Innovative green technology for SMEs

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Abstract. The increasing human need for natural resources causes global warming. Innovative green technology is one of the eco-friendly actions that can be taken by small and medium sized enterprises (SMEs). The purpose of this study is to discover how SMEs can possibly use green technology. To this end, an explanatory survey was conducted on a sample of 286 batik business units. The results reveal that there are several innovative green technologies that can be used by SMEs. The findings of this study may imply that innovative green technologies can be used to improve SMEs environmental performance.

1. Introduction
Small and medium-sized enterprises (SMEs) have become the focal point of economic innovation [1], growth [2], and social cohesion in high-income countries and low-income developing countries [3]. This is due to the fact that SMEs play a crucial role in creating employment opportunities in modern economic activities [4] and in social mobility [5]. SMEs have been the subject of interest of many researchers. Recent studies in developing countries like Pakistan show that most SMEs is owned and run by a family. The ability these SMEs to solve business and social issues is restricted by its own limited capability and resources [6]. Some studies in developed countries such as the US [7] and European countries [8], show that eco-friendly technological innovations are required to boost the productivity of SMEs [9].

However, the adoption of eco-friendly technologies for SMEs in developing countries like Indonesia has not been able to reduce the environmental footprint and make the operating climate more resilient [10]. Eco-friendly technological innovations do not necessarily imply effective and efficient, and eco-efficient business activities [11]. This can affect the performance of SMEs in creating eco-friendly businesses.

SMEs in Indonesia in the 2012-2017 period grew by 25.72% and 32.40%, with larger growth shown by medium-sized enterprises at 32.40% as summarized in Table 1.

Table 1. The Growth of Indonesian SMEs in 2012-2017.

| Business Unit          | Total    | Growth in 2012-2017 |
|------------------------|----------|---------------------|
|                        | 2012     | 2013    | 2014    | 2015    | 2016    | 2017    | Total   | %         |
| Small Enterprise (UK) | 602,195  | 629,418 | 654,222 | 681,522 | 731,047 | 757,090 | 154,895 | 25.72     |
| Medium Enterprise (UM)| 44,280   | 48,997  | 52,106  | 59,263  | 56,551  | 58,627  | 14,347  | 32.40     |

Source: depkop.go.id

This study specifically explores batik SMEs in Indonesia by creating innovative green technology as a solution to current globalization problems. Innovative green technology is one of the attractive
investment opportunities in the private sector [12]. When applied in SMEs, innovative green technology offers products, processes or services that contribute to the recovery or prevention of environmental damage [13] and creates business models that are more resource efficient [14]. This study is aimed at examining the use of innovative green technology in SMEs. It is hypothesized that innovative green technology can improve the environmental performance of batik SMEs.

2. Method
This study was conducted using an explanatory approach. Data were collected through a survey. Questionnaires were addressed to 286 sample batik SMEs selected as the respondents using accidental simple random sampling technique.

3. Results and discussion
The innovative green technology variables in SMEs include product, process, or service designed with the main purpose of contributing to restoring or preventing any type of environmental damage. Table 2 summarizes the score of respondents’ responses to the application of innovative green technology in batik SMEs in Indonesia. Service received the highest score by 88.85%. This is due to increasingly competitive and dynamic global competition, making consumer preferences for eco-friendly products continue to increase [15]. Process received the lowest score by 86.54%. Such things happen because SMEs generally do not have sufficient resources and capabilities to make the green technology management process reduce business cost and produce product differentiation [16].

Table 2. Online retail website visitors’ responses towards innovative green technology in SMEs.

| Dimension       | Score | Average Score | Ideal Score | %   |
|-----------------|-------|---------------|-------------|-----|
| Process         | 4,107 | 1,405.67      | 4,746       | 86.54|
| Service         | 4,217 | 1,405.67      | 4,746       | 88.85|
| Products        | 6,999 | 2,333.00      | 9,492       | 88.48|
| Total           | 15,323| 5,144.33      | 18,984      | 87.96|

Further analysis was goodness of fit test using indicators Table 3 shows that although not all goodness of fit measures was higher than the cut off value, still it was concluded that most models were good fit since the RMSEA value was 0.075 ≤ 0.08 (good fit), AGFI value was 0.869 ≥ 0.90 (not fit), and TLI value 0.974 ≥ 0.90 (good fit). Some criteria have met the requirements and have good fit values. Therefore, it can be said that this model is marginally feasible to be used as a tool for confirming the theories derived from existing observation data. Table 3 presents the results of goodness of fit test using IBM SPSS AMOS 19 for Windows.

Table 3. Results of goodness of fit test.

| No | Goodness-of-Fit Measures                        | Cut-off value                      | Result | Model Evaluation |
|----|-------------------------------------------------|------------------------------------|--------|------------------|
|    | Absolute Fit Measures                           |                                    |        |                  |
|    | Statistic Chi-square (χ²) (df= 8)                | Observed χ² < Critical χ² (26.12448) | 20.298 | Good Fit         |
|    | Goodness of Fit Index (GFI)                      | GFI ≥ 0.90 good fit, 0.80 ≤ GFI < 0.90 marginal fit | 0.915  | Good Fit         |
|    | Root Mean Square Error of Approximation (RMSEA)  | ≤ 0.08                             | 0.075  | Good Fit         |
|    | Incremental Fit Measures                         |                                    |        |                  |
|    | Trucker-Lewis Index (TLI)                        | TLI ≥ 0.90 good fit, 0.80 ≤ TLI < 0.90 marginal fit | 0.974  | Good Fit         |
|    | Adjusted Goodness of Fit Indices (AGFI)          | ≥ 0.90                             | 0.869  | Not Fit          |
|    | Comparative Fit Index (CFI)                      | CFI ≥ 0.90 good fit, 0.80 ≤ CFI < 0.90 marginal fit | 0.979  | Good Fit         |
Table 3. Cont.

| Parsimonious Fit Measures | PGFI < GFI | 0.596 | Good Fit |
|---------------------------|------------|-------|----------|
| 1  | Parsimonious Goodness of fit Index (PGFI) | The higher the better, compared to alternative model | 0.746 | Good Fit |

The hypothesis testing was carried out using t-value with a significance of 0.05 and degree of freedom that equals the number of samples (n). The t-value in IBM SPSS AMOS 19 is the critical (C.R.) value. If the C.R. ≥ 1.967 or the probability (P) ≤ 0.05, H₀ is rejected. The hypothesis of this study is formulated as follows:

H₀ C.R. ≤ 1.967 innovative green technology cannot improve the environmental performance of SMEs.

H₁ C.R. ≥ 1.967 innovative green technology can improve the environmental performance of SMEs.

The results of data processing show that the C.R. was 15.895 (≥ 1.967); therefore, H₀ was rejected. It means that innovative green technology improved the environmental performance of SMEs. The output total effect of 0.762 indicates that innovative green technology had significant positive effect on the improvement of SME environmental performance as much as 76.2%.

Innovative green technology in SMEs consists of three dimensions and 12 indicators. The first dimension, process, has the following indicators: communication intensity, experience, and usage frequency. The indicators of the second dimension, product, includes relevancy of products with the needs, relevancy of price and product quality, and consideration in purchase decision making. The third dimension, service, has the following indicators: interest in information, interest in the benefit, uniqueness, satisfaction, confidence, and recommending.

Based on the questionnaire data, the ratio between the obtained score of 15,323 and the ideal score of 18,984 shows that innovative green technology has been well implemented in SMEs in Indonesia. This obtained score in a continuum is in the good category with an interval between 14,335 and 16,660. Consideration in purchase decision making was the indicator that received the highest score of 1,443 or 91.21%. And green technology usage frequency was the indicator to receive the lowest score of 1,335 or 84.39%.

The results of the study show that service plays an important role in the creation of innovative green technology in SMEs. This is in line with previous studies suggesting that services designed to reduce environmental risk, environmental sector technology must contribute to preventing, measuring, limiting, minimizing or repairing environmental damage to water, air and land, and problems related to waste, noise and ecosystem [8]. Innovative green technology can provide cleaner production services, with technology and processes that can reduce pollution and use of resources [17].

The implementation of innovative green technology in batik SMEs in Indonesia starts with introducing new raw materials such as rayon fibers or utilizing environmentally friendly raw materials for Bemberg yarn. Bemberg yarn is a Japanese-made filament yarn from cupro fibers (short fibers attached around cotton seeds) that still contain cotton oil so that when pulled, the filament becomes shiny like silk. It is soft and offers cooling sensation, so it is suitable for clothing in tropical countries [18]. The use of natural dyes in batik products is also a solution to reduce the impact of pollution and even make batik an eco-product with high economic value. The development of natural dyes helps reduce the import of synthetic dyes. Batik with natural dyes is believed to increase market opportunities in the era of globalization. SME products such as batik must have good quality and standards. Design and product innovations are required in order to be able to compete in global market [19].

4. Conclusion

The implementation of innovative green technology in SMEs can be seen from three dimensions consisting of processes, services, and products. This study has found that innovative green technology
has been well implemented in SMEs in Indonesia. It is also revealed that statistically innovative green technology has helped improve the environmental performance of batik SMEs in a very significant way.

References

[1] Saridakis G, Idris B, Hansen J M, Dana L P 2019 SMEs’ internationalisation: When does innovation matter? J Bus Res 250–63

[2] Pergelova A, Manolova T, Simeonova-Ganeva R and Yordanova D 2019 Democratizing Entrepreneurship? Digital Technologies and the Internationalization of Female-Led SMEs J Small Bus Manag 57(1)14–39

[3] Verdolini E, Bak C, Ruet J and Venkatachalam A 2018 Innovative green-technology SMEs as an opportunity to promote financial de-risking, Econ Open-Access Open-Assessment E-Journal 1–9

[4] Okamuro H, van Stel A and Verheul I 2010 CCES Discussion Paper Series Center for Research on Contemporary Economic Systems 44

[5] Hamdani N A 2018 Building knowledge-creation for making business competition atmosphere in SMEs of Batik Manag Sci Lett. 8 667–76

[6] Awan U, Khattak A and Kraslowski A 2019 Corporate Social Responsibility in the Manufacturing and Services Sectors (Springer Berlin Heidelberg) 267-278

[7] Breitzman A and Thomas P 2011 Analysis of Small Business Innovation in Green Technologies Contract 1–44

[8] Apak S and Atay E 2015 Global Competitiveness in the EU Through Green Innovation Technologies and Knowledge Production Procedia - Soc Behav Sci 181 207–17

[9] Groot A E, Bolt J S, Jat H S, Jat M L, Kumar M and Agarwal T 2019 Business models of SMEs as a mechanism for scaling climate smart technologies: The case of Punjab, India J Clean Prod. 210 1109–19

[10] Sadiku-Dushi N, Dana L-P and Ramadani V 2019 Entrepreneurial marketing dimensions and SMEs performance J Bus Res 86–99

[11] Ismail T N H T, Don R A M, Diman S F and Wijeyesekera D C 2013 Innovative green technology and products meeting geo-environmental challenges Procedia Eng. 53 104–15

[12] El-Mously H 2018 Innovating green products as a mean to alleviate poverty in Upper Egypt Ain Shams Eng J 9(4)

[13] Qiu L, Zhang M, Tang J, Adhikari B and Cao P 2019 Innovative technologies for producing and preserving intermediate moisture foods: A review 116 Food Research International 90-102

[14] Pajić M, Mišan A and Tiwari B 2018 Eco-innovative technologies for extraction of proteins for human consumption from renewable protein sources of plant origin Trends Food Sci Technol. 93–104

[15] Fernando Y and Wah W X 2017 The impact of eco-innovation drivers on environmental performance: Empirical results from the green technology sector in Malaysia Sustain Prod Consum 12 27–43

[16] Bai C, Kusi-Sarpong S, and Sarkis J 2017 An implementation path for green information technology systems in the Ghanaian mining industry Clean Prod. 164:1105–23

[17] Ustaoglu M and Yildiz B 2012 Innovative Green Technology in Turkey: Electric Vehicles’Future and Forecasting Market Share Procedia - Soc Behav Sci. 41(11600) 139–46

[18] Sugimoto S. Handkerchiefs, Scarves, Saris and Cotton Printed Fabrics: Japanese Traders and Producers and the Challenges of Global Markets Text Trades, Consum Cult Mater Worlds Indian Ocean 79–104

[19] Alam Hamdani N and Abdul Fatah Maulani G 2018 The influence of E-WOM on purchase intentions in local culinary business sector Int J Eng Technol. 7(2.29) 246