

Adoption of Technology among Businesses: The Strategic Adoption

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Abstract

Theories explaining adoption of technology have developed significantly over the last few decades. From the initial interest on individual's adoption of innovative technology, some studies have implicitly and explicitly applied the theories to examine a firm's decision to adopt technology. This study argues that individuals and firms make decision based on different criteria thus enhancing the Diffusion of Innovation (DOI), Perceived Characteristics of Innovating (PCI), and the framework developed by Compeau, Meister, and Higgins [7] to propose a framework for strategic adoption suit the context of profit-oriented organisation. However, future works are still needed to modify, develop measures, empirical examine, and validate the framework.

Keywords Diffusion of Innovation, Perceived Characteristics of Innovating, Strategic Adoption, Profit-Oriented Firms

1. Introduction

Technology adoption model (TAM) and subsequent theories such as diffusion of innovation (DOI) and Perceived Characteristics of Innovating (PCI) have significantly explained the adoption and use of new technologies and innovations. From the initial motive of explaining an individual's behaviour towards adopting new technologies and innovations [4, 7, 18, 30], researchers have extended the interest of these models to explain a firm's pattern of adoption [e.g. 11, 14, 15, 16, 27]. The expansion of a theory with the motive to enhance the robustness of the theory and to generate more knowledge will definitely be viewed as good and encouraging in the academic society. Nevertheless, application of a theory into a new area should follow by some extent of amendments to suit the context rather than applying it "blindly". Thus, the problem is whether the application of these theories to study the intention of a firm to adopt a technology or innovation is accurate. The answer is a yes and no. It could be appropriate in the sense that the theories are robust to accommodate for the shift of unit of analysis. However, in the case where the perceived innovation characteristics are not modified to suit the context of the study, it

is almost impossible to be applied. It is obvious that the decision making process of a firm is different from individual [4]. Just a simple example, do you believe that a profit-oriented firm makes decision to adopt newly launch high-speed broadband based hugely on ease of use and usefulness, or even compatibility, relative advantage, visibility, security, and trialability of the broadband? These variables are robust and vast in nature and need to be modified accordingly when apply to different interest of study.

Related to the above-mentioned problem, TAM has received criticism lately on the oversimplify framework used and lack of further efforts to investigate objectives for adoption of technology [e.g. 4, 6]. Investigation into related theories central around TAM (e.g. DOI and PCI) to some extent can draw similar conclusion. Thus, this paper aims to pull attention on the academic society to potential misleading development in the technology and innovation adoption theories application to explain a firm's technology and innovation adoption. However, it would not be generalised to all studies using technology adoption theories to study firm's technology and innovation adoption. Furthermore, the study also provides little contributions to suggest possible ways in investigating the adoption of technology and innovation at firm

level, which this study terms as “strategic adoption” to distinguish from merely adoption to avoid confusion from existing practice. The authors also hope the little thought highlight in this paper can induce greater feedbacks and ideas from fellow researchers.

The next section of the study provides brief review on the literatures development of technology adoption theories and some studies applied the theories to investigate adoption of technology and innovation at firm level. Then, the study suggests a framework to better understand firm’s decision to adopt and use of technology and innovation.

2. Review of Literature

Studies of individuals and organisations in adoption of information technology have been one of the central focuses in information system study [18]. In order to understand the adoption of technology among potential users, various theories were developed namely Theory of Reasoned Action (TRA), Theory of Planned Behaviour (TPB) [1], Technology Adoption Model [8, 9], Diffusion of Innovation [26], and Perceived Characteristics of Innovation [18].

One of the very first widely cited theories to explain adoption of technology and innovation is TRA [10, 2, 1. 20]. Based on the theory of social psychology, TRA explains human behaviour across various settings rather than focusing on technology acceptance [2]. Based on TRA, Davis [8] tailored a specific model to explain users’ adoption of information systems known as TAM. The initial TAM model based solely on perceived ease of use and perceived usefulness in explaining a user’s adoption of technology [8]. Davis [8] and Venkatesh and Davis [29] are among the researchers have exhibited strong theoretical and empirical justification for TAM as solid and parsimony model.

On the other hand, Rogers [26] had summarised 3800 innovation diffusion literatures to formulate theory of DOI. The theory emphasises that adoption of innovation involves five major steps; knowledge, persuasion, decision, implementation, and confirmation. Among them, persuasion is the most critical step in explaining individual’s decision to adopt an

innovation. Rogers [26] has incorporated five innovation characteristics; relative advantage, compatibility, complexity, trialability, and observability, predict 49 percent to 87 percent of innovation adoption decision. Moore and Benbasat [18] had enhanced the perceived innovation characteristics by Rogers [26] to construct the PCI with the justification that to examine the secondary attributes (perceived attributes) is more accurate than primary attributes to predict adoption of an innovation. Moore and Benbasat’s [18] PCI consists of eight innovation characteristics compared to five in Rogers’s [26] DOI. By maintaining relative advantage, compatibility, and trialability and renamed complexity to ease of use, PCI segregated the concept of image from relative advantage, segregated visibility and result demonstrability from observability in DOI. In addition, concept of voluntariness of use is added to PCI [18, 7].

Construction and development of these theories have contributed significantly in understanding and predicting individual’s decision to adopt new technology and non-technology innovation [e.g. 12, 21]. However, the evolution is unlikely to be optimum as various criticism and new ideas were added to the existing model of late (e.g. 3, 6, 7). Some common criticisms highlighted include the antecedent explaining user’s technology and innovation adoption is too simple, failure to consider the consequences or objectives of adoption, and failure to explore the factors determine a potential user’s perception towards innovation characteristics of a technology or innovation. A refined model namely Unified Theory of Acceptance and User of Technology (UTAUT) by Venkatesh et al. [30] consists of “41 independent variables for predicting intention and at least eight independent variables for predicting behaviour” [4, p. 245] might not synonym with the context of parsimony as one might claim. Besides, TAM specifically has been claimed to be cultural sensitive thus reduce the universality of the model across culture [3, 22].

In facilitating better understanding of factors influencing behaviour rather than merely acceptance or use of technology and innovation, Compeau et al. [7] has extended to framework of PCI to formulate a complex model include expansion of variables used and investigating both direct and indirect effect among the variables on a user’s

behaviour on technology based innovation. The evolution presented by them is showed in Figure 1 below. In addition to enrich the PCI with more variables, they also provide empirical support for a complex model that highlights the interrelationship among the independent variables.

The focus of the study is not purely on development of the theories and models. Rather, this study aims to propose a model to examine the adoption of technology and innovation among the businesses based mainly on DOI [26], PCI [18], and Compeau et al.'s [7] framework. Existing studies on adoption of technology and innovation in the firm have widely applied these theories to examine a firm's decision to adopt technology [e.g. 15, 27]. Other studies of technology adoption have shown similarity of the context of these theories even not explicitly mentioned in papers [14, 16]. Although modifications have been made on the items in the variables, application of an individual's decision making theory on business level should follow by greater extent of modification.

3. The Proposed Framework

Figure 2 below shows the proposed framework to study firm's technology adoption pattern. Enhancing from Compeau et al.'s [7] framework, this study customises the model to the interest of a profit-making firm. For the antecedent of decision to adopt technology, this study enriches the four main constructs; relative advantage, compatibility, ease of use, and observability.

Relative advantage is broken into three concepts namely improved firm's status (the concept of image in Moore and Benbasat's PCI model), customer value creation, and efficiency and effectiveness. Relative advantage is defined by Moore and Benbasat [18, p. 195] as "the degree to which an innovation is perceived as being better than its precursor". This study enhances the concept of relative advantage by adding in firm's status, customer's value creation, and improvement in efficiency and effectiveness as the reference points. For a profit-making firm, it is crucial for the firm to continuously seeking ways to improve the efficiency and effectiveness and improve the value creation for customer. This is in line with the concept of lower cost and differentiation advantage proposed by Porter [23, 24] for firm to gain

competitive advantage. Thus, if an innovative technology can help the firm to achieve competitive advantage, either lower cost or differentiation advantage, the firm is expected to adopt the technology. Besides that, in encouraging the usage of information technology, policy maker might implement some initiative such as giving the status of Multimedia Super Corridor Status in Malaysia. Having this status might enable firm to enjoy various incentives such as tax deduction, premium status, and so on. Besides, this status will also create positive perception among the public towards the firm. Customers might believe that they enjoy greater value by purchasing from the firm. If a firm believe that these impacts exist, then the likelihood to adopt the technology will be higher.

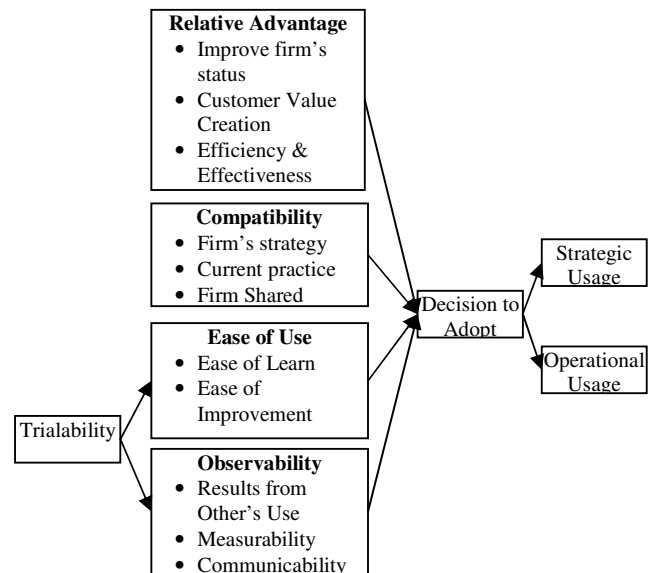


Figure 2: The Proposed Strategic Adoption Framework

Compatibility measures consistency of the new innovation with existing values, needs, and past experiences of potential adopters [18, 26]. Karahanna, Agarwal, and Angst [13] and Compeau et al. [7] has segregated the dimension into three concepts that is compatibility with prior experience, compatibility with preferred work style, and compatibility with values. The study adapted the construct developed by proposing the construct of compatibility to be segregated into three concepts; compatibility with firm's strategy, compatibility with current practice, and compatibility with firm's shared values. Compatibility with current practice reflects

the concept of compatibility with prior experience. This concept measures the compatibility of the innovative technology to the existing skills and capabilities of the employees, their work practice, and need to have the technology. Compatibility with firm's strategy is more future oriented reflecting the concept with compatibility with preferred work style. This concept captures the compatibility of the innovative technology with the future direction and strategy of the firm. Compatibility with firm's shared values reflects the likelihood for the innovative technology to reinforce the common values within the firm. For instance, if a firm's value strongly to promote the green production, then a technology or a technology provider that has negative effect on the environment will be unlikely to be adopted by the firm.

Besides, ease of use in the framework proposed is divided into ease of learn and ease of improvement to suit the context of a firm. Ease of learn examines the efforts required by employees within a firm to learn and use the innovative technology while ease of improvement associates with difficulty of the firm to innovate or build their innovation upon the technology or to customise the technology for the use of the firm. If decision makers perceive the two concepts can be performed easily, then it is more likely for the firm to adopt the technology.

The concept of observability in Rogers's [26] DOI was divided into visibility and results demonstrability by Moore and Benbasat's [18] PCI and further segregated by Compeau et al. [7] into the dimensions of communicability, measurability, and other's use. This study adapted the construct developed by Compeau et al. [7]. Firm is interested to observe the results from early adopters before making the decision to adopt a technology. If clear impact is observed in the early adopter, then the firm is more likely to adopt the technology. Measurability and communicability concern ease of the results or impacts of using the technology to be measured objectively and presented to the others, respectively [7]. If the impacts can be measured and communicate easily, then firm is more likely to adopt. This is important in study of innovative technology adoption at profit making firm since the management team needs to present and persuade the owners or Board of Director in adopting a technology. Thus, if the effects of using the technologies can be measured in figures and

presented to the Board of Director, the possibility of the proposal to be accepted is higher.

The concept of trialability in the proposed framework is not direct to the decision of the firm to adopt a technology. Rather, trialability is proposed to have indirect effect on adoption decision through ease of learn, measurability, and communicability. This is because logically, the possibility to have a trial version of a technology would not directly lead to adoption of the technology. However, the opportunity to try the technology will enable the employees to assess the difficulty for them to learn and use the technology and therefore easier for the managers and experts to predict the impact of the technology more concretely and accurately and to ease them to present these effects to the decision makers. As such, trialability is proposed to have indirect effect rather than the direct effect on adoption decision as proposed in Rogers's [26] and Moore and Benbasat's [18] works.

As predicted outcomes, a firm decision to adopt the technology can be due to strategic or operational usage. The strategic usage is where the technology is adopted to pursue the strategy set thus expected to yield competitive advantage to the firm. In the context of resource-based view, the strategic resources need to be valuable, rare, imperfectly imitable, and imperfectly substitutable with the prerequisite that the resources are heterogeneous and imperfectly mobile [5]. However, the tradability of the technology in the market does not discounted the likelihood for the technology to emerge as strategic resource if the firm able to integrate the human resources with the technology [5, 17, 19, 25, 28]. Thus, a firm adopt an innovative technology for strategic usage will normally customise the technology to form isolating mechanism for the firm to achieve sustainable competitive advantage. On the other hand, firm adopts an innovative technology can also be merely for operational use. This technology is normally the competitive requirement for the firm to survive in the competitive market. Thus, the decision to adopt an innovative technology for operational usage is more straightforward because others the technology is likely to be very common in the industry. This study proposed that firm will consider different

factors in making a decision to adopt the technology for different usage.

4. Managerial Implications

From literature point of view, the proposed framework assists to enhance understanding on adoption of an innovative technology among the businesses. Practically, the framework can be taken as a guideline for management to make decision on adoption of an innovative technology. First, the management should decide whether the innovative technology is for strategic usage or operational usage. Normally, if the technology is already widely adopted in the industry and possibility to further innovate or customise the technology is low, the technology might be at best for operational usage to maintain the competitiveness of the firm. If the innovative technology is valuable, rare, imperfectly imitable, and imperfectly substitutable, then the technology can contribute to firm competitive advantage [5]. However, firm should aware that technology can only be strategic resource through integration between human factors and the technology [5, 17, 19, 25, 28]. Thus, in order to adopt the innovative technology for strategic purpose, a firm needs to have suitable human resources and organisation culture to complement the technology.

Besides, the proposed framework provides better insight on factors to be considered in adoption of innovative technology. Unlike the generic model of TAM, DOI, and PCI, the proposed framework is recommended for profit-oriented firm. Thus, the important factors are outline in more concrete ways. For relative advantage, a firm should consider to adopt a technology when the technology can promise greater efficiency and effectiveness to the firm, create more value to the customers, and improve the status of the firm. However, to some extent, these factors are interrelated with each others. A firm is able to create greater customer value when it is more convenience for the customers to deal with the firm or at least psychologically, the customers believe they have purchased a superior product or purchased from a superior firm if compared to the competitors or if the firm do not adopt the technology. The greater customer value might be due to greater efficiency and effectiveness or when the firm is perceived to be with more superior status. Thus, if the innovative technology cannot promise

improvement in these three interrelated area, then the management should not consider adopting the technology.

Next, a firm needs to ensure the compatibility of the technology with shared values, strategy, and current practice of the firm. If a technology is not against the shared value of the firm, it is more likely to be accepted widely within the firm. The support from the whole organisation is crucial for long-term survival. Otherwise, adoption of the technology might lead some key members to leave the firm. This will affect the well-being of the firm. For example, if the firm value is to respect the privacy of all the employees, adoption of a new technology that might record the activities within the employees' personal workstation is hardly acceptable by the employees. Besides, associating the adoption of a new technology with the strategic plan of the firm is also crucial to make sure the firm does not need to scarify the technology to pursue the long term goal. For example, if a firm is to pursue differentiation strategy by producing highly customise product, then the firm should not consider to adopt a technology with high precision to produce huge volume of standard product. Apart of considering the future strategy, a firm needs to also consider compatibility of the technology with existing work practice within the firm. For instance, a restaurant might not consider adopting high speed broadband since the technology is not inline with how the firm does business currently.

In addition, a technology can only be fully utilised to have the optimum impact when the employees of the firm is able to capture the necessary skills and knowledge. Thus, firm needs to consider ease of capturing the skills and knowledge before deciding to adopt the technology. This is because training to the employees will incur cost to the firm. Normally, the training needs to be conducted continuously since existing employees might quite and a firm needs to hire new one. On the other hand, technology evolves over time. Thus, robustness of the technology needs to be considered by the management as well. Robustness here refers to capability for the firm to build on or to improve the technology to avoid the technology obsolete within short time. Furthermore, for a firm adopts the technology for strategic usage, possibility for the technology to be customised to make it rare and imperfectly imitable is crucial for the

firm to enjoy sustainable competitive advantage.

Prior to making decision to adopt a technology, firm is also encouraged to observe the impact of the technology from the earlier adopters. This is especially for a risk-averse firm. Observing how the others use the technology and the results they get from the technology help the firm in term of providing a good reference on success of failure story. Besides that, in a world where scientific evidence is crucial for decision making process in a firm, it is important for the firm to acquire objective information for the impact of the technology on productivity and profitability of the firm before adopting the technology. Therefore, it is important also for the impact of adopting the technology to be communicable. This is important to convince decision makers and shareholders that adopting of the technology will make the firm better off. These criteria are especially important in larger organisation compare to small and medium enterprises where the owner-manager makes most of the decision. However, a firm should recognise that giving too much time to observe and measure the benefits of using a new technology might lead to missing the opportunity of capitalising the technology for strategic purpose thus achieving sustainable competitive advantage for the firm.

Nevertheless, elements such as ease to learn, measurability, and communicability can be assessed mostly through trying the technology. Thus, it is important for a firm to have a trial version of the new technology, regardless is a psychical product or service to have deeper understanding on the technology and to get feedbacks from employees directly working with the technology before deciding to adopt.

On the other hand, the seller of the new technology must be aware of these factors to properly market the technology. For example, during the development of new technology, the developer should focus on developing a robust platform for the technology so that the end-user can also customise the technology for their own use. In addition, statistical figures on potential benefits of the new technology could be provided to convince the decision makers in a firm. A trial version of the technology should be given whenever possible, but proper protection over imitation should be done at

the same time. Other factors such as user friendliness of the technology and the social values of the society must be taken into consideration as well.

5. Conclusion

This study aims to propose a model to study adoption of technology and innovation among the profit-oriented firms by extending the existing theories mainly DOI and PCI [7, 18, 26]. Although these technology adoption theories have gone through significance stages of development and empirical validation, there is a need to recognise that these are theories to explain technology adoption at individual level. Studies that applied the theories to examine technology adoption among firms might have neglected this fact thus limited attempts to enhance to theory to suit the context of decision making of a profit-oriented firm. This study proposed a framework to explain strategic adoption of technology among firms. However, further works are needed to develop the instrument to measure the variables, testify, and validate the proposed framework empirically. This will help to provide greater practical value to the framework and enhance understanding on adoption of technology among profit-oriented firms. Besides, the framework proposed here to a large extend is still a generic framework. Thus, modifications need to be made whenever the framework is applied to accommodate for the differences in the nature of an innovation.

6. References

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