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THE BARRIERS TO ADOPTION OF GREEN TECHNOLOGY BY HIGHER EDUCATION INSTITUTIONS IN MALAYSIA

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ABSTRACT

The purpose of this paper is to present a comprehensive look on the key factors that may hinder higher education in adopting green technology. An extensive literature review was conducted and found a research gap in the area of green technology adoption by higher education in Malaysia. Based on the analysis, the authors set out to propose a theoretical model focusing on the critical barriers affecting adoption. Increasing awareness and anxiety on environmental issues have raised the importance of adopting green technology measures. Although numerous studies have been conducted on green technology adoption in various sectors, little research has been conducted on why higher education in Malaysia has yet to fully embrace it. Therefore, the authors felt that it is imperative to conduct an in-depth study on the adoption barriers. Key barriers identified include high adoption cost, lack of environment knowledge and green awareness, lack of trust, adoption skepticism, institution adoption rate and switching barrier issues. Though the study is conceptual in nature, its findings can be used as the foundation for future research to identify the most significant factors that promote green technology adoption in order to assess the readiness of higher education in Malaysia to implement green initiatives and practices.

Keywords: Green technology, Adoption barriers, Higher education, Sustainability, Environment, Green initiatives

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INTRODUCTION

The rising concerns on environmental issues have had an impact on most of the social factors, which include geography, political science and sociology. Issues relating to the environment also are linked with the economic, cultural, and social factors (Eden, 1998). There are many new upcoming technologies in the market; however, many of them never achieve commercial success. Though green technologies offer real environmental benefit and services, they may not be as easy to commercialize as other technologies because adoption barriers include large capital expenditure, lack of historical track record, difficulty entering existing markets, and high entry pricing for consumers (Radcliffe, 2010).

One of the reasons for barriers in green technology adoption may be the reluctance to change. In identifying new technologies adoption barriers in higher education, resistance to change is strong and although there is a change, educators at all levels still want a few things to remain the same in their daily teaching routine (Rogers, 2000).

The increasing cost of technology adoption is one of the major barriers in adopting new technology. This cost barrier appears in different forms such as legal and regulatory restrictions, threat of violence, worker strikes, outright disruption, and bribes to be paid (Parente & Prescott, 1994). The barriers to technology adoption and development had been argued by past researchers including Rosenberg and Birdzell (1986) who stated that the pace of technology adoption is determined by the resistance of a country and that people in the West grew rich faster due to a weaker resistance to technology adoption.

Parente and Prescott (1994) supported the statement by assuming firms in a country make investment decisions in advancing its technology level. The researchers segregated technology adoption into two factors, which are the general and scientific knowledge and the size of barriers to the adoption in a specific country. The higher the growth of both general and scientific knowledge, the faster a country adopts a particular technology (Parente & Prescott, 1994).

PROBLEM STATEMENT

The absence of technology practiced in curriculum activities may not be blamed entirely on the instructor, but also lie with the institution (Rogers, 2000). Although new technologies are available, many faculty members are slow to adopt them as they deemed that it may not bring them any benefits and are not convinced that it may improve their learning process (Neal, 1998).

Butler and Sellbom (2002) had identified a number of technology adoption barriers including equipment malfunction, time to learn new technology, different equipment across classrooms, weak campus support and so forth. However, to the researchers' surprise, faculty with high level of proficiency generally identified the same barriers as low level proficiency faculty. What is lacking is a concrete comprehensive study on why higher education in Malaysia has not fully implemented green technology for spearheading the government sustainability initiatives.



The present study seeks to identify the key barriers that prevent green technology adoption and determine whether it is relevant to higher education in Malaysia (as highlighted at Figure 1). This will enable future research to be carried out to assess adoption readiness for higher education in Malaysia. The data were obtained through secondary sources from past research, published journals and websites.

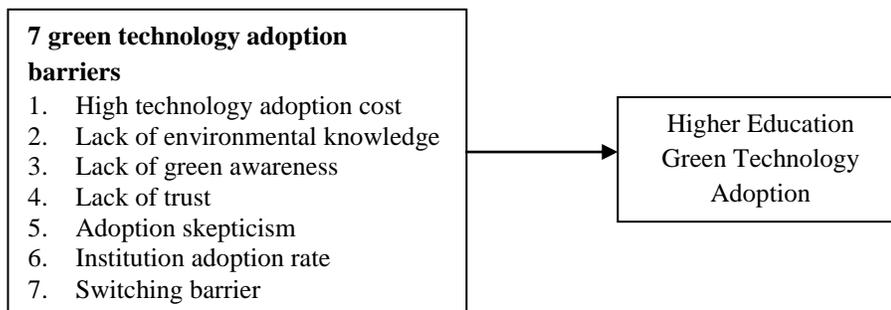


Figure 1. Proposed conceptual model.

REVIEW OF LITERATURE

Potential Barriers Affecting Higher Education Green Technology Adoption

The study on sustainability transformation on universities had presented four potential barriers that may hinder the transformation process. The first barrier presented by researchers is freedom of faculty members, which means that most decisions on achieving education and research goals are made by individual faculty members themselves; thus, it is not easy for the administration to put pressure on them because changes require agreement from faculty members. The second potential barrier is the incentive structure. Most universities do not recognize sustainable development contributions from faculty members, thus, lowering their motivation in transforming for sustainability. Next, the lack of desire to change in terms of educational and research facilities, as these activities requires a massive amount of time and cost. Usually, once an institution is established, these facilities will stay as long as students are still attached to the University, in this case, it is difficult for the transformation process. There is no reason for transforming the University unless society demands changes from the University (Ferrer-Balas et al., 2008).

Various barriers affect success of implementing sustainability in universities around the world. Sustainability is a key element in the education system; however, transforming into a sustainable university is still in its infancy stage (Velazquez, Munguia, & Sanchez, 2005). In order for universities to be sustainable, green technology adoption is vital to ensure success. Therefore, it is important for institutions to transform adoption barriers into challenges, in order to further improve successful adoption of green technology to become a sustainable university. Thomas (2004) had included barriers to change as a general factor, and further expanded the factor. An understanding of organizational change and culture is needed in order to overcome the barriers.



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High technology adoption cost

The rising scarcity of resources, degradation of environment, and cost pressures have led to many new developments (Gollin, Morris, & Byerlee, 2005). Some researchers state high technology cost as one of the adoption barriers (Parente & Prescott, 1994; Radcliffe, 2010); some had suggested that green technology adoption may lead not only to benefits but also cost reduction (Arkesteijn & Oerlemans, 2005; Zhu & Weyant, 2003). As stated earlier in this article, legal and regulatory restriction, threat of violence, worker strikes, outright disruption, and bribes are some of the different forms of cost barriers, and cost barrier is one of the major barriers in new technology adoption (Parente & Prescott, 1994). Zhu and Weyant (2003) had stated that if new technology adoption succeeds, the implementation cost may be low; however the implementation cost will be high if it fails.

Regarding new technology in health care services, researchers studied the cost and effectiveness of several technologies and suggested that the best technology which is "grade A" should be implemented as it is both less costly and more effective compared to the existing technology. According to the researchers, although "grade A" technologies are not necessary as most of the health care technologies do not meet the criteria, the lower cost is the compelling reason for introducing it (Laupacis, Feeny, Detsky, & Tugwell, 1992). Katz and Shapiro (1996) had studied technology adoption and sponsorship; they found that sponsorship can aid in establishing a new technology adoption through below-cost pricing. According to them, sponsored technology may monopolize the market although consumers are aware that the non-sponsored technologies are far superior. A study conducted on technology adoption and energy-efficiency audits had suggested that technology with lower average cost and high annual savings tend to have higher adoption rates (Anderson & Newell, 2004). Firms will find themselves in a "win-win situation" if they implement environmental regulations, and it is needless to substantiate precisely the social benefits of an environmental program if the implementation costs are low (Palmer, Oates, & Portney, 1995).

In the study of team learning and new technology implementation in hospitals, the researchers had found that team empowering and managing learning process is crucial for organizational response towards new technology adoption (Edmonson, Bohmer, & Pisano, 2001). However, according to the researchers, new technology adoption in the clinical context had led to high learning cost for surgeons and OR teams. In the study of technology adoption in the higher education system, the researcher had found that due to the competition of higher education, the new technology implementation process is fast; moreover, universities and colleges can offer courses at reasonable cost due to the stiff competition (D. L. Rogers, 2000). In a study on implementing hybrid vehicle technology, Gallagher and Muehlegger (2011) had found that the drive motivating consumers to adopt new hybrid vehicles are the variety of incentives offered by the federal, state and local governments. These include deductions and credits of income tax, sales tax waivers, carpool lane access and so forth (Gallagher & Muehlegger, 2011). In the study of Florida (1996), the researcher had studied corporate efforts in moving the trend of production practices to adopt environmental manufacturing approach; firms that are innovative in their manufacturing approach tend to be more ingenious in dealing with environmental risks and costs.

Hall and Khan (2003) had given a wireless communication example of technology adoption; they stated that the flow of benefits of wireless communication will be received throughout the lifespan of the implementation. However, the costs are usually incurred at the time of adoption, and these costs have been sunk. The researchers added that although there may be some costs incurred during the ongoing period, however, they are normally



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much less compared to the high initial cost. The researchers had given an example of the automated teller machine (ATM). The time saving and current technology of the ATM had increased the demand and desirability of users. As the demand increased, so did the average fixed cost and the cost of installation. Thus, this encouraged banks to implement the ATM more rapidly. According to Florida (1996), companies that adopt green production and design are likely to improve the company's productivity, cost reduction, quality, and technological innovation. Empirical studies had recognized the legislative and regulatory pressures in promoting adoption and implementation of cleaner technology and management systems in firms which act environmentally, then followed by market opportunity and cost savings (Florida, 1996; Garrod & Chadwick, 1996; Nameroff, Garant, & Albert, 2004; Sharfman, Meo, & Ellington, 2000). Thus, this study has identified cost as a factor affecting green technology adoption barriers which may affect institutions of higher education.

Lack of environmental knowledge

Environmental knowledge refers to a person's knowledge about the environment, aspects and impacts of environmental issues, and sustainable development responsibilities (Fryxell & Lo, 2003; Mostafa, 2007). Gendall, Smith, and Russell (1995) have examined the level of environmental knowledge in six different countries and found that people who acquire higher education levels tend to have higher environmental knowledge, but little empirical findings have supported the relationship with demographic characteristics. Kollmuss and Agyeman (2002) had stated that the higher the education level, the more a person is knowledgeable pertaining to environmental issues; however, it does not suggest the person to have pro-environmental behavior. Another study conducted by Martin and Simintiras (1995) on the relationship between environmental knowledge and attitudes had proven that environmental knowledge and attitudes have a weak relationship. However, some researchers had suggested that attitudes and environmental knowledge are correlated with one another (Tikka, Kuitunen, & Tynys, 2000). Thus, this study determined lack of environmental knowledge to be one of the barriers in adopting green technology among institutions of higher education.

Lack of green awareness

In recent years, social marketing techniques such as campaigns and workshops have been widely used in the context of public issues including AIDS awareness campaigns and anti-smoking workshops (Kollmuss & Agyeman, 2002). However, according to the researchers, these social marketing techniques seem ineffective in marketing sustainability or environmental campaigns. ISO14001 is one of the certifications influencing everyone to be more aware of environmental issues, regulations, and effects. These impacts not only apply to them at work, but also in the community and at home (Rondinelli & Vastag, 2000). The environmental awareness system (EMS) requires managers or subordinates of each department to conduct a targeted number of training annually.

According to the researchers, training programs enable employees to be aware of the importance of complying with environmental policies, procedures, work activities and environmental benefit to improve personal performance (Rondinelli & Vastag, 2000). The researchers also added that the training enable employees to be aware of their responsibilities and personal roles in implementing the environmental awareness system (EMS) (Rondinelli & Vastag, 2000). ISO14401 certification not only influenced employees to be more sensitive to



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recycling, but also led to waste reduction in the plant. Thus, managers also felt the advantage of this certification as it puts pressure in ensuring environmental compliance. We believe that the lack of environmental awareness may be one of the factors affecting institutional green technology adoption rates. Furthermore, educators are concerned about the efficiency and effectiveness on delivering educational information on environmental issues (Bruening, Radhakrism, & Rollins, 1992). This awareness has to be further examined in the context of green technology adoption.

Lack of Trust

Blake (1999) had identified three barriers to environmental action, which are individuality, practicality, and responsibility. Individuality barriers are barriers that lie within a person, which is closely related with attitude and temperament; on the other hand, practicality barriers are the constraints from institutions and social factors that prevent people from acting environmentally regardless of their own intentions. Last but not least, responsibility barriers refer to a person's opinion that they will not make any difference to society even if they act pro-environmentally. The researcher also added that the individuals' lack of trust in the institution often prevents them from acting pro-environmentally.

As Butler and Sellbom (2002) have reported, many faculty members are not convinced and wonder whether the technology advancement will be worth their effort to learn, thus forming skepticism towards the technology. This statement argues that the lack of trust toward a new technology and institution may hinder higher education adoption of green technology. Studies on trust and distrust in firms have grown drastically over the years. There are numerous definitions of trust, in terms or orientations and cognitive practices. Trust is defined as a situation of susceptibility or risk that a person faced regarding the intentions, motives, and actions of others they depend on (Kramer, 1999). Other researchers described trust in terms of risk taking action on confident expectations (Lewis & Weigert, 1985).

According to Govier (as cited in Kramer, 1999), distrust is defined as the lack of confidence in others, and concern that the other will try to harm them. Fein (1996) also stated that suspicion can be due to various circumstances, which includes perceived insincerity and untrustworthiness in others. In the condition of limited trust, all actions may be heavily examined, resulting in more difficult assessments of motives. In other words, if a person has disconfirmed on a selected activity, he or she will tend to have more thoughts on the activity and tend to ask more "why questions", making decisions more difficult. Thus, there is a need for this study to include the trust variable to examine its relationship towards technology adoption, and whether this variable influenced technology adoption.

Skepticism towards green technology adoption

Skeptics are people who have suspicion on others' actions and sayings, but their suspicion may decrease when they are convinced by facts and proof (Mohr, Eroglu, & Ellen, 1998). Although skepticism and lack of trust may seem similar, however, these two terms are conceptually different. According to researchers, distrust and skepticism are different where distrust is more definitive compared to skepticism. People who distrust have



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accepted something as not true; however, people who are skeptical about something are still mulling whether to accept it as true or not (Morel & Pruyn, 2003).

A study conducted by Sobczak, Debucquet, and Havard (2006) had defined skepticism as people who have negative stance toward a company's motives. Although there are many empirical findings from studies on skepticism (Campbell & Keller, 2003; Obermiller & Spangenberg, 1998), yet very little empirical findings exist on the relationship between skepticism towards adopting green technology and its eventual adoption. Consumers that are skeptics toward environmental benefits advertised in ads and labels on products had wasted the effort and costs of developing improved and new "green" products. This also applies to skepticism towards green technology adoption where technologies will not be implemented if consumers are skeptical toward them. Mohr et al. (1998) stated that skepticism is an individual's distrust on cognitive responses which differs across the context and content of communications. According to Singh, Kristensen, and Villasenor (2009), skepticism normally happens when consumers have doubt on a company's motives in participating a certain activity. Therefore, if consumers have doubt on green technology adoption, it is hard for the institution to adopt it. Thus, this study will explore further how skepticism by institutions of higher learning becomes a barrier in adopting green technology.

Institution adoption rate

According to Rogers (2002), innovation is a practice, concept, and object that is known as new by individuals or other units of adoption. The researcher also added that some innovations spread faster than others due to the characteristics of the innovation, which includes relative advantage, compatibility, complexity, observability, and trialability. Innovativeness is described as a person's adoption rate being comparatively faster than others of a social system. This innovativeness is classified as innovators, early adopters, early majority, late majority, and laggards. Each and every classification relates to a person's speed in adopting the new innovation.

In a study on the determinants influencing language schools to adopt the Internet as a teaching tool by Martins, Steil, and Todesco (2004), the study found that language schools in Southern Brazil are shifting slowly to internet application teaching tools, and around 55.43% of the schools in Southern Brazil are using Internet teaching tools. The researchers stated that due to the fierce competition faced by language schools, pressure has been put on schools to hasten the rate of adoption, in order to satisfy the needs of students and teachers, and also to sustain a high market share and present a modern image. On the other hand, a study conducted by Van Everdingen and Waarts (2003) on the adoption rate influenced by national culture, had shown that variables that describes national culture will have a significant impact on the country's adoption rate. Hence, it depends on the institution on how they perceive adoption of green technology. If they perceive that adopting green technology is crucial for the institution, the adoption rate will be high. If the institution feels inferior or unsure about the technology, adoption rate will be slow. Thus, this study will determine whether institution adoption rate will be a barrier in adopting green technology.



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Switching barrier

This factor encompasses the traits of technical systems in influencing new technology adoption decisions. According to Arkesteijn and Oerlemans (2005), the technical system factor is related to how the system is built, perceived by users, and accepted by the final users. One of the studies conducted by the researchers is how individuals perceive using and understanding the adoption of green power, which also relates to the switching cost from conventional technology to green power. The hypotheses were proven that the more users perceived that a technology is difficult to integrate, the more difficult the adoption will be. In the study of e-store loyalty and perceived switching barriers, the researchers had found that the more consumers are loyal to a particular product, the harder it is for them to switch to different products (Balabanis, Reynolds, & Simintiras, 2006). This concept can also be examined in this study where we consider whether switching barriers exist in adopting green technology when institutions of higher learning are comfortable with and loyal to the existing system.

RECOMMENDATIONS AND FUTURE WORK

The future study will continue to investigate whether the barriers have a significant relationship towards green technology adoption and identify the most significant factors that promote green technology adoption in higher education. According to Butler and Sellbom (2002), it is important to understand the adoption rate in any given situation as these factors may become barriers to adoption. Arkesteijn and Oerlemans (2005) also stated that potential adopters have to overcome the economic market barriers that may hinder or delay the adoption rate. With the independent variables being tested, it is crucial to analyze whether the independent variables are significant to the dependent variable. Future target respondents will be the educators in higher education in Malaysia.

CONCLUSION

The green technology adoption barrier among higher institutions can also be classified as a barrier to market entry of green technology. Fisher (1997) described barrier as “anything that prevents entry when entry is socially beneficial”. This statement is specifically appropriate in the context of green technology adoption. Thus, this study examined through extensive literature review of past research the relationship between the barriers of green technology adoption and higher education adoption of green technology in Malaysia.



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