

ICT Adoption Models

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Abstract

The uptake of ICT among Pasifika businesses in the Wellington region has been studied using a mixed methodology approach which consisted of a quantitative and a qualitative phase. The results of the qualitative study were used to identify factors that motivate ICT uptake by Pasifika businesses. A number of models have been proposed to explain the adoption of information and communications technologies. Three different approaches are described in this paper. One of them is used to rationalise the factors found in this study.

Keywords: ICT adoption models, stage of ICT adoption, Pasifika businesses, motivating factors of ICT adoption.

1 Introduction

With rapid technological advances, the challenge to Pasifika peoples to succeed is much harder and we believed that it can be a deterrent for those aspiring to engage in business. We therefore think that it is important to find out the extent of ICT uptake by Pasifika businesses. Research was carried out to determine this in the Wellington region. The ultimate goal of the research is to ensure increased participation of Pasifika peoples in business in New Zealand (NZ) and, more importantly, to augment the current Pasifika businesses success.

The study focused on discovering the factors that motivate and those that deter ICT uptake by Pasifika peoples in the region. To understand these factors several theories and models of ICT adoption were used.

This paper discusses the theories and models of ICT adoption that can be used to interpret the results of the research. As the adoption of ICT by Pasifika businesses varied from the simple use of email to the relatively sophisticated deployment of e-commerce technology, it was necessary to classify the stage of ICT adoption. A four-stage model for this purpose is proposed in this paper.

In a previous publication we defined uptake as the adoption and/or use of ICT by Pasifika businesses (Manueli, Latu and Koh, 2006). ICT refers to information and communications technologies such as

computers and the Internet, as well as fixed-line telecommunications, mobile phones, other wireless communications devices, networks, broadband and various specialised devices ranging from barcode scanners to global positioning systems (Ministry of Economic Development, 2004). We also defined Pasifika peoples as peoples living in New Zealand who have migrated from the Pacific Islands or who identify with the Pacific Islands because of ancestry or heritage (Ministry of Education, 2004). It must be noted that the term does not refer to one particular ethnic group but rather to a diverse range of peoples.

2 Theory and Models of ICT Adoption

Pedersen (2003) claims that studies on ICT adoption have generally taken three possible approaches: a diffusion approach, an adoption approach and a domestication approach.

2.1 The Diffusion Approach

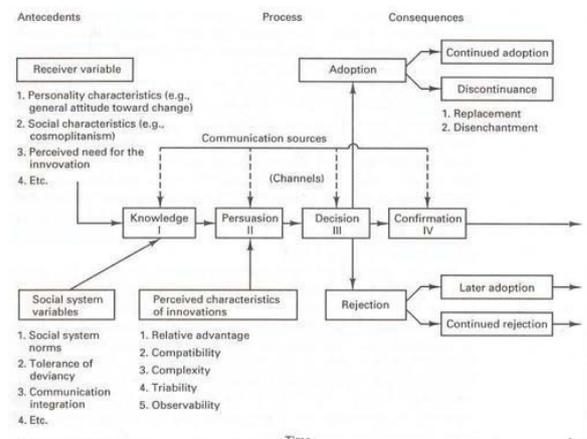


Figure 1: Rogers' Diffusion of Innovation model
(Source: Rogers, 1995)

Roger's Diffusion of Innovation theory (cited by Van Akkeren and Harker, 2003, p205) argues that media and interpersonal contacts provide information that influences a person's opinion and judgement. The theory comprises four elements: invention, diffusion through the social networks, time and consequences. Information filters through the networks and depending on the nature of the networks and the roles of its opinion leaders, new innovations are either adopted or rejected. Opinion leaders influence an audience through personal contact while intermediaries such as change agents and

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gatekeepers also contribute to the process of diffusion. Roger further claims that there are five adopter categories that include: innovators, early adopters, early majority, late majority, and laggards. Interestingly, the five categories follow a standard deviation curve where very little innovators adopt at the beginning (2.5%), early adopters constituting 13.5%, the early majority constituting 34%, the late majority another 34%, finally the laggards at 16%. Roger's model is shown in Figure 1.

2.2 The Adoption Approach

The adoption approach describes and explains the adoption decision of users applying different individual and social decision making theories. Three widely used models include the Technology Acceptance Model (TAM), the Theory of Reasoned Action (TRA), and the extension of TRA into a Theory of Planned Behaviour (TPB) (Pedersen, 2003). The TAM presented by Davis (cited by van Akkeren and Cavaye, 1999) suggests that when a user is presented with a new technology, a number of factors influence their decision regarding how and when they will use it. This includes its perceived usefulness and its perceived ease of use. However, the TAM does not account for the influence and personal control factors on behaviour. Other factors such as economic factors, outside influences from suppliers, customers and competitors are also not considered by the TAM (van Akkeren and Cavaye, 1999). The Technology Acceptance Model is shown in Figure 2.

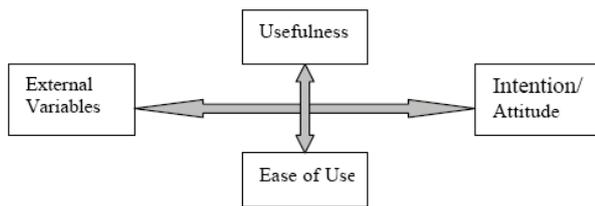


Figure 2: Technology Acceptance Model

(Source: Cloete, E. and Courtney, S., 2002, p2.)

To overcome the limitations of the TAM, the TRA was introduced which is a more general theory than the TAM. The TRA model includes four general concepts namely: behavioural attitudes; subjective norms; intention to use; and actual use. The TPB is an extension of the TRA and deals with conditions where the individual has no control of their behaviour. This model is shown in Figure 3.

2.3 The Domestication Process

The domestication approach focuses on the process in which technology becomes an integral part of our everyday habits. Conceptual context distinctions are applied to new phenomena. Three important distinctions include work and leisure context; end-users that belong or do not belong to a demographic group; and the private and the public. This view is dominated by sociologist researchers and are often characterised by demographic variables such as age and gender. (Pedersen, 2003).

2.4 Other Adoption Factors

Further adoption factors identified by Kirby and Turner (cited by van Akkeren and Cavaye, 1999) include: ICT literacy of small business owner, lack of knowledge of derived ICT benefits, and dependence of the small customer on supplier. Other follow-up research by Julien and Raymond (cited by van Akkeren and Cavaye, 1999) identified three other factors that include: the organisation's structural sophistication; level of assertiveness, rationality and interaction in business decision processes; and the organisation's size, sector and status. Disappointingly, the model has its limitation with the exclusion of perception, attitude and design. Many different contributing factors have been identified by other researches which can be summarised in two main categories: owner/manager characteristics and business characteristics (van Akkeren and Cavaye, 1999, 1081)

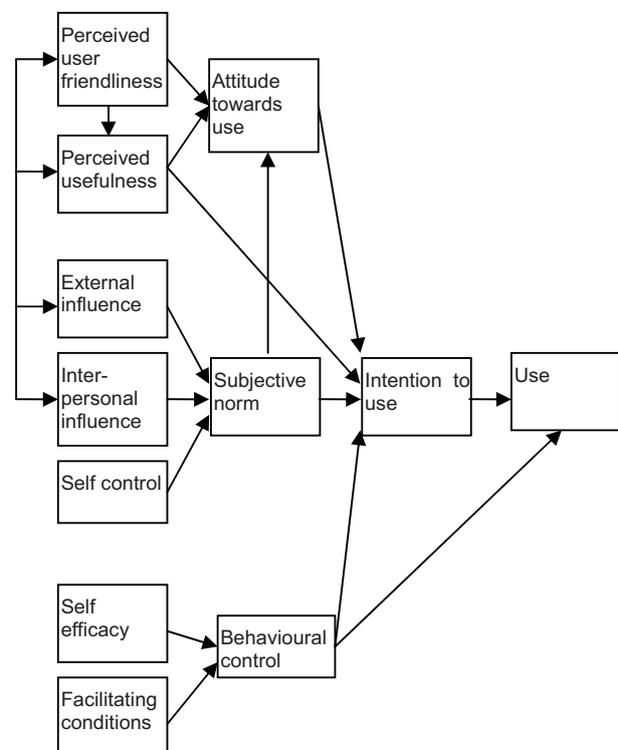


Figure 3: Decomposed TPB modified by domestication research findings

(Source: Pedersen, 2003.)

Figure 4 depicts a model with three components: owner/manager characteristics; return on investment (ROI); and firm/business characteristics for factors that contribute to ICT adoption. The owner/manager characteristics include their perceived benefits from ICT adoption; ICT literacy of the owner/manager; high level of assertiveness in terms of business decision processes, understanding the benefits of ICT in their business and able to rationalise the information; has perceived control over a requirement for opportunities and resources; not easily influenced by what other's say or do; mistrust of

ICT; and simply lack of time. The ROI for small businesses is critical for its short to medium-term survival, therefore any substantial investment for ICT needs to be justified (Van Akkeren and Harker, 2003, p206-208)

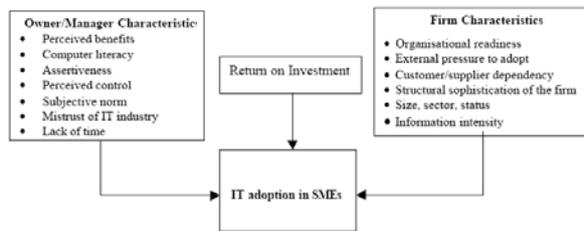


Figure 4: Factors affecting ICT adoption by SMEs

(Source: van Akkeren J. and Cavaye, A.L., 1999, p1081.)

The firm/business characteristics include: the organisation's ICT readiness; external pressure to adopt; customer/supplier dependency; structural sophistication of the business; size, sector and status; and its information intensity. The business's ICT readiness refers to its current level of technology use in its business processes. Little or no technology use reflects low ICT readiness and a strong reluctance for ICT adoption. External pressure may come from suppliers and/or customers for ICT adoption. Consequently, customer/supplier dependency may arise from the external pressure, whereby a small business tows the line to ensure its continuous survival. The structural sophistication of the firm/business refers to its ability to incorporate ICT into its existing business processes. A complex structure may encourage ICT adoption because ICT is perceived as a tool for making work easier, whereas a simple structure may not readily adopt ICT because of the perception that everything is working smoothly and there is no need to change it. The size, sector and status of a firm/business influence its ICT adoption. If competitors, suppliers, customers in a certain sector have adopted ICT, a firm/business is inclined to do so because are already in it. Finally, the level of information intensity within the firm/business can be a contributing factor for ICT adoption. For example, if a firm/business handles large amounts of information, it is most likely that ICT adoption will be undertaken to improve its efficiencies (Van Akkeren and Harker, 2003, p208).

Windrum and de Berranger (2002) view that contributing factors for ICT adoption can be categorised into five major clusters that include: the business characteristics; business action; system characteristic; internal expertise; and external expertise. Business characteristics such as size, determines the business structure that in turn strongly influence the business's ICT uptake. Small businesses have simple business structures when compared to larger businesses and have less internal requirements for extensive communication technologies. Small businesses communicate and store smaller volumes of information and as a result far lesser need to use ICT.

Typically, business action is driven from the top management. In this case, if the business owner or top management establishes appropriate ICT goals, identifies

critical ICT business needs, and allocates financial resources then ICT adoption is possible. For small businesses, age and the experience of the owner strongly influences ICT adoption. System characteristics within a business assist in ICT adoption. For instance, small businesses with a large number of administrative applications readily support management control, operational control and administration. In addition, access to ICT expertise within a business and externally is another contributing factors to ICT adoption. If the business owner or employees are ICT literate, there is a strong tendency to adopt ICT for business processes. In the event that they face difficulties, the availability of external expert will provide support and motivation to succeed (Windrum and de Berranger, 2002).

3 Stages of ICT Adoption

The main ICT adopted by Pasifika businesses include mobile phones, EFTPOS machines, personal computers and the Internet. It must be noted that most of the ICT adopted and used by Pasifika businesses in the Wellington region can be classified as "basic level ICT". Basic level in the sense that there was no recorded use of any sophisticated ICT integrated into their business processes. For example, the use of the fax machine to send a hand-written order form as opposed to a secure on-line order and payment forms at the supplier's website. Fifty eight percent (58%) indicated their use of Internet banking for conducting business transactions. However the research did not gather detailed information on the nature and frequency of the transactions. The fact that most Pasifika businesses are small sized and has been in existence for a few years may influence their ICT maturity.

Based on the research findings, a four-stage ICT adoption process has been proposed to classify Pasifika businesses' ICT adoption stages. They include:

- "No ICT adoption"
- "Basic ICT adoption"
- "Intermediate ICT adoption"
- "Advanced ICT adoption" stage.

In the "No ICT adoption" stage are Pasifika businesses that have not adopted any ICT other than the traditional landline phones or a simple cellular phone. The "Basic ICT adoption" stage includes Pasifika businesses that have adopted ICT such as the Internet for collecting information, use email, or use the latest cellular phones (such as the 3rd Generation, 3G) to send/receive emails and access the Internet. The "Intermediate ICT adoption" stage includes Pasifika businesses that have a basic/static website and that are engaged in electronic commerce while the "Advanced ICT adoption" stage include those that conduct business-to-business transactions electronically, business-to-customers transactions or have any complex ICT integration in their business processes. Table 1, below, summarises the four ICT adoption stages for Pasifika businesses.

Table 1: The four-stage ICT adoption classification scheme applied to Pasifika businesses

Stage	ICT adopted	Pasifika businesses
1. No ICT	None	-
2. Basic	Internet access	92%
	Email	89%
3. Intermediate	Basic website	47%
	Electronic payments (eg Internet banking)	58%
4. Advanced	Business-to-business transactions	-

4 Research Methodology

The methodology employed for this research was a mixed methods design. The mixed research approach involves the integrating of quantitative and qualitative methods in a single study (Rocco, Bliss, Gallagher and Perez-Prado, 2003, p19; Borkan, 2004; Creswell, Fetters and Ivankova, 2004). The choice for this approach was based on the premise that when quantitative and qualitative methods are used in combination a more complete analysis will be obtained since they complement each other (Morse, 2003, p195). The quantitative results are not relevant to this paper and only the qualitative phase involving a case study will be described. In this phase eight participants were interviewed in separate sessions. The participants were from the larger group involved in the quantitative phase and had volunteered to be interviewed. Three participants were in the retail business (dairy shop, Pacific arts, takeaway/fish and chips), and one each from the following areas: personal services, building, office cleaning contractor, IT consultant, landscaping contractor.

Notes were taken during the interview. The notes were validated by reading the written responses back to the participant and confirming that what had been written was what they had said.

Questions asked during the interviews were:

1. Which of the ICT do you use the most in your business?
2. Why is ICT important to your business?
3. Describe the impact of the ICT to your business before and after using the technology?
4. Which of the other ICT that are available (here/overseas) may be used in your business?
5. Why do you think other Pasifika businesses are not using ICT?

For participants with businesses that are not ICT adopters or are slow ICT adopters the following questions were asked:

1. Why is using ICT not encouraged in your business?
2. Are you aware of other businesses (similar to your business) that use ICT? If so, what can you learn from them?

5 Results

The interviews revealed that the most commonly used ICT in Pasifika businesses are telephones (landlines and mobiles), followed by EFTPOS machines, fax machines, personal computers and the Internet. Advanced technologies have enabled many additional features such as non-cash payments, cash withdrawals for customers, and the purchase of a selected range of products – such as the Vodafone Prepay cards.

The interviews also indicated that ICT had contributed positively in the daily business activities. A participant revealed that with the fax machine, new business opportunities have also been identified. Another participant was able to receive business calls anywhere on the mobile phone and not worry about missed calls as in the past. This view was shared by another participant. A fourth was able to check prices of materials for preparing quotations through the internet. The ability for ICT to support or complement work flow has made work much easier for the fifth participant who used a digital camera to take photos which are then downloaded to a computer for preparing quotations. Similar sentiments were shared by another participant who contacted suppliers and customers by email and found that it costs much less when compared to using the telephone costs. The sixth participant said that the use of ICT in his business was a necessity, adding that without it his business would not exist. The last participant stated that the ICT they used daily are the telephones (landline and mobile) and the EFTPOS machine. He also said the the new EFTPOS machine is very useful and kept customers happy because they did not have to use cash to buy food.

The impact of ICT to Pasifika businesses that participated in this research was wide spread. One participant accepted that ICT is the way forward and that they need to be aware of the impacts of ICT even though it may be good or bad. Another stated that they were very switched on to the use of new communication gadgets and that they help promote their services. Another participant was aware of overseas trends in her line of business and it's slow emergence in New Zealand. Another participant viewed ICT as an enabler which allowed him to attend to a client even if he is out at a job site. A website provided another participant with orders from overseas buyers and created new markets. The sixth participant highlighted the cost effectiveness of ICT to his business and added that the convenience of paying some of his bills over the Internet meant that he does not have to waste time standing in a queue at the bank.

On the negative impact of ICT, one of the participants stated that the bigger supermarkets have access to

advanced technologies that enabled them to drive prices down causing smaller operators like him to lose customers. However, two of the participants could not see any negative impact. A third participant had reservations for ICT because of the possibility of problems and failures. Another participant stressed the need to know its limitations to have backup plans. A different participant was uneasy about theft of credit card numbers over the Internet even though that has not happened to her. The problems connected with computer crashes was mentioned by another participant. The last participant felt that ICT was too complicated and cost too much.

All participants seemed to be aware of the dynamic and rapid changes that ICT has caused in their industry. For example, three of the participants who are in the retail industry revealed their apprehension of on-line trading and hoped that they will survive it. Another participant boasted that web-cams are a success with their kind of business overseas and that he believed that it will be great when it gets here. Three of the participants could not identify specific ICT that are new to their line of business. However, one participant emphasised the need to be innovative in the use of ICT as opposed to following what others are doing.

6 Characteristics of Pasifika ICT adopters

ICT uptake by Pasifika businesses in the Wellington region as discovered in this research, is varied and depends on the individuals who own or manage the business. The personal experiences, backgrounds and attitudes of the Pasifika peoples who own and manage the business influence the ICT adoption in their business. There existed two main groups comprising of “intermediate ICT adopter” and “basic ICT adopter”. Based on their ability to use ICT and their confidence in adopting new ICT, the “intermediate adopters” have adopted ICT and were immersed in the use of ICT while the “basic adopters” were still “ICT-shy”. These groups are shown in Table 1.

7 Discussion

Of the three approaches to understanding ICT adoption, only the diffusion approach is suitable for rationalising the uptake among Pasifika businesses. The TAM model in the adoption approach has elements that are similar to the diffusion model but is less comprehensive. The TRA model includes more concepts but is still less comprehensive. The TPB deals with the situation where an individual has no control of his or her behaviour. This is hardly a characteristic of the participants in this research. The domestication process deals with the situation where technology has become an integral part of daily activities. This is also not the case with the Pasifika businesses studied. The rest of this discussion will focus on the diffusion approach.

Rogers’ (1995) diffusion of innovation model is used to understand the adoption of ICT by Pasifika businesses in the Wellington region. The four elements of the diffusion theory include: the innovation, communication channels, time and the social system. In this case, ICT is the

innovation that is perceived as new by Pasifika businesses. Rogers (1995) emphasised that the rate of adoption is dependent upon five characteristics of the innovation. These include its relative advantage to existing technologies or practices; compatible with the current environment; easy to use; can be trialled and can be observed prior to adoption.

The research findings confirm some of the characteristics stated above. For example, the adoption of a new fax machine and EFTPOS was immediate because the participants immediately saw its relative advantage. The new ICT compatibility within the retail business environment further ensured its acceptance and use. The participants indicated that at first the new ICT were not easy to use. However over time and through frequent use they eventually gained confidence and were able to overcome their initial fears. In both cases, the participants trialled and observed the ICT with the supervision and guidance of the technicians who supplied the equipment.

Communication channels include interpersonal channels where an individual adopts an innovation through the influence of others in their social networks or through mass media channels such as the newspaper, radio or television. This research found that ICT adoption by Pasifika businesses was mainly through the interpersonal channel. The impact of ICT adoption promoted through the mass media is minimal and this needs to be explored to ensure the wider and faster adoption of ICT by Pasifika businesses. There are newspapers and radio programmes (Wellington Access Radio) in the Pasifika peoples’ ethnic languages such as Samoan, Tongan and Cook Islands that can be used to promote ICT. The use of Pasifika peoples’ first language will help overcome the communication problem that has been inherent with the use of the English language.

In addition, Rogers (1995) highlighted the need to recognise one of the most distinct problems with diffusion where the messenger is likely to be someone who the target audience find difficult to identify with. Characteristics such as beliefs, cultural values, education levels, living in the same neighbourhood, working in the same workplace or sharing the same interests are some of things that influence the decision making process of Pasifika peoples.

A participant revealed that she learnt from another member of her church that the Internet is not “a good thing to have because anyone can access pornography from it”. As a result she was sceptical about using the Internet until another member of her church explained to her that the Internet is similar to having a television and video player. Anyone can view a videotape of whatever content they choose on the same television and video player. Similarly, the Internet enables anyone to access all sorts of information and at the same time there are ways, such as the use of computer programs, to block those undesirable websites. As the participant trusts members of her church, she readily accepted their advice on matters that were unfamiliar to her.

The diffusion of innovation includes time as an essential element of the theory. Time starts with the innovation’s

antecedents, its process, and ends with its consequences. The antecedents include the receiver's personal and social characteristics, perceived need for the innovation, the social system practices that they adhere to, their willingness to change, and the communication integration within their social system. There are three time factors namely: the innovation-decision process, relative time required for the adoption of the innovation, and the innovation's rate of adoption. For Pasifika businesses, the timeframe for the diffusion of innovation may take more time and occur at a slower rate.

Rogers (1995) offers five stages for the innovation-decision process. This begins with knowledge of the innovation, followed by the formation of an attitude about the innovation, and then the decision to adopt or reject. If the decision to adopt is chosen then implementation of the innovation occurs, and finally the confirmation of the decision. The interview participants who represented Pasifika businesses can be grouped based on where they are at in the innovation-decision process.

For one of the participants, the five stages mentioned above have been observed in the adoption of the new fax and EFTPOS machines. Prior conditions or antecedents as mentioned above have supported the ICT adoption. For the second participant, the adoption of the latest mobile phones with photo capability has been easy. The five stages of the innovation-decision process have been easily achieved and antecedents have supported the adoption. The same can be seen for five other participants. For a different participant, prior condition has affected the innovation-decision process. The perception that ICT equipment such as the personal computer and the Internet with the exception of the mobile phone has no effect on his current business needs has led to the rejection of the innovation.

Lastly the social system that surrounds Pasifika businesses plays an influential role in the diffusion of innovation. Five aspects of the social system that is involved in the diffusion process include: the social structure, social system norms, opinion leaders and change agents, types of innovation decisions, and consequences of innovations. The social structure of most Pasifika peoples are communal-based and may affect the aspirations of those in business. Cultural values, obligations and expectations have been identified as obstacles for Pasifika businesses (Pacific Business Trust, 2003b). However, there is a shift towards a nuclear oriented social structure. This research did not pursue the impact of culture on ICT adoption and it may be an area that is worthwhile researching.

Opinion leaders who are ICT literate and can influence Pasifika businesses to adopt ICT. They can be Pasifika people themselves, or friends of Pasifika peoples who can explain the advantages and disadvantages of ICT equipment. In the Pasifika social structures, elders, traditional chiefs and church pastors are influential leaders who can be instrumental in influencing ICT adoption by Pasifika peoples. Change agents and gatekeepers can be the government departments, such as the Ministry of Pacific Island Affairs, or agents such as the Pacific Business Trust, who deliberately set out to

promote ICT adoption to Pasifika businesses by offering unbiased advice on the need to adopt ICT and how to go about doing it.

8 Conclusion

The factors that support ICT uptake by Pasifika businesses are of three types:

- ICT skills
- Support
- Social networks.

The business owners need to have a sufficiently high level of ICT skills. The high internet and email usage of the Pasifika peoples indicates that some ICT skills do exist.

In order to adopt ICT, Pasifika business owners need access to ICT support from family, friends or suppliers. The availability of informal ICT training is also an important factor.

Social networks have an important role to play in assisting Pasifika businesses to adopt ICT. The availability of Pasifika ICT champions need to be widely publicised. The creation of cyber-clusters for Pasifika businesses would also help.

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