The Factors Influencing Digital Technologies Adoption in Green Supply Chain Innovation: Evidence from the Social Enterprises in Malaysia

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Abstract

This study aims to explore the factors influencing digital technologies adoption in green supply chain innovation of social enterprises in Malaysia. In this study, the antecedents as factors are performance expectancy, effort expectancy, facilitating conditions and costs of use will be examined on the digital technologies adoption. Through the quantitative method, the survey approach through a personally administered questionnaire survey was used as a data collection instrument. The samples were obtained from 410 social enterprises located in five states in Malaysia. Structural equation modelling (SEM) was applied to analyse the collected data. The findings reveal that performance expectancy, effort expectancy and costs of use have a significant positive influence on digital technologies adoption. Facilitating conditions have no significant influence on digital technologies adoption. The findings contribute to practical and theoretical implications.

1.0 Introduction

The social enterprises in Malaysia are growing significantly and striving to achieve green supply chain innovation. Digital technologies adoption in green supply chain innovation involves the application of digital technologies in supply environmental management, green procurement, customer cooperation, inventory recovery, and eco-design (Feng et al., 2022). Green supply chain innovation is an evolving area in the supply chain and increasingly emphasise by large and medium enterprises (Ye and Lau, 2022), but its adoption is still at the fundamental stage for most social enterprises in Malaysia. Social enterprises are enterprises that focus on balanced economic, social and environmental outcomes (Oli´nski, 2022). Popular digital technologies such as blockchain, artificial intelligence, the internet of things, big data analytics and cloud computing are important to drive green supply chain innovation of the social enterprises in Malaysia.

The challenges facing social enterprises in the aspects of limited resources, lack of knowledge and skills, and inadequate support in digital technologies adoption are critical factors to practice

and achieve green supply chain innovation (Taylor and Rosca, 2022; Oli´nski, 2022). Past studies have explored the general areas of social enterprises' supply chain management (i.e., Taylor and Rosca, 2022) and sustainability (i.e., Jug and Sarkis, 2019; Bals and Tate, 2018). However, there is a paucity of research in the context of digital technologies adoption in green supply chain innovation in social enterprises.

This study aims to address the research gaps by exploring the factors influencing the digital technologies adoption in green supply chain innovation of social enterprises in Malaysia. The main research objective of this study is to examine the factors of performance expectancy, effort expectancy, facilitating conditions and costs of use in influencing the digital technologies adoption in green supply chain innovation of social enterprises in Malaysia. The expected contributions of the present research are the proposal of constructive planning and implementation strategies for social enterprises in Malaysia to leverage digital technologies adoption in green supply chain innovation. In the aspect of theoretical contributions, the Unified Theory of Acceptance and Use of Technology (UTAUT) model is applied to investigate the digital technologies adoption factors in the green supply chain. This study will extend the UTAUT model by incorporating the influence of an external factor, which is the costs of use.

2.0 Literature Review

2.1 Unified Theory of Acceptance and Use of Technology (UTAUT) model

The UTAUT aims to explain user intentions to use an information system and subsequent usage behaviour (Venkatesh et al. 2003). The existing UTAUT model consists of the dimension of performance expectancy, effort expectancy, and facilitating conditions. In the present study, the new dimension of digital technologies adoption, as an external factor, to be investigated in the UTAUT model is the costs of use to provide a better understanding of the effect of external influence. Therefore, these factors will be examined in the intention to adopt digital technologies in the green supply chain (behavioural intention usage). UTAUT model has been applied in various past studies (i.e., Nyugen and Nyugen, 2021; Queiroz and Pereira, 2019; Francisco and Swanson, 2018) to explore the factors that influenced users' adoption of digital technologies in supply chains.

2.2 Digital Technologies Adoption

Digital technologies adoption in the supply chain involves the process of acceptance of digital technologies in the supply chain, which contributes to supply chain structure, efficiency, innovation, and sustainability (Yang et al., 2021). Various technological, organisational and environmental factors influence the level of digital technology adoption in green supply chain innovation (Lin et al., 2020). Performance expectancy and effort expectancy are related to the technological context (Sair and Danish, 2018). The conditions within the organisation such as facilitating conditions are the support situation to ensure the effectiveness of digital technologies adoption. As for the external environment factors such as costs of use will determine the affordability of the organisations in digital technologies adoption (Lee et al., 2021).

2.3 Performance Expectancy

Performance expectancy refers to the degree that individual believes the use of the system will attain performance improvement (Venkatesh et al., 2003). Queiroz and Pereira (2019) found that performance expectancy is a critical factor influencing big data adoption. The usage of digital technologies will improve productivity and efficiencies in the supply chains and contribute to enhancement in business performance (Gunasekaran et al., 2017). Nyugen and Nyugen (2021) reported that performance expectancy was found to be a predictor of behavioural adoption of blockchain in supply chain innovation. It was caused by the expected outcomes of better performance achievements. With that, the following hypothesis is developed:

H1: Performance expectancy has a positive effect on digital technologies adoption

2.4 Effort Expectancy

Effort expectancy refers to the degree that individual perceives ease of use of the system (Venkatesh et al., 2003). Effort expectancy played an important influencing role in blockchain technology adoption in supply chain management based on the experience of ease to use (Nyugen and Nyugen, 2021). Digital technologies that are simple and easy to implement have created a higher adoption rate and improved supply chain functions (Almehairbi et al., 2022). Through digital technologies adoption, the green supply chain processes are streamlined with more simplified processes. Hence, the following hypothesis is derived:

H2: Effort expectancy has a positive effect on digital technologies adoption

2.5 Facilitating Conditions

Facilitating conditions refer to the degree that individual perceives an organisation's technical infrastructure available to support the use of the system (Venkatesh et al., 2003). Past studies (i.e., Francisco and Swanson, 2018) have found a positive effect of facilitating conditions on digital technologies adoption in supply chains. The availability of technical resources and organisational support has positively influenced blockchain technology adoption in supply chains (Francisco and Swanson, 2018). Queiroz and Pereira (2019) found that facilitating conditions of digital technologies infrastructure have a strong effect on the intention to adopt big data. The important facilitating conditions in artificial intelligence adoption in the supply chain involve high-quality and user-friendly computing infrastructure within the organisations (Grover et al., 2020). Thus, the below hypothesis is derived:

H3: Facilitating conditions has a positive effect on digital technologies adoption

2.6 Costs of Use

Costs of use involve the amount of expenditures and investment incurred from the adoption of digital technologies. The managerial decision to invest in digital technologies for adoption in the supply chain involves the evaluation of switching costs, with lower switching costs will be more beneficial in the adoption process (Chulko, 2017). According to Cavalcanti et al (2022), transactional costs and cost/benefit evaluation are the critical factors for the adoption of digital technologies. The usage of digital technologies in the green supply chain that streamlines

certain processes can contribute to more costs efficiencies achievement. Therefore, the below hypothesis is derived:

H4: Costs of use has a positive effect on digital technologies adoption

2.7 Conceptual Framework

Figure 1 illustrates the hypothesised relationships of the four independent variables consisting of performance expectancy (H1), effort expectancy (H2), facilitating conditions (H3) and costs of use (H4) towards digital technologies adoption.

Figure 1: Conceptual Framework
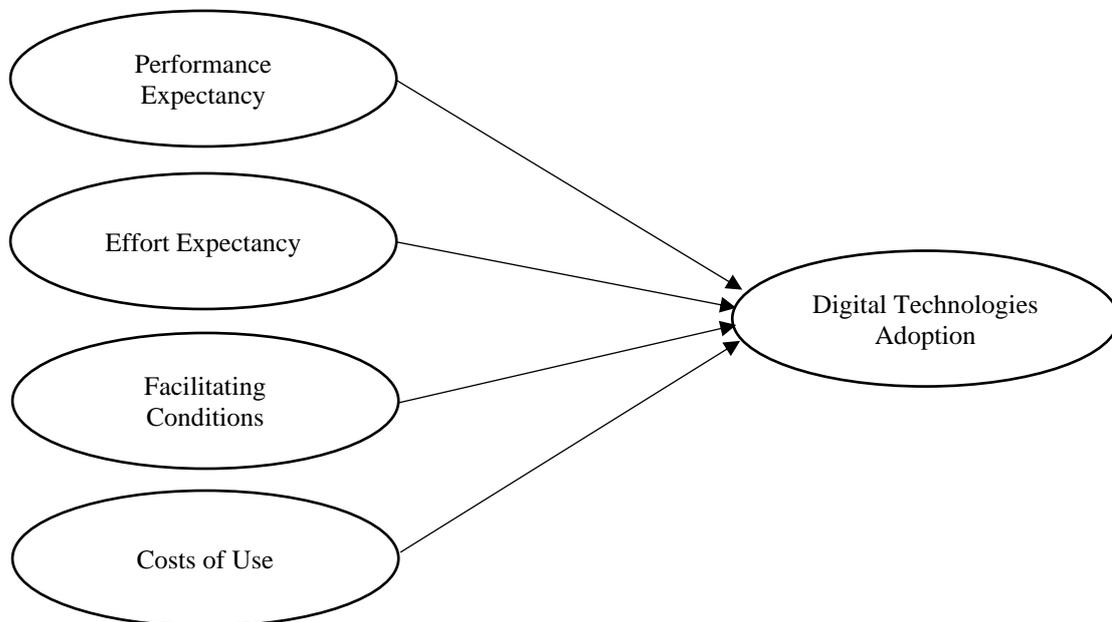
3.0 Research Methodology

The study population consists of social enterprises located in Malaysia. A total of 410 samples were obtained from the online survey method via email sent to the owner or supply chain managers of the social enterprises in Malaysia. The online survey questionnaires were sent together with a cover letter. With 443 survey emails sent to the social enterprises and the response rate achieved was 95%.

A total of 21 measurement items were formed for performance expectancy (4 items), effort expectancy (5 items), facilitating conditions (4 items), costs of use (4 items) and digital technologies adoption (4 items). The measurement items for performance expectancy consist of being useful for daily operations, increasing the likelihood of task completion, accomplishing tasks quickly, and increasing productivity (Queiroz and Pereira, 2019). As for

effort expectancy, it was measured by ease of use, simple, simplified processes, and ease of implementation (Nyugen and Nyugen, 2021). Facilitating conditions were measured by technical resources, organisational support, and user-friendly and high-quality digital technologies infrastructure (Francisco and Swanson, 2018; Queiroz and Pereira, 2019). The measurement items for costs of use were cost savings, low switching costs, cost-effectiveness, and transactional costs (Cavalcanti et al., 2022; Chulko, 2017). Lastly, digital technologies adoption was measured by investing in resources for adoption, usage in business activities, usage functional areas, and present use in supply chain processes (Ruangkanjanases et al., 2022). The Likert scale of 6-point with a scale between 1 for strongly disagree and 6 for strongly agree was used for the measurement item responses to provide more precise responses and avoid neutral point responses.

As for the validity assessment of the measurement items, the factor loading values achieved were all above 0.3 showing good construct validity. Using Cronbach's Alpha (CA), a reliability assessment was performed and the values showed a range of between 0.793 and 0.895. The CA values were above the minimum level of 0.7 (Pallant, 2007).

4.0 Results

This study consists of the total respondents of 410 social enterprises in Malaysia. The business types of social enterprises are food (31%), beauty (22%), health (20%), clothing (18%), and handicraft (9%). The majority of the social enterprises are located in Kuala Lumpur (30%), followed by Selangor (28%), Terengganu (15%), Johor (15%), and Sabah (12%). As for their years of establishment in Malaysia, the majority of the social enterprises have been established between 6 to 10 years (56%), followed by 1 to 5 years (34%), and above 10 years (10%).

By using a quantitative approach, the study applied SPSS AMOS version 26 for SEM analysis. The objective of using SEM is to assess the structural model and conduct hypotheses testing. Based on the structural model, the results have achieved an overall good fit. RMSEA value is 0.055, below the limit of 0.08 (Hooper et al., 2008). The chi-square value was 400.472. The ratio of x2/df was 2.237. As for the values of incremental fit, IFI of 0.947, CFI of 0.947 and TLI of 0.938 which were above the limit of 0.9. Figure 2 illustrates the structural model.

Figure 2: Structural Model
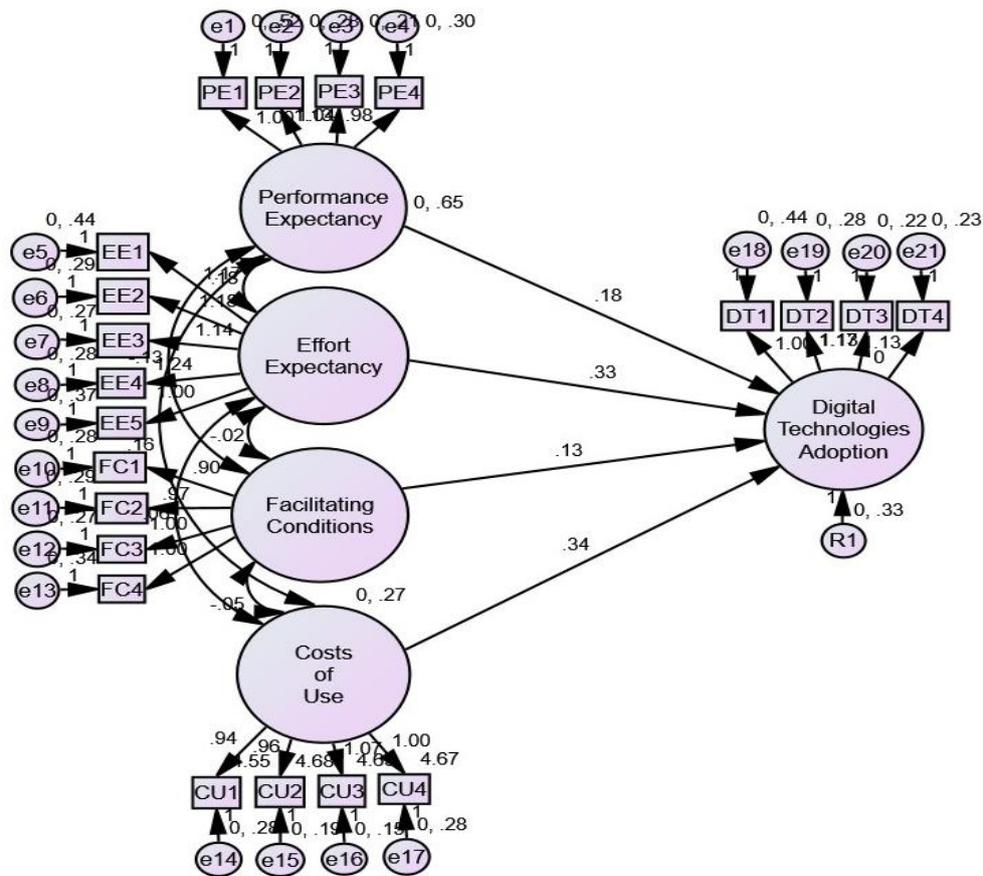
Overall, all three hypotheses were supported and one hypothesis was rejected. H1 indicates that performance expectancy has a positive influence on digital technologies adoption in green supply chain innovation with significant $p < 0.001$ and $\beta = 0.184$. H2 was accepted with $p < 0.001$ and $\beta = 0.331$ and showed that effort expectancy has a positive effect on digital technologies adoption. Subsequently, H3 was rejected indicating that facilitation conditions have no significant effect on digital technologies adoption, with $p > 0.05$ and $\beta = 0.127$. Lastly, H4 was accepted with $p < 0.001$ and $\beta = 0.338$, therefore costs of use has a positive effect on digital technologies adoption.

5.0 Discussion

Social enterprises have to leverage better performance expectancy through digital technologies adoption in the green supply chain. The usage of appropriate digital technologies in the supply chain that can improve productivity and innovation should be prioritised. The costs of use of digital technologies have to be managed efficiently by the social enterprises as they have limitations of resources, and support by the government and other related parties is needed to enhance their knowledge skills in digital technologies adoption. Facilitating conditions that should be prioritised are the technical resources, organisational support, and user-friendly and high-quality digital technologies infrastructure to make digital technologies adoption faster and more efficient among social enterprises. Furthermore, the network collaborations between the parties involved in the green supply chain are critical to ensure maximum benefits are obtained from digital technologies adoption.

6.0 Conclusion

The limitations of the present research are the study is confined to Malaysia and samples were obtained from social enterprises. Future studies could explore other countries as comparative studies and investigate other business enterprises such as large enterprises and small-medium enterprises. Furthermore, other variables can be analysed in future studies such as the risk and external environmental factors.

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