



UNIVERSITI PUTRA MALAYSIA

***AWARENESS OF GREEN TECHNOLOGY ADOPTION BY SELECTED
WOOD FURNITURE INDUSTRIES IN PENINSULAR MALAYSIA***

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FH 2016 25



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WOOD FURNITURE INDUSTRIES IN PENINSULAR MALAYSIA**

By

KALJEET SINGH A/L AMBRA SINGH

**Thesis Submitted to the School of Graduate Studies,
Universiti Putra Malaysia, in Fulfilment of the
Requirements for the Degree of Master of Science**

December 2016

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DEDICATIONS

This thesis is dedicated to:

My mother, Bran Kaur Dalip Singh

A strong and gentle woman who taught me to trust in God and believe in hard work.

My father, Ambra Singh Sundara Singh

A hardworking man who supported and encouraged me to believe in myself.



Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfillment of the requirement for the degree of Master of Science.

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December 2016

Chair: Associate Professor H'Ng Paik San, PhD

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The awareness of green technology is important to ensure proper adoption in an organization. In Malaysia, green technology refers to products, equipment, and systems used to conserve the natural environment and resources, which minimizes the negative impact of human activities. Green technology brings about tremendous environmental and financial benefits (cost saving) besides creating the organization's environmental reputation. The government has provided various incentives to encourage green technology uptake by industries in Malaysia. This study looks into the level of awareness on green technology adoption by selected wood furniture industry in Peninsular Malaysia. The goal is to gauge current understanding and practices related to green technology amongst the target group. The extent of green skills development in this industry was also examined. To achieve this, survey questionnaire that consists of various constructs to determine awareness level of green technology adoption was prepared and provided to selected green companies located in Peninsular Malaysia during Malaysian International Furniture Fair (MIFF 2015) and International Greentech & Eco Products Exhibition & Conference Malaysia (IGEM 2015). Results from direct engagement with the survey respondents show that understanding of green technology definition amongst the target group need improvement. Top management plays a crucial part to ensure proper guideline and policy exist in the organization for green technology adoption. Although there are initiatives and ventures into green technology adoption, skill development in the industry also need to be addressed as this ensures that there are proper talent to execute green agenda set in the organization. Additionally, emphasis on incentive uptake needs to be made as this provide financial assistance provided by the government to organizations.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk Ijazah Sarjana Sains.

**KESEDARAN MENGENAI PENERAPAN TEKNOLOGI HIJAU DALAM
KALANGAN INDUSTRI PERABOT KAYU TERPILIH DI SEMENANJUNG
MALAYSIA**

Oleh

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Kesedaran tentang teknologi hijau adalah penting untuk memastikan penerapan teknologi dapat dilakukan dengan betul oleh sesebuah organisasi. Teknologi hijau di Malaysia merujuk kepada pembangunan dan aplikasi produk, peralatan serta sistem untuk memulihara alam sekitar dan sumber semula jadi, dan meminimumkan atau mengurangkan kesan negatif daripada aktiviti manusia. Teknologi hijau membawa banyak faedah terutamanya kepada alam sekitar dan dari segi kewangan (penjimatan kos) serta mewujudkan reputasi baik berkaitan alam sekitar dalam sesebuah organisasi. Pihak kerajaan telah menyediakan pelbagai jenis insentif untuk menggalakkan penggunaan teknologi hijau dalam industri di Malaysia. Kajian ini dijalankan bagi menentukan tahap kesedaran mengenai penerapan teknologi hijau dalam kalangan industri perabot kayu terpilih di Semenanjung Malaysia. Matlamat kajian ini adalah untuk menilai kefahaman dan amalan berkaitan teknologi hijau dalam kumpulan sasaran tersebut. Tahap pembangunan kemahiran hijau dalam industri ini juga dikaji. Bagi mencapai matlamat berkenaan, borang soal selidik yang terdiri daripada pelbagai konstruk untuk menentukan tahap kesedaran mengenai penerapan teknologi hijau telah disediakan. Borang soal selidik berkenaan telah diberikan kepada syarikat-syarikat bertaraf hijau di Semenanjung Malaysia yang terpilih pada Pameran *Malaysian International Furniture Fair (MIFF 2015)* dan *International Greentech & Eco Products Exhibition & Conference Malaysia (IGEM 2015)*. Hasil perjumpaan bersama responden borang kaji selidik berkenaan mendapati pemahaman definisi teknologi hijau dalam kalangan kumpulan sasaran tersebut perlu dipertingkatkan. Pihak pengurusan atasan sesebuah organisasi memainkan peranan penting dalam mewujudkan dasar dan garis panduan yang betul berkaitan teknologi hijau. Walaupun terdapat inisiatif dan usaha ke arah penerapan teknologi hijau, pembangunan kemahiran dalam industri berkenaan juga perlu diberi keutamaan kerana ia dapat memastikan adanya bakat kemahiran yang betul di dalam organisasi untuk melaksanakan agenda hijau yang telah ditetapkan. Selain itu, sesebuah organisasi juga perlu memberi penekanan terhadap pengambilan insentif kewangan yang telah disediakan oleh pihak kerajaan.

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Thank you, God, for always being there for me.

I certify that a Thesis Examination Committee has met on 27 December 2016 to conduct the final examination of Kaljeet Singh A/L Ambra Singh on his thesis entitled “Awareness of Green Technology Adoption by Selected Wood Furniture Industries in Peninsular Malaysia” in accordance with the Universities and University College Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

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Name of Member of Supervisory Committee: Professor Dr. Jegatheswaran A/L Ratnasingam

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LIST OF ABBREVIATIONS

CGC	Credit Guarantee Corporation Malaysia Berhad
CO ₂	carbon dioxide
EU	European Union
FRIM	Forest Research Institute Malaysia
GHG	greenhouse gas
GreenTech Malaysia	Malaysian Green Technology Corporation
HTD	high-temperature drying
IGEM	International Greentech & Eco Products Exhibition & Conference Malaysia
ISO	International Organization for Standardization
ITA	Investment Tax Allowance
KeTTHA	Ministry of Energy, Green Technology, and Water
MATRADE	Malaysian External Trade Development Corporation
MFIC	Malaysian Furniture Industry Council
MFPC	Malaysian Furniture Promotion Council
MIDA	Malaysian Investment Development Authority
MIFF	Malaysian International Furniture Fair
MITI	Ministry of International Trade and Industry
M-MYR	Malaysian ringgit (million)
MTIB	Malaysian Timber Industry Board
MWIA	Malaysia Wood Industries Association
NGTP	National Green Technology Policy
SFC	Sarawak Forestry Corporation
SFM	Sustainable Forest Management
SME	small and medium-sized enterprises
T-CO ₂	ton of carbon dioxide
toe	ton of oil equivalent

CHAPTER 1

INTRODUCTION

1.1 General Description

Malaysia has defined green technology as the development and application of products, equipment, and systems used to conserve the natural environment and resources, which minimizes the negative impact of human activities (Ministry of Energy, Green Technology, and Water, 2012). The National Green Technology Policy (NGTP) introduced in 2009 by the Ministry of Energy, Green Technology and Water (KeTTHA) has clearly outlined the need for green technology development and adoption, not only for achieving energy autonomy and mitigating climate change but also as emerging drivers for economic growth. The policy is recognized as the guiding document towards a greener Malaysia and the criteria in which the product, equipment, and systems that are adopted must satisfy the following:

- a) Minimize the deterioration of environment;
- b) Relates with zero or low greenhouse gas (GHG) emission;
- c) Not harmful to human health and promotes healthy and improved environment for all forms of life;
- d) Conserves the use of energy and natural resources; and
- e) Promotes the use of renewable resources.

The NGTP indicates the way forward for green technology development in Malaysia to ensure environment sustainability besides to promote healthy business culture amongst businesses and industries for continuous economic growth. For this, four key sectors have been identified, namely energy, building, transport, waste, and water. Two additional key sectors that also has vast potential in contributing to the economy through green technology are agriculture and forestry (Ministry of Energy Green Technology and Water, 2013).

Key sector industries are urged to move towards green growth through the adoption of green technology. A report published by Organisation for Economic Co-operation and Development in 2011 has highlighted the potential of green technology adoption by key industries. This includes an increase in productivity and making resources available to their highest value, creating opportunities in product innovation, opening new markets and customer niche, besides boosting investor confidence. The report also suggests that the estimated fuel saving from the investment in low-carbon energy systems for the period of 2020-2050 is valued at USD 112 trillion.

Adopting green technology requires participation from all level in an organization and involves various factors. This includes top management participation, organizational encouragement for innovation and government support (Lin *et al.*, 2009). Lin *et al.* (2009) also rightfully pointed out that the successful adoption of green technology and

innovation also depends on the workforce that is able to learn new technology by training and also knowledge acquired to become knowledge workers.

Hooi (2016), in his book, has highlighted that Malaysia's economic growth and employment has increased especially in the manufacturing sector in 2014 and such growth is desirable towards becoming a high-income nation. With the expected increase in global demand, predominantly in key manufacturing sectors such as electrical and electronics as well as wood products, economic and employment growth will increase in near future. This will promote career opportunities besides the key manufacturing sector requiring skilled and talented workers. Also, keeping up with sustainable technology is important to ensure environmental wellbeing (Hooi, 2016).

Wood furniture in Malaysia is a large manufacturing industry. Malaysia exports 80% of its production, thus currently ranked as a 10th largest exporter of furniture in the world (Malaysian International Furniture Fair, 2017). Technology innovation is an important area to be taken into consideration when implementing sustainability in the industry and there are challenges in adopting green technology such as the type of established principles in the organization, product that the company offer, consumer expectations, companies policy, facilities, resources, and legislations. (Valipoor & Ujang, 2011).

A study conducted by the Ministry of Energy, Green Technology and Water in 2013 suggests a tremendous potential in the adoption of green technology especially in the downstream operation of forestry sector including wood furniture manufacturing. Malaysian wood furniture industry is taking initiatives to enhance productivity besides addressing the needs to adopt green technology in its manufacturing process. This is an important step to develop its image globally and to portray Malaysian-made furniture as being sustainable. The Malaysian Furniture Industry Council (MFIC) has been promoting this agenda, with its members using rubberwood as raw materials for furniture production. Rubberwood has generally considered as waste about 20 to 30 years ago (Chen, 2011).

Wood furniture manufacturing companies can also practice and apply green technology in its facility and manufacturing processes. This includes projects that involve solar panels for energy generation, green building and, water and waste management. Producing clean power or steam supply through the recovery of heat generated during manufacturing process proves to be beneficial and promote energy efficiency (Asian Legal Business, 2014).

To further promote green agenda, Malaysian Furniture Promotion Council (MFPC) has highlighted three (3) main criteria used to define Malaysian wood furniture as green (Chen, 2011):

- **Material from sustainable sources:** Wood and fabric used in furniture manufacturing must be from sustainable sources. Timber must be obtained from forest areas certified under Sustainable Forest Management (SFM) or from

forest plantation. Additionally, encouraging the use of palm wood from oil palm tree and rubber wood, which would otherwise be burnt or deposited on landfill that might cause air pollution.

- **Minimal waste:** Waste minimization can be achieved through good design, finishing, and quality. It can also be achieved through compliance with environmental regulation and requirements. The use of water-based stains and glues, recycled carton boxes and biodegradable plastic bags promotes better use of resources.
- **Conformance with health & safety standards:** Pre-and post-treatment of timbers and the use of chemicals (for protection purposes or to increase the dimensional stability of wood based products) should be conformed to health and safety regulation and requirements. This is to avoid health risks to humans as excessive exposure to chemicals is harmful to health.

1.2 Problem Statement

From a business standpoint, it is common to represent a product with environmental-friendly perspective be it processes, systems or technology (Vachon & Klassen, 2006). Green technology is seen as a technological innovation that can tremendously improve current way of operation to suit sustainability need whilst having cost saving potentials (Boon-Kwee & Thiruchelvam, 2011). However, a survey that was completed in 2009 revealed that the adoption of green technology in the manufacturing processes is limited in the wood furniture industry (Ratnasingam & Wagner, 2009).

A separate study conducted by Ratnasingam *et al.* (2008) found that the adoption of a chain of custody certification among wooden furniture manufacturers was low. The main purpose of this certification was to ensure that wood products are from sustainable sources. There are several reasons that constitute to the slow adoption of green technology. One of them is that companies do not fully understand the potential and benefits that green technology offers to improve their operation and cost saving. Companies also often have long equipment replacement cycles which hinder the adoption of newer and cleaner technologies.

Availability of information also plays a crucial part, as companies may not have enough information to estimate if switching to green technology is in their private interest (Doraszelski, 2001; Farzin *et al.*, 1998; Jensen, 1982). Apart from that, studies on environmental components of wood furniture industry are small and the result suggests low implantation on sustainability especially on green technology. Also, proper identification of green technology in the industry and its impact on various factors in the organization has not been studied (Valipoor & Ujang, 2011).

In adopting green technology, assistance is required to guide and provide relevant information for the industry to be at its peak. The Malaysian government is providing channels such as information and assistance, however, the key issue is in understanding green technology and to cater for the changes in the organization so to allow efficient

administration and operation. Also, various green technology incentives are available for wood furniture manufacturers.

1.3 Overall Objective

The general objective of this study is to determine the level of awareness of selected wood furniture industry in Peninsular Malaysia on green technology adoption. This includes various factors such as understanding on the definition, incentives uptake that are presented by the government, current green technology practices, green product development, training skills offered to the workforce in the company (human capital development) and benefits obtained.

For this, survey related to green technology adoption was done to cover the aspects perceived as important factors (as listed above) that would influence the adoption.

1.4 Specific Objective

The specific objectives were to:

- a) Determine level of understanding of green technology definition amongst the selected wood furniture industry in Peninsular Malaysia;
- b) To assess the extent of human capital development especially green jobs (green collar) in Malaysia's wood-based industry;
- c) To determine current green technology adoption and practices by the selected wood furniture industry.

1.5 Study Scope

The study determines adoption of green technology from various angles, starting from the understanding of green technology definition. This was assessed from the NGTP definition introduced by the Ministry of Energy, Green Technology and Water. This is an important step to see which aspect of the definition matters the most in the selected wood furniture manufacturing companies. This step provides an initial indication of the organization's uptake of green technology. It may vary from their standpoint as to produce green products, adoption for cost-saving measures and also as an initiative to reduce and manage waste.

As there are various incentives introduced by the government, this study also looks into the uptake of those incentives for the proper implementation of green technology. As green skilled workers are also an essential part in green technology adoption, this study also assessed human capital development in the organizations especially in specific training in a green field. The selected wood furniture companies were from those that attended Malaysian International Furniture Fair (MIFF) and International Greentech &

Eco Products Exhibition & Conference Malaysia (IGEM). Company selection basis was those that has green product certification (produce green products) and also those that have already implemented green technologies in its operations/facility.

1.6 Significance of Study

The outcome of this study determines the current understanding of green technology adoption of selected wood furniture industry in Peninsular Malaysia. This provides an initial indication of the current state and can replicate on a larger scale nationwide which would be beneficial for future policy development in this sector. As this study looks into government incentives (green technology) uptake, green skills, and product development, the finding is expected to contribute to the following:

a) Policy and incentives support

The availability of green incentives and financing scheme aims to accelerate the green technology adoption. Government support is important to assist companies and organization to support and implement green initiatives.

b) Improved manufacturing of green wood furniture and skilled workers.

Being one of the main producers of wood furniture, Malaysia has a tremendous advantage in producing green furniture. Developing green skilled workers is important as that promotes better green technology adoption and allows the company to quickly implement green initiatives. Green talent development is not only limited to educational background, however, it also involves on-the-ground application and training.

- iii) Start to adopt basic green practices to encourage and educate the workforce.

As for this study scope, the following are recommended:

- i) To survey more companies in this industry to get more accurate data. The challenge here would be on getting all the necessary information as this process is difficult and requires extensive effort;
- ii) Looking into successful case studies (especially of those companies that already secure green incentives) to understand the level of awareness in that organization in adopting green technology. All aspect (management, financial standing, human capital development and green product) need to be examined;
- iii) Include other wood based industry to complete the mapping of green technology adoption and to extend the research to include more companies in East Malaysia;
- iv) Additional parameters in the questionnaire to get direct feedback from a management perspective and future outlook about the adoption of green technology.

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APPENDICES

Appendix 1 – Survey Questionnaire

PUBLICATION

H'ng, P. S., **Kaljeet, S.**, Ismail, A. Z., Kiranjeet K., & Pang, S. K. (2015). Initiatives and Efforts Towards Greening Malaysian Furniture Industry. *Asian Journal of Scientific Research*, 8(2), 122-133.

