American Journal of Economics 2015, 5(2): 251-258
DOI: 10.5923/c.economics.201501.32

An Integrated Model of the Likelihood and Extent of Adoption of Green Practices in Small and Medium Sized Logistics Firms

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Abstract Environmental issues have become an essential part of business strategies; it therefore poses a challenge for managers and researchers to explore the integration of environmental concepts in business operations. Although a number of studies on green practice adoption can be found in the literature, few of them analyzed the likelihood of adoption(use or not use) and the extent of adoption(light or intensive) among non- adopters' and adopters' of green practices in organizations. This work aims to explain firms' decisions to adopt green practices, and the extent to which the adopters subsequently implement green practices. Past research of green management concentrated on manufacturing sectors; limited attention was paid on research in service sectors. Over the past 50 years, logistics and transportation, a sector in the services industry, has been regarded as a key determinant of business performance. This paper focuses on the green practice adoption in logistics companies because many logistics operations often lead to severe environmental impacts. The conceptual model was grounded in the technology–organization–environment (TOE) framework (Tornatzky and Fleischer, 1990), Roger's DOI theory and Thong's (1999) Model. The main purpose of this study is to explore the influences of determinant factors on green practice adoption and the extent to which the practices are adopted among the adopters in Malaysian logistics companies. A quantitative research technique using the survey method will be applied for the research.

Keywords Green logistics practices, Small and medium sized logistics firms, Environmental sustainability, Decision makers, Technology-Organization-Environment, Diffusion of Innovation Theory, Thong's Model

1. Introduction

Environmental problems such as climatic change, global warming, ozone depletion, solid waste, air and noise pollution, depletion of natural resources, irreparable loss of biodiversity and congestion are major concerns of the world today. Due increasing human and industrial impacts on the environment, environmental issues have become more intense and widespread. Environmental issues, if not addressed, are perceived to have the potential to lead to the extinction of mankind [1].

Environmentally conscious business practices have been receiving increasing attention from researchers, practitioners, government and regulators. Business operations, such as sourcing, manufacturing and logistics are believed to be responsible for most of the environmental problems. Industrial companies are to a great extent responsible for this degradation. Due to this the focus of government, stakeholders, regulators and customers has been on the manufacturing industries. Most studies, therefore, concentrated on environmental issues in the on the manufacturing sectors. The services sector on the other end received least attention as it is considered a sector that consumes least natural resources [2] with minimal impact the natural environment. However logistics industry which is in the services sector consumes significant amount of natural resources and pollutes the environment significantly [3]. The burning of fossil fuels by the transportation sector, a major component of the logistics industry causes GHG emissions, such as carbon dioxide (CO2) that can have a major negative impact on our environment [4] and on the general health. Even though this sector is known to generate significant contaminants it receives least attention. According to [5] the logistics sector produces up to 75 per cent of a company's carbon footprint and the sector is also huge. The international monetary fund (IMF) estimates that the logistics costs averages about 12 per cent of the world GDP [6]. The combination of monetary cost and environmental impact that logistics contributes to operations is significant yet studies done in this sector is relatively small. Further, the OECD has reported that logistics is one of the significant sectors that

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Published online at http://journal.sapub.org/economics

contribute to overall greenhouse gases emissions in the world.

During the last two decades Malaysia went through rapid economic growth [7]. Malaysia transformed its economy form material production to one driven by trade [8]. International trade has therefore become a critical component of Malaysia's economic engine. The dramatic expansion in the external trade in Malaysia has resulted in an increase in demand for more efficient and effective logistics services. Many manufacturers and retailers have adopted a supply chain management approach increasingly outsourcing their logistics activities to logistics service providers. In order to meet demands of their customers and to deliver products and services quickly, many companies sought to outsource their logistics activities to logistics service providers (LSPs). According to [66] the current trend of the Malaysian logistics industry is concentrating in outsourcing of logistics activities and on the growth of third party logistics (3PLs). Third party logistics service providers (3PLs) are known to make a substantial contribution to environmental degradation with transport and logistics activities contributing significantly to greenhouse gas emissions. It is estimated that there are approximately 22000 logistics firm providing a variety of services in the logistics industry in Malaysia. The logistics industry in Malaysia comprises of numerous small and medium sized firms [3]. Although there is no available statistics on the percentage of SME logistics firms in Malaysia, it is generally assumed to be more than 90 percent as the percentage of SMEs to total business establishments [3]. Due to the large number and the vital influence that SME logistics firms have on the environment, their impact cannot be ignored. Although the environmental impact of these logistics firms is not easily quantifiable it is estimated that SME contribute about 70% of environmental degradation [69]. Small-Medium Enterprises (SMEs) can be of particular significant on green concept as their total impact towards environmental degradation is huge. Despite an emerging literature on the role of large firms, the role of small and medium-sized enterprises (SMEs) remains underexposed [9]. This neglect by researchers on the role of SME logistics firms on environmental degradation is not justified given the substantial impact these SMEs impose on the natural environment [10].

This paper reports a research which aims to understand further the factors that influences the likelihood of adoption (use or not use) and the extent of adoption (light or extensive), amongst small and medium sized logistics firms in Malaysia. Although there is a proliferation of studies on green adoption by businesses in the last few years, this research type (logistics in specific and an integrated one), however, been limited in a developing country like Malaysia. Most studies on green adoption have been conducted in the advanced economies. In Malaysian context, the studies on SME's have not yet reached an in-depth analysis on the development of SME in many major areas especially concerning the issues of green practices adoption and also in the services sectors such as logistics. Despite a number of small scale studies on the issue, the current level of adoption of green practices adoption amongst small and medium sized logistics firms in Malaysia is still not clear. The scarcity of research focusing on green adoption by small and medium sized logistics companies communicates a need for research that concentrates on this specific industry. In addressing these research gaps, this study will focus on small and medium sized logistics firms in an effort to reveal the factors which predict the intention and the extent of green practices adoption in Malaysian logistics firms.

Adoption of innovations by individuals has been extensively written [11], but questions about the process of organizational adoption still remain. Researchers have sought to understand why some firms readily embark on adoption of green practices while others prefer to wait and see how events unfold. In order to determine the variables that contribute to explaining the extent to which firms use green practices, given that to date the literature has not yet offered conclusive evidence on this question. The current work aims to provide an integrated vision of the set of factors influencing the green practices adoption process.

2. Theories Used in Green Practices Adoption

Many researchers have equated green practices adoption to a technological innovation adoption process [12] [13]. Thus technological innovation theories are used. For this purpose, technological innovation is the focus and this study and approaches environmental innovations as new or modified processes, products or services that reduce environmental harms [14].

The foundation of many previous technological innovation adoption studies was based on the theoretical frameworks derived from Fishbein & Ajzen's [15] Theory of Reasoned Action (TRA); Ajzen's [16] Theory of Planned Behaviour (TPB); Davis's [17] Technology Acceptance Model (TAM); Rogers' [18], [19] Diffusion of Innovation Theory (DOI) and Tornatzky & Fleischer's [27] Technology-Organisation-Environment (TOE) model. Extensive review of the literature on Technology adoption indicates that there are several studies at the individual level. Technology Acceptance Model (TAM) [17], Theory of Planned Behavior (TPB) [16] are theories and models used for technology adoption study at the individual level [20]. Though there are many theories at the individual level, theories at the organizational level are indeed limited. As this study is confined to small and medium sized logistics firms only theories and models at organizational level are used. Some researchers [21] [22] have questioned the possibility of developing a single theory on adoption and diffusion that can be applied to all types of innovation. Basing on this line of thought, one cannot expect a single theory to adequately explain the adoption of different innovations, with their extremely diverse contexts of adoption [23]. In view of this lack of a single general theory on innovation adoption, some

authors (for example, [21] [23]) proposed an alternative approach that involves designing specific theories [25] that take into consideration the distinctive characteristics and contexts of each type of technology. Therefore the prominent theories, Roger's theory of DOI coupled with TOE framework provides a useful theoretical framework to explain the organization's adoption of green practices in general and among small and medium sized logistics companies, in particular. The TOE framework is more frequently used with DOI as it seems to be driven by the fact that this framework is consistent with DOI [24], where [23] highlighted individual as well as internal and external characteristics of the organization. The other reasons for using DOI theory in combination with the TOE model is that the latter can describe the organizational adoption of innovation among business firms by considering the external factors while DOI is used as it considers the organizational and the technological factors. Furthermore as [24] stresses that integrating and combining constructs of two or more theoretical models have improved the understanding of a complex technological innovations compared with using one theoretical model for the same study. Rogers' DOI theory's consistency has been proven in over 5,000 studies across a variety of different disciplines, including the study of environmentally friendly technology since was first published in 1962 [26].

Tornatzky & Fleischer [27] developed the technology-organization-environment framework to study innovation adoption at organization level. This framework has been tested widely by many researchers to investigate innovation adoption at organizational level, and the results are promising. The specific factors identified and tested in each of the three contexts differ from one study to study depending on the nature and type of innovation adoption.

Extending the works of [30], [23] and [27], an integrated model for recognising green adoption as a technological innovation using a technology organization-environment framework (TOE) is developed and explained. Rogers [19] suggests that the adoption and implementation of new technology in an organization is much more complex than innovation decisions made by individual, as often many people are involved in the decision making. This theoretical basis has allowed researchers to examine the relation between the characteristics of the green innovations, of its potential adopters, and of the environment, on the one hand, and the speed and extent that firms adopt or implement these innovations, on the other [28].

It is worth mentioning that there is no single factor that is universally tested in every innovation research and the identification of factors to be included depends on the specificity of the innovation studied [29]. It is worth noting that numerous factors have been identified in the innovation adoption literature. However, the specific factors identified in each of the three contexts differ from one study to another [29]. Rogers [19] suggests that the adoption and implementation of new technology in an organization is much more complex than innovation decisions made by individual, as often many people are involved in the decision making.

By synthesizing previous research, [23] developed an integrated model and identified four contextual elements that were relevant to technology adoption in small firms: Decision makers' characteristics, Technological characteristics, Organizational characteristics, Environmental characteristics.

3. Proposed Conceptual Model

The proposed research model to be tested in this study is a combination of the joint predictive tendencies of three base models of DOI [30], TOE [27] which later extended by [31] and Thong's Integrated Model (1999). The four characteristics, Decision Maker Characteristics, Technological characteristics, Organisational characteristics and Environmental characteristics, were derived from the three base models. The constructs used at the technological, organizational, and environmental (TOE) levels have been selected very carefully and by customizing its particular components catering for the needs, visualizing the context of the present research.

Prior literature has focused more on the issues of green management adoption decision. For example, [32] summarized some factors influencing green innovation adoption in small and medium-sized enterprises, including, management style, human resources, manufacturing activity, technological approach, innovative capacity, external cooperation and financial resources. Weng & Lin [13] developed a model that analysed factors influencing the adoption of green innovations for the small and medium-size enterprises (SMEs) from the perspective of technical innovation. The determinant factors consisting of technological, organizational and environmental dimensions were tested. The researchers found that technological characteristics of green innovations, organizational characteristics, governmental supports, customer pressure and regulatory pressure have significantly influences on green innovation adoption for SMEs while the influence of environmental uncertainty was found not significant. Rottenburg & Zyglidopolos [33] in a study of the printing industry found that the adoption of green innovations was positively associated with the dynamism of the company's task environment. Henriques & Sadorsky [34] in their likelihood of implementation study of Canadian manufacturing companies implement cleaner technical innovations found that total quality management and external stakeholder pressure would increase the likelihood of implementation. Ho & Lin [35] analyzed the factors influencing Taiwanese logistics companies' attitudes toward environmental management practices. Research findings reveal that complexity, compatibility and relative advantage of environmental management practices, quality of human resources, organizational support, governmental supports and regulatory pressure have significantly positive

influences on Taiwanese logistics companies' attitudes toward environmental management practices. However, the influences of environmental uncertainty and customer pressure are not significant for Taiwanese logistics companies. Lin & Ho [12] analysed the factors influencing the adoption of green practices in Chinese logistics industry. Research results reveal that relative advantage and compatibility of green practices, organizational support, and quality of human resources, regulatory pressure, and governmental support have significantly positive influences on the adoption of green practices for Chinese logistics companies. Environmental uncertainty and green practice's complexity have significantly negative influences on green practice adoption. However, the influence of customer pressure is not significant for Chinese logistics companies. Liu & Liu [36] argue that Chinese firms' adoption of green practices is influenced by the coercive pressure from the organizations holding mandatory power, normative pressure from the industrial association and the public, and mimetic pressure from the competitors. Stakeholder pressure, environmental regulation, company size, managers' characteristics, human resources and industry sector are relevant variables frequently appeared in studies on green practice adoption decision [37]; [38]). Ho et. al. [39] studied factors influencing infusion of green practices in small and medium sized logistics firms in China. Research findings reveal that complexity, compatibility and relative advantage of green practices, quality of human resources, organizational support, governmental support and regulatory pressure show significantly influences on green practice infusion for the logistics companies in China. The influences of adoption cost, company size, environmental uncertainty and customer pressure on logistics companies' green behaviour are not significant. Decision maker factors in the adoption of green logistics adoption has not been be tested on any studies involving green practices adoption in logistics firms but there are several studies in other fields such as IT where Decision Maker factors were test. Hameed [40] found that both CEO innovativeness and CEO knowledge of the technology has considerable influence on its adoption. In this study chief executive officer's (CEO's) innovativeness, and CEO's green knowledge are included as an additional group of factors of CEO characteristics or managerial attributes ([41] [31] [23]). The technological factors include the adoption cost, company image, complexity, compatibility and relative advantage of green practices; the organizational factors include quality of human resources, organizational support, and company size; and environmental factors include competitive pressure, governmental support, regulatory pressure, and customer pressure.

The framework in Figure 1 proposed to be used to investigate the adoption of green practices among small and medium sized Logistics firms in Malaysia. Each of the factors will be investigated to see if there are any sort of relationship with green practices adoption.

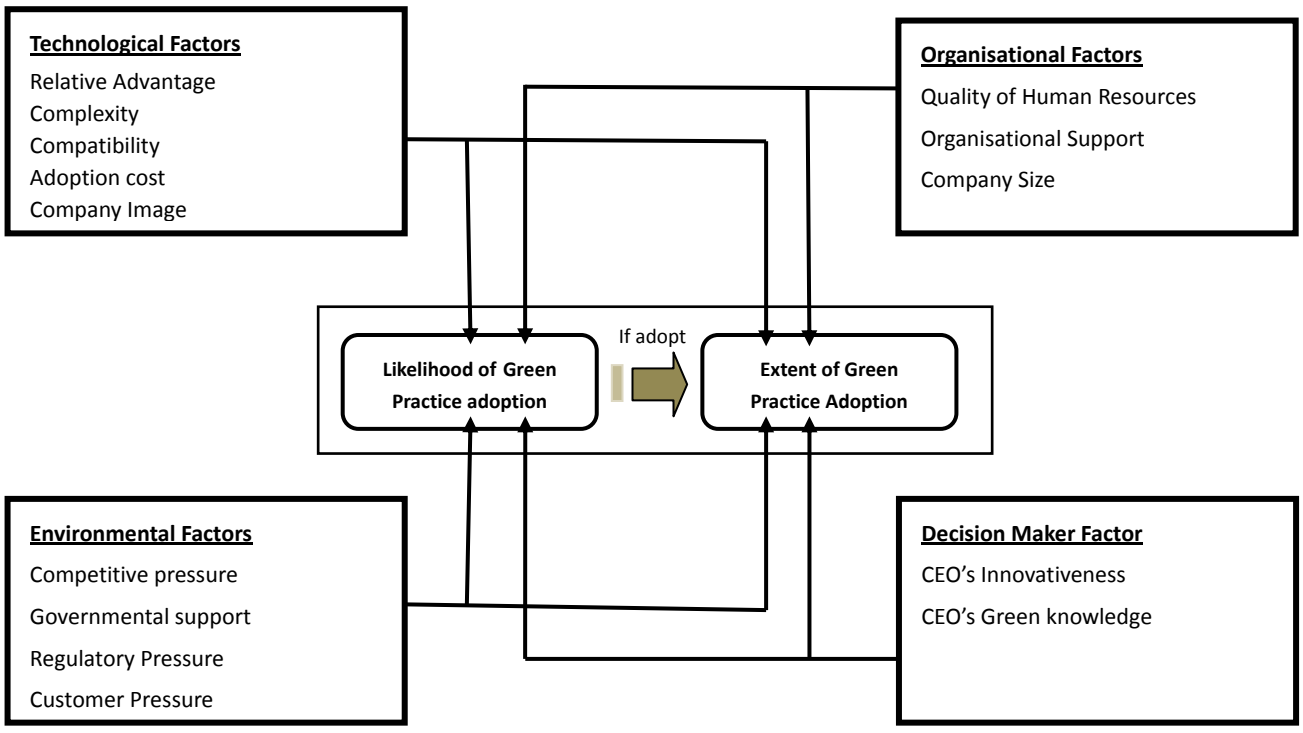

Figure 1. An Integrated model for Green Practices Adoption in Small and Medium sized logistics firms

3.1. Decision Makers' Characteristics

In SMEs, top management usually refers to the chief executive officers (CEO's) or owner-managers of the firm**.** In SMEs studies, CEO and the owner-manager is used interchangeable since in most cases CEO and owner-manager is the same person [43]. Research conducted by [44] and [45] have identified the important role of CEO or owner-manager in influencing the adoption of new technology in small and medium sized firms. SME firms are not merely scaled down versions of large firms [46]. They have their own distinct characteristics. The owner managers play a pertinent role in the adoption of any new technology [46]. As key personnel, CEO or the owner managers is the authority in decision making and also recognizes that going green has its potentials and in turn develops a strategy to adopt it. Thus, the decision whether to adopt or not to adopt will highly depends on these owner managers. Innovativeness is described as "a willingness to introduce newness and novelty through experimentation and creative process aimed at developing new products and services, as well as new process" ([47], p. 148). CEOs can influence technology adoption by virtue of their innovativeness and interest towards change. In small businesses, the CEO is usually the owner and the sole decision maker and CEO's innovativeness and involvement contributes to the success of any technology adoption process [48]. According to [49], amongst these CEOs, knowledge of the technology to adopt was found to have a strong correlation with technological innovation adoption. Since small and medium sized enterprises (SMEs) usually lack an internal expertise (highly trained human resource for example), it is the CEO who normally guides them towards technology adoption [50]. A CEO with greater green practices knowledge is able to assess the benefits of new technology and more likely to adopt innovation.

3.2. Technological Characteristics

Characteristics of an innovation such as compatibility, complexity, and relative advantage may affect innovation diffusion ([51] [30] [52]). Complexity is the degree to which an innovation is perceived as difficult to understand and use. The more complex an innovation, the less likely it will be adopted [19]. Compatibility is the degree to which an innovation is perceived as being consistent with existing values, past experience, and the needs of potential adopters. "Image" is defined as "the degree to which the use of an innovation is perceived to enhance one's image or status in one's social system" [53] p195. The company image expressed with the reputation of the firm and image of the firm and its products are two great driving forces for green logistics. Organizations can also steer clear from negative public attention and thus get support from their stakeholders to be environmentally responsible [54]. Adoption costs include the required human and financial resources in adopting green practices. Costs have been long posited as a barrier for the adoption of innovations [52]

3.3. Organisational Characteristics

The organizational context represents the factors internal to an organization influencing an innovation adoption and implementation [27]. Organization size is one of the factors that have been frequently associated with innovation adoption. Size indirectly reflects the resources owned by the firm; financial and human. One of the most common measures of size is the number of employees [22]. Other measures include fixed assets [23] and annual revenues [55]. Recent studies show that the firm size is one of the major determinants of a firm's green strategy –environmental actions undertaken are inversely proportional to the company size [56]. Top Management Support refers to the extent that a company helps employees use a particular technology or system [35]. Top management support is important for creating a supportive climate, providing the required resources and encouraging employees to adoption the new technology [28]. According to [51] providing the necessary incentives for adoption of the innovation by ensuring the availability of both financial and technical resources for its adoption have positive effects on the adoption of technical innovations. Organization support (Top management support) is an imperative for adoption of technology as this ensures sufficient resources for adopting environmental (green) practices. Several previous studies have shown that top management support is a significant predictor of technology adoption [41] [42]. Tornatzky & Fleischer [27] claims that quality of human resources is an essential factor in influencing technical innovation adoption. The innovative capabilities and the competent learning abilities of qualified human resources are helpful to adopt innovations [35]. Adopting and implementing green innovations or environmental practices is a complex processes requiring cross–disciplinary coordination and also requires firms to make substantial changes to their current operation process [57]. The green practices adoption process is demanding on the human resources of the firm and there high dependence on the development and training of tacit skills through the employees involvement [32]. Lack of knowledge of the innovation or green (environmental) practice as in this case is a barrier to the adoption process.

3.4. Environmental Characteristics

Competitive pressure refers to recurrent and unpredictable changes in customer preferences, technological changes and competitive behaviour perceived by the organization's management [35]. Many researchers have shown that competitive pressure has an influence on the company's decision to adopt technology [58] [59]. It is generally believed that competition increases the likelihood of adoption of innovation [22]. According to [60], "governmental support" is "the policies, initiatives, agencies, and everything that is provided or organized by the government to accelerate the rate of adopting a techno-innovation". According to [27], the government can also help boost technological innovation adoptions thru

several encouraging policies such as providing financial incentives, technical resources, human resource training, pilot projects allowing tax breaks and tax rebates, providing subsidies, lower rates from financial institutions for environmentally friendly technologies, and lower insurance premiums for lower environmental risks etc. According to the literature, the significant positive relationships could be found between [67] [68] governmental support and green practices. According to the stakeholder theory, organizations carry out activities to satisfy their main stakeholders. According to [65] stakeholder pressure is regarded the most prominent pressure that influences a company's environmental strategies. Amongst the various groups of stakeholders, regulators are arguably viewed as most important stakeholders [37] to the companies. In the regulatory environment, governmental legislation is cited as the most important driver for environmental strategies [61]. Organizations conduct activities within an environmental context [62]. Innovation research scholar have suggested that external environments provide opportunities and constraints [62]. Among various groups of stakeholders, customers are viewed as companies' most important stakeholders. A body of research reveals the positive relationships between firms' environmental activities and customer pressure [63]. A customer who has adopted green practices in their organization would force their supply partners to adopt the green practices too.

3.5. Methodology

A quantitative research technique using the survey method will be applied for the research. The population of interest consist of small and medium sized Logistics Service providers in Malaysia. The sampling list will be obtained from the Federation of Freight Forwarders. The owners-managers of the small and medium sized Logistics Service providers in Malaysia will be the unit of analysis. A stratified probability sampling method to reflect a true representation of the population will be adopted for the research. The sample size targeted will be 500 questionnaires. The targeted sample size was chosen based on the type of data analysis to be performed and provide a representative of the population.

4. Conclusions and Summary

In recent years the natural environment becomes a major global issue. Environmental issues in the logistics industry are vital for studying. It is widely recognized in the literature that logistics could have a significant impact on the environment [64]. Despite its importance very few studies analyse environmental issues in the logistics industry [12]. The proposed research model has been created upon scrutinising various models and reviewing literature used in previous adoption studies at the organizational level. The developed research model was based on the TOE framework subsequently expanded by [31] combined with DOI theory. The TOE is used because it is compatible with DOI Theory. A integrated framework has been created to test the factors influencing green adoption and the extend of adoption at the same time. The use of this framework therefore will not only empirically validate its usefulness but will also test the performance of the DOI theory and Thong integrated model in the SME logistics setting. The integration of TOE framework, IDT theory, Thong's model is further expected to create specialized model for SME in the logistics sector.

5. Limitations and Future Direction

The formulation of the proposed research model is based on the empirical validation of the constructs taken from different research studies of green practices adoption and other relevant studies at the organizational level which were not fully exploited from extant research on green practices adoption in small and medium sized logistics companies. Therefore, empirical validation of the constructs considered for this model is yet to be validated. The future research direction for this research is to collect data from the various small and medium sized logistics organizations in Malaysia, in order to test the proposed research model. In addition, if this model is proven to be one of the accepted models for the adoption of green practices adoption in Malaysia, it can be tested further to see whether its performance remains similar in the context of other developing Asian countries.

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