ABSTRACT

The aim of this paper is to identify the level of green manufacturing implementation as well as to determine the impact of green manufacturing practice on business performance among small and medium enterprises (SMEs) in the manufacturing sector. Employing survey based approach in quantitative method, this study distributes a set of questionnaire to get primary data from targeted respondents. In total, 120 responses were received from SMEs in Malaysia which come from a wide variety of manufacturing industries. The data were analyzed using Statistical Package for Social Science (SPSS) version 22. This study reveals that the level of green manufacturing implementation, represented by two environmental friendly practices, namely cleaner production and eco-efficiency, is still moderate. Generally, the adoption of green manufacturing by SMEs leads to improve business performance. However, further investigation of the effects of individual practice of green manufacturing, this study found that cleaner production is the single predictor of business performance. Targeting better environmental performance, the adoption of green manufacturing practices are important because such recyclable items and waste reduction practices can be beneficial to the business as a whole. This can increase their profits and reduce costs in the business.

Keywords: green manufacturing, small and medium enterprises, business performance, manufacturing sector

INTRODUCTION

Small and medium enterprises (SMEs) play a significant role on Malaysian economic growth. In transforming Malaysian economy to a high income nation by 2020, SMEs would be a main driver of economic changes as they account for large proportion of businesses in this country, about 99.2% of establishments (SME Masterplan, 2012). Contributing to 32% of gross domestic product (GDP) and 19% of export, SMEs employ 59% of the country’s workforce in 2010 (SME Masterplan, 2012). While there is a positive trend of development in SMEs recorded in recent years, the contribution of SMEs to Malaysian GDP still low compared to the other middle and high income countries (SME Masterplan, 2012). Moving toward high income status, SMEs need to improve their business performance drastically to manage the wide gap occurred with the other develop countries.
Adapting with the emerging of sustainability concept and pressure from various stakeholders to be more socially responsible, SMEs need to put high priority in protecting natural environment by integrating environmental aspects into their business and daily operations. They are suggested to adopt green manufacturing practices in their firms in order to improve business performance as well as environmental performance. Having limitation in some areas such as innovation and technology, human capital development, market access, access to financing, legal and regulatory framework and infrastructure and security (SME Masterplan, 2012), SMEs are expected to face greater challenge on being sustainable companies.

While there is a lot of studies on how large and multinational firm demonstrates their commitment toward sustainability in business, little is known about how small and medium-sized firms demonstrate their commitment towards environmental practices. It is important to determine how well SMEs respond to the imperative of becoming sustainable business, as many firm remain confused about whether and how to internalize natural environmental consideration into their daily business operation. Therefore, the objectives of this study are:

1. To identify the level of green manufacturing implementation among SMEs in Malaysian manufacturing sector.
2. To determine the impact of green manufacturing implementation on business performance among SMEs in Malaysian manufacturing sector.

Manufacturing industry, especially SMEs, will adopt green manufacturing practices if they know that this will lead to certain financial and operational benefits. However, for green manufacturing practices to be fully adopted by SMEs in developing countries, the relationship between such practices and better performance is necessary. In this way, the empirical findings provided by this study will be informative and useful guide for SMEs. The findings of this study are expected to encourage them to implement green technologies and practices in their business and daily operations. In addition, this study will also contribute to the body of knowledge by empirically tested the relationship between green practices and business performance. The next section reviews the past conceptual and empirical studies related to the green manufacturing and business performance which form the basis of the development of research framework and hypothesis in this study. This is followed by the discussion of research method and analysis technique that employed in this study. Finally, the paper further discuss and concludes the major findings derived from the analysis in this study.

LITERATURE REVIEW

Business performance
In general, business performance is defined as "the operational ability to satisfy the demands of the major stakeholders of the organization" (Smith & Reece, 1999; Zulkifli & Perera, 2011), and it should be evaluated to measure the achievement of the organization. There are a variety of ways that can be used to measure business performance (Clark et al., 2006; de Waal, 2002; Taghian et al., 2015). The business performance can be evaluated by the extent to which an organization accomplish their objectives (Hult et al., 2004; Al-Ansari et al., 2013), firm performance history, objectives and expectations of the organization (Herremans & Ryans, 1995; Homburg et al., 1999; Taghian et al., 2015). Management considers business performance as a subjective appraisal of the establishment of the market and changes in profitability.
Business performance is the result of interaction between the action brought in relation to the competitiveness that allows systems to manage internal resources and adjust to the external environment, so merging the concepts of efficiency and effectiveness (Keizer et al., 2002; Miller, 1988; Al-Ansari et al., 2013).

Contending in the intense business environment nowadays, which put environmental sustainability as a primary issue, SMEs need to place a high priority in protecting the natural environment by adopting environmental friendly practices into their business and daily operations. Targeting better environmental performance, manufacturing firms, including SMEs are forced to adopt green manufacturing practices in their firms in order to improve business performance.

**Green manufacturing**

The concept of green manufacturing (GM) was emerged since late 1980s. Beginning in the 1980s, the conception of sustainable natural processes to reduce waste was occurred. Paradigm for sustainable manufacturing has shifted from process-oriented to product-oriented. According to Cortellini (2001), and Rehman and Shrivastava, (2013), GM is a method of manufacturing to reduce waste and pollution, slow the depletion of natural resources and reduce the amount of waste entering landfills. GM technology through product design and continuous operations, preserve energy and cut dependence on non-replaceable of raw material (Chien & Shih 2007; Rehman & Shrivastava, 2013). In this study, there are two practices that considered as green manufacturing namely cleaner production and eco-efficiency. Cleaner Production (CP) is a preferred strategy to achieve effective utilization of innate resources and contamination prevention. From the perspective of thinking, CP can also be defined as the use of key concepts in the prevention, eco-efficiency, environmental strategy and full life cycle (Zeng & Wand, 2009). As an integrated management strategy and approach to environmental protection, the CP has managed to give a positive impression with many implications for manufacturing firms, workers and the environment (Getzner, 2002). The implementation of CP will contribute to economic wealth generate and environmental benefits, and the foundation for the realization of circular economy (Hicks & Dietmar, 2007; Peng & Li, 2011). CP can be enlarged and used as ideas for improving procedures and can be mixed with any procedure for achieving better environmental performance (Doniec, et al., 2002).

Eco-efficiency is increasingly becoming a key requirement for success in business. The World Business Council for Sustainable Development (WBCSD) describes eco-efficiency as a management strategy of doing more with less. Referable to the opportunity for cost savings associated with reduced resource consumption and energy use, eco-efficiency is a safer strategy to get beneficial business. In fact, many companies that have adopted eco-efficient technologies and practices demonstrate that eco-efficiency stimulates productivity and innovation, increases competitiveness and improves environmental performance.

**Green manufacturing and business performance**

Simultaneously with improving environmental performance through reduce the level of natural resource consumption, solid waste generation and the number of accidents caused by the environment, green manufacturing would improve business performance by reduce cost for materials consumption, waste treatment and energy consumption (Zhu & Sarkis, 2004; Ghazilla et al., 2015).
CP implementation by manufacturing companies indicated a substantial effect on economic growth towards sustainable development (Peng, & Li, 2011). CP implementation also affects the performance of the business. There are many manufacturing companies benefiting economically, especially in production operations management system (Hicks & Dietmar, 2007). The continued implementation of CP initiatives would help firms in achieving financial and economic benefits such as recycling goods that enable better control of their financial resources (Moolla & Chompu-inwai, 2010). This will contribute to reduce overall production costs and thus help them in enhancing financial and business performance.

Based on the above discussions, this study propose that green manufacturing practices would lead to achieve better business performance, as graphically displayed in Figure 1 and clearly stated in the following hypothesis.

![Figure 1](Research framework)

Deriving from the proposed research framework, the following hypotheses are developed.

H1 : Green manufacturing has a positive and significant impact on business performance.
H1(a) : Cleaner production has a positive and significant impact on business performance.
H1(b) : Eco-efficiency has a positive and significant impact on business performance.

**RESEARCH METHOD**

**Sampling and data collection**
The population of this study is SMEs in the Malaysian manufacturing sector. Unit of analysis is individual manufacturing company. About 260 manufacturing firms were selected as a sample in this study. Employing survey based approach in quantitative method, this study distributes a set of questionnaire to get primary data from 260 targeted respondents. In total, 120 responses were received. After discarding one invalid response, 119 usable responses were considered for further analysis.

Respondents in this study came from various size and types of manufacturing industries. More than half of responding firms are small companies (51.3%), 29.4% are micro and 19.3% are medium companies. In term of industrial classification, majority of responding companies involve in four industries including food & beverage products (21.8%) rubber and plastic products (10.9%), wood and wood products (10.1%) and electrical and electronic (9.2%). The remaining respondents came from textile and wearing apparel, fabricated metal products, machinery and equipment, nonmetallic mineral products, paper products, leather and relate products, coke and refined
petroleum products, printing and reproduction of recorded media, furniture, basic metal, chemicals and chemical products, and pharmaceutical products. Meanwhile, about 31.9% responding companies have ISO 9000 certification. With regard to the position in the company, respondents in this study consists of CEOs or Directors, production or manufacturing managers, executives and others.

**Measurement scale**

A set of questionnaire was used to collect primary data from the respondents. The questionnaire was adapted from Hami et al. (2016). Five-point scale, anchored by one to "strongly disagree" and five to "strongly agree", has been chosen to measure the level of agreement or disagreement of the respondents to each item in two variables studied (i.e. green manufacturing and business performance. The questionnaire was validated by a group of experts (academicians) during the pretest stage.

Factor analysis and Cronbach Alpha test were performed in this study to verify the validity and reliability of the measures. The validation results are shown in Table 1. The first run of factor analysis was unsatisfactory since the variable of cleaner production is bivariate. After removing one item in cleaner production, the uni-dimensionality of this variable was confirmed, thus proved the construct validity of the measures in this study. The remaining items were tested for interim consistency reliability by using Cronbach’s alpha coefficient. This test was conducted to ascertain the consistency of respondents’ answers to all the items in a measure. The closer the reliability coefficients get to 1.0, the higher the internal consistency reliability (Sekaran, 2003). The Cronbach alpha values for the two practices of green manufacturing and business performance are ranging from 0.607 to 0.777, therefore proving the reliability of each variable.

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of item</th>
<th>Item deleted</th>
<th>KMO</th>
<th>Cronbach alpha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaner production</td>
<td>6</td>
<td>1</td>
<td>0.681</td>
<td>0.819</td>
</tr>
<tr>
<td>Eco-efficiency</td>
<td>6</td>
<td>-</td>
<td>0.809</td>
<td>0.864</td>
</tr>
<tr>
<td>Business performance</td>
<td>9</td>
<td>-</td>
<td>0.905</td>
<td>0.909</td>
</tr>
</tbody>
</table>

Notes: KMO = Kaiser-Meyer-Olkin measure of sampling adequacy; n = 119

**Data analysis technique**

The quantitative data analysis was employed in this study. The collected data were analyzed using the IBM Statistical Package for Social Sciences version 22 software (SPSS 22). Descriptive analysis was done to accomplish the first research objective in this study relating to the level of green manufacturing and business performance. In order to test the proposed hypothesis which are reflected to the second objective, the Pearson correlation and multiple regression analysis were adopted. Regression analysis was used to examine the causal relationship between green manufacturing and business performance.

**FINDING AND DISCUSSION**

The mean and standard deviation of green manufacturing and business performance are presented in Table 2.
Table 2
Descriptive results of green manufacturing and business performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Standard deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cleaner production</td>
<td>1.00</td>
<td>5.00</td>
<td>3.8504</td>
<td>0.65054</td>
</tr>
<tr>
<td>Eco-efficiency</td>
<td>1.67</td>
<td>5.00</td>
<td>3.8179</td>
<td>0.71340</td>
</tr>
<tr>
<td>Business performance</td>
<td>1.00</td>
<td>5.00</td>
<td>4.1774</td>
<td>0.55937</td>
</tr>
</tbody>
</table>

The mean values of 3.85 and 3.82 indicate moderate to good extent of implementation of cleaner production and eco-efficiency, respectively. While, the level of business performance achieve by the responding companies is slightly good. Generally, the results show that the Malaysian SMEs in manufacturing sector began to realize cleaner production and eco-efficiency as critical issues in recent years for the long-term existence and thriving firms. However, there are still SMEs that poorly implemented green manufacturing practices as indicated by the minimum values of 1.00 and 1.67. SMEs need to know the benefits or advantages of adopting green manufacturing in order to achieve business performance. The implementation of green manufacturing should be beyond the production of the products, to include administration and other functions or departments within the organization such as marketing, financial, purchasing, and human resource.

Table 3 presents the correlation results. As shown in the table, all of the correlation tested in this study found to be positive and significant at the 0.01 level. The results reveal that there is a positive and significant relationship between cleaner production and business performance ($r = 0.443$, $p < 0.01$) as well as eco-efficiency and business performance ($r = 0.336$, $p < 0.01$). Since the correlation values ($r$) are 0.439 and 0.321, both green manufacturing practices have medium strength relationship with environmental sustainability as suggested by Cohen (1988), with cleaner production is stronger than eco-efficiency.

Table 3
Correlation results

<table>
<thead>
<tr>
<th>Correlation results</th>
<th>Cleaner production</th>
<th>Eco-efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business performance</td>
<td>Pearson Correlation</td>
<td>0.443**</td>
</tr>
<tr>
<td></td>
<td>Sig. (1-tailed)</td>
<td>0.00</td>
</tr>
<tr>
<td></td>
<td>N</td>
<td>119</td>
</tr>
</tbody>
</table>

** Correlation is significant at the 0.01 level (1-tailed).

Responding to the second objective of this study, regression analysis was conducted to analyze the impact of green manufacturing on business performance. The results are presented in Table 4.

Table 4
Regression result

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Independent variable</th>
<th>Sig. F</th>
<th>$R^2$</th>
<th>Beta</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business performance</td>
<td>Cleaner production</td>
<td>0.0</td>
<td>0.207</td>
<td>0.371</td>
<td>0.000</td>
</tr>
<tr>
<td></td>
<td>Eco-efficiency</td>
<td></td>
<td></td>
<td>0.127</td>
<td>0.209</td>
</tr>
</tbody>
</table>
As tabulated in Table 4, green manufacturing has a positive and substantial impact on business performance as proving by the significant F result. Thus, hypothesis 1 (H1) is supported. $R^2$ value of 0.207 indicates that the 20.7% of variance in improving business performance is significantly explained by the combination of two green manufacturing practices (i.e. cleaner production and eco-efficiency). Nevertheless, in-depth investigation of the individual impact of green manufacturing practice on business performance found that only cleaner production is the significant predictor of improving business performance. This result supports the finding by Moolla and Chompu-inwai (2010) regarding the significant contribution of cleaner production to improve business performance. There is no statistical evidence found to confirm the significant impact of eco-efficiency on business performance. Thus, the specific hypothesis of H1 (a) is accepted while H1 (b) is rejected. One plausible reason for insignificant result is SMEs in manufacturing sector behave environmental friendly merely to fulfil social obligation rather than focusing on economic goal. Another possible reason is investing sustainable practices involves a lot of money and usually is a long-term return on investment (Urwin & Watson, 2010).

CONCLUSION AND LIMITATION

The primary aim of this study is to examine the status of implementation of green manufacturing and business performance achieved as well as the impact of green manufacturing on business performance among SMEs in the manufacturing sector. Green manufacturing can be parted into two practices, cleaner production and eco-efficiency. In general, the results have shown that there is a moderate level of implementation of both practices among responding companies with sustainable efforts more focus on cleaner production while the level of SMEs’ achievement on business performance is slightly good. Meanwhile, this study manage to prove the significant impact of cleaner production on business performance.

This study is expected to increase awareness of green manufacturing practices and promote the implementation of environmental friendly initiatives, particularly in the manufacturing industry. Although the important role of green manufacturing on achieving better business performance was frequently discussed in the literature, the results of this study reveal that SMEs in manufacturing sector still not fully integrate the two practices of green manufacturing into their business activities and operations. The findings of this study can be utilized as an additional source of reference in decision making and strategy for improving business performance. Considering the limitation of this study which is only used quantitative approach, future research is suggested to conduct qualitative approach to support the result of this study.

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