative destruction and sustainability.*Research-Technology Management*, *48*(5), 21-27.

[6] Hillary, R. (2004). Environmental management systems and the smaller enterprise. *Journal of cleaner production*, *12*(6), 561-569.

[7] Hobbs, J 2000, Promoting cleaner production in small and medium-sized enterprises. In *Small and Medium-sized Enterprises and the Environment: Business Imperatives*, 148, Greenleaf Publishing in association with GSE Research, 148-157.

[8] Kanagaraj, J, Velappan, K, Chandra Babu, N & Sadulla, S 2006, 'Solid wastes generation in the leather industry and its utilization for cleaner environment-A review', *Journal of scientific and industrial research*, 65(7), 541-548.

[9] Kangas, J., Kurttila, M., Kajanus, M., & Kangas, A, 2003, Evaluating the management strategies of a forestland estate—the SOS approach, *Journal of environmental management*, *69*(4), 349-358.

[10] Lee, KH 2009, 'Why and how to adopt green management into business organizations? The case study of Korean SMEs in manufacturing industry', *Management Decision*, *47*(7), 1101-1121

[11] Logaa, S & Zailani, S 2013, 'Motives in implementing Green Productivity among EMS 14001 certified companies in Malaysia', *African Journal of Business Management*, vol. 7, no. 38, pp. 3914-3922.

[12] Massoud, M. A., Fayad, R., El-Fadel, M., & Kamleh, R., 2010, Drivers, barriers and incentives to implementing environmental management systems in the food industry: A case of Lebanon, *Journal of Cleaner Production*, *18*(3), 200-209.

[13] Moorthy, MK, Yakob, P, Chelliah, MK & Arokiasamy, L 2012, 'Drivers for Malaysian SMEs to go green', *International Journal of Academic Research in Business and Social Sciences*, 2(9), 74-86.

[14] Murillo-Luna, J. L., Garcés-Ayerbe, C., & Rivera-Torres, P., 2011, Barriers to the adoption of proactive environmental strategies, *Journal of Cleaner Production*, *19*(13), 1417-1425.

[15] Nikolaou, I. E., & Evangelinos, K. I. (2010). A SWOT analysis of environmental management practices in Greek Mining and Mineral Industry. *Resources Policy*, *35*(3), 226-234.

[16] Ozgunay, H, Colak, S, Mutlu, M & Akyuz, F 2007, 'Characterization of leather industry wastes', *Polish Journal of Environmental Studies*, 16(6), 867.

[17] Revell, A., & Rutherfoord, R., 2003, UK environmental policy and the small firm: broadening the focus, *Business Strategy and the Environment*, *12*(1), 26-35.

ISBN : 978-1-4673-7404-0

[18] Rojšek, I, 2001, From red to green: Towards the environmental management in the country in transition, *Journal of Business Ethics*, *33*(1), 37-50.

[19] Studer, S, Tsang, S, Welford, R & Hills, P 2008, 'SMEs and voluntary environmental initiatives: a study of stakeholders' perspectives in Hong Kong', *Journal of environmental planning and management*, 51(2), 285-301.

[20] Tilley, F 1999, 'The gap between the environmental attitudes and the environmental behaviour of small firms', *Business Strategy and the Environment*, 8(4), 238-248.

[21] Wilson, CD, Williams, ID & Kemp, S 2012, 'An evaluation of the impact and effectiveness of environmental legislation in small and medium-sized enterprises: Experiences from the UK', *Business Strategy and the Environment*, 21(3), 141-156.

[22] Woo, C, Chung, Y, Chun, D & Seo, H 2014, 'Exploring the Impact of Complementary Assets on the Environmental Performance in Manufacturing SMEs', *Sustainability*,6(10), 7412-7432..

[23] Zilahy, G, 2004, Organisational factors determining the implementation of cleaner production measures in the corporate sector, *Journal of Cleaner production*, *12*(4), 311-319.

[24] Zutshi, A & Sohal, A, 2004, Environmental management system adoption by Australasian organisations: part 1: reasons, benefits and impediments, *Technovation*, *24*(4), 335-357.