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Determinants of Information Technology Adoption among Malaysian Farm-based Enterprises

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ABSTRACT

Information technologies (ITs) have been employed in various fields of human endeavour especially to engender socio-economic development. One key sub-sector in which the adoption of ITs is increasingly becoming critical in Malaysia is the farm-based (agri-based) enterprises. However, previous studies have suggested that a number of factors influences the adoption of ICT by enterprises, especially small and medium firms. This study was prompted by the need to determine the factors that influence the adoption of IT among farm-based enterprises. A pre-test study was conducted with 50 IT-using entrepreneurs selected from five farm-based firms that were selected using systematic random sampling from a population of 500 farm-based entrepreneurs (selected from 50 farm-based firms) in Selangor, Malaysia. The study applied modified Entrepreneurial Event Model (EEM) theory with System Support and Readiness and Perceived Benefits as independent variables, while IT Adoption was the dependent variable. The data was collected using a structured questionnaire and analysed using descriptive statistics and factor analyses. The findings revealed that System support and readiness and Perceived benefits are the critical factors that determine IT adoption and that most of the enterprises (M = 3.81, SD = 1.00) adopted basic entrepreneurial ITs while a number of them (M = 3.68, SD = 1.23) adopted advanced entrepreneurial ITs. The limitations of the study include the size of the sample. Recommendations for effective application of IT into practical usage for farm-based enterprises development were included.

Keywords: Determinants of IT adoption, farm-based enterprises, information technologies (IT), IT and farm-based enterprises development

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INTRODUCTION

Entrepreneurial ability is a wide term that refers to the ability of individuals to 'perceive,' and 'exploit', business opportunities (Urbig et al., 2012; Ngah et al.,2016). Entrepreneurial perception deals with alertness, imagination as well as experience and knowledge of the market (Urbig, et al. 2012; Martiarena, 2013; Edwards-Schachter et al., 2015). Entrepreneurial perception is also heightened by greater access to information and an ability to analyse information. This may highlight the role IT adoption can play in small and medium-scale enterprises (SMEs), especially farm-based SMEs. Therefore, business contacts and entrepreneurial skills, or education could become important attributes (Iglesias-Sanchez et al., 2016).

The ability to exploit profit opportunities is influenced by many of the same forms of human capital. In general, one would expect an individual with greater business contacts, or networks, work experience, education, knowledge of the entrepreneurial market and business practice to be more productive (Ngugi et al., 2012). The extent to which an individual is motivated (Mazzel et al., 2016) should also influence performance (Gleinik et al., 2014; Ngah et al., 2016). Ngah et al. (2016) also reconsidered the role of non-pecuniary motivation as a determinant of the performance of the entrepreneur. Non-pecuniary motivation can include factors such as the desire to be independent (one-person business), specific non-profit objectives for the organisation (for example, to benefit the environment or help others) and enjoyment of the work involved in the enterprise (e.g. working in a particular business sector, being creative, securing a specific form of recognition or notoriety, etc.).

The traditional view in small and medium-scale entrepreneurial or self-employment studies (Arend, 2014; Etemad & Keen, 2014) is that non-pecuniary motives may reduce conventional success in terms of wealth creation (Ngah et al., 2016). However, when one considers the role of effort, specifically, disutility from entrepreneurial effort (Ngah et al., 2016) in determining entrepreneurial performance, another possibility emerges.

An entrepreneur who is highly motivated by non-profit objectives involving job satisfaction may have low disutility of effort and, as a result, may exert greater (entrepreneurial) effort in the business venture (Ngugi, et al., 2012). The self-employed individual's efforts thus may have the consequence of boosting the firm's financial performance. If, however, an entrepreneur has high non-pecuniary motivation for 'unprofitable' self-employed activity, he/she confronts a trade-off; and presumably, will choose an optimal mix of profit and non-pecuniary satisfaction (Sonawane, 2014).

FARM-BASED ENTERPRISES AND IT ADOPTION

The adoption of information technologies (ITs) to boost small and medium-scale businesses, improve the socio-economic status of people and improve the gross domestic products (GDP) of nations is

progressively being demonstrated by research and upheld by development communication and IT intellectuals. Hence, applying IT to farm-based businesses for entrepreneurial development is seen as an interesting area of research (Sonawane, 2014). Moreover, many case studies have indicated that as a toll, IT can have very reliable potentials to boost farm-based SMEs and bring about positive improvements in people's standard of living (Moghaddam & Khatoon-Abadi, 2013).

Previous studies have found a myriad of factors that influence IT Adoption by farm-based enterprises. Venkatesh et al. (2003) found that performance expectations, effort expectations, social influence and facilitating conditions influence IT adoption. In addition to these four factors, Venkatesh, Thong and Xu (2012) found that hedonic motivation, price value and (IT usage) habit affect IT adoption. In addition, management strategy, management creativity and firms' size (population of employees and capital-base) have also been linked with IT adoption by firms (Idota et al., 2014). While Davis et al. (1989) found that perceived benefits and perceived usefulness influence IT adoption.

Most farm-based SMEs in Malaysia have adopted IT in their businesses. However, the level of (advanced) IT adoption by a majority of them is found to be low (Nawi & Luen, 2014), and moderately low (Ramli et al., 2015). Moreover, the Malaysian Communication and Multimedia Commission (MCMC) (2013) survey shows that in 2011, the household broadband penetration rate had reached 62.3% of homes and other buildings in the country. The mobile phone penetration rate was 127.7%, which indicates that that Malaysians have multiple subscriptions on cellular phone plans. In 2013, Malaysia was ranked 30th in terms of network readiness and usage (MCMC 2013), was the highest ranking among developing countries in the world, and it is seen as having a relatively high level of IT infrastructure development (MCMC, 2013).

However, results of a study by Ismail, Nawi, Kamarulzaman and Abdullah (2014) support the findings of Nawi and Luen (2014), that the usage of advanced entrepreneurial IT by small and medium-scale enterprises (SMEs) was low, where three-quarters (73%) of SMEs did not use advanced IT in their businesses. Whereas, Ismail et al. (2014) found that many (67%) SMEs used the Internet in their businesses, with only 12% of them having their own websites. The adoption of Internet and mobile phones in business has been categorised as basic (low) (Ramayah et al., 2016), while website is categorised as advanced (Saleh & Burgess, 2009) and moderately advanced (Ramayah et al., 2016).

Ismail et al. (2011) argued that this phenomenon affects most of the SMEs in the country, stressing that the phenomenon is even more prevalent among SMEs in urban areas like Kuala Lumpur. Furthermore, Ismail et al.'s (2011) findings highlight the level of adoption of advanced entrepreneurial ITs such as e-commerce, entrepreneurial resource planning software and websites by most SMEs, whereas Nawi

and Luen's (2014) results stress the adoption of non-advanced ITs such as mobile phones, telephones and personal computers by most SMEs in the country.

OBJECTIVES OF THE STUDY

Organisations and individuals have distinctive expectations of IT adoption, which may either permit or limit change, innovation and performance (Fink & Disterer, 2006). Therefore, it is important to investigate whether these factors affect organisational adoption of technology by farm-based enterprises. This study investigated the farm-based firms' IT adoption behaviour using the Entrepreneurial Event Model (EEM), which was developed by Shapero and Skolo (1982). The scholars suggest that desirability, feasibility and propensity to act are the critical factors that affect individual's intention to start an enterprise. They identified entrepreneurial intentions (EI) as the expected entrepreneurial behaviour of the entrepreneurs, which is the dependent variable of the model.

The need to deepen empirical investigation into those phenomena and contribute more knowledge to the literature (by focusing on enterprises rather than employees that many of the above-cited literature adopted) prompted this study. The study was conducted with the aim of achieving two specific objectives: to identify the entrepreneurial IT adoption indices among the farm-based enterprises and to determine the critical factors that affect IT adoption by the enterprises.

MATERIAL AND METHODS

The 50 respondents in this study were selected using systematic random sampling from 500 farm-based entrepreneurs in Selangor. The Small and Medium-scale Enterprises Corporation (SMECORP) of Malaysia and the SME Bank of Malaysia provided the lists of the SMEs. The sample was drawn in-line with the suggestion in the literature that for a pre-test study, 10% of the population suffices (Babbie 2007; Levy & Lemeshow 2013). Hence, 50 farm-based entrepreneurs were selected from a table of samples that was drawn, where all the 500 entrepreneurs were listed serially, by assigning numbers from 1 to 500. The sample fraction was calculated using this formula (see Babbie, 2007; Levy & Lemeshow, 2013).

Sampling fraction

$$= \frac{n}{N} = \frac{50}{500} = \frac{1}{10} \textit{ (i.e., 1 in 10)}$$

where n = Sample size,
N = Population

Therefore, one farm-based entrepreneur from every 10 enterprises was selected from the population. The first enterprise was selected using the online sampling software, Randomizer, which automatically selected 007 (i.e., 7). Since this number fits between one and 10, the first enterprise that was selected was the seventh on the list. Since the researcher needed to select 10 enterprises from the list, the seventh enterprise therefore was used as the starting point and then every 10th enterprise was selected from this point.

To obtain the primary data, a 30-item structured survey questionnaire was administered face-to-face with the respondents at their premises after approval was obtained from the organisation's administrators. The Chronbach alpha scores of the pre-tested scale (before performing factor analysis) ranged from 0.75 to 0.90, indicating high internal consistency (see Hair et al., 2010) of the scale.

Since this study focused on enterprises (organisations), the questionnaire was administered to the managers/chief executive officers (CEOs) of the sampled organisations. Descriptive analysis was used to interpret the data in terms of frequency distributions and percentages while factor analysis was used to determine the most important items that determined the adoption of IT among the farm-based enterprises. Moreover, in this study, the Eigenvalue of the factors that loaded strongly in the factor analysis was used to indicate the ability of those factors to predict IT adoption. The further analysis of the factor-analysed data will be performed in the main study, in future research.

Since this study focused on determining factors that influence IT adoption and identifying the entrepreneurial IT adoption indices among farm-based entrepreneurs, the Entrepreneurial Event Model (EEM) (Shapero & Sokol 1982) was modified and adopted. The model's three key predictors (independent variables): Perceived Desirability (PD), Perceived Propensity (PP) and Perceived Feasibility (PF) were replaced with Perceived Benefits (PB), System Support and Readiness (SSR) and Perceived Usefulness (PU) respectively. The PB and PU constructs were adapted from the Technology Acceptance Model (TAM), developed by Davis et al. (1989) while the SSR construct was derived from the work of Shapero and Sokol (1982).

Furthermore, the dependent variable, Entrepreneurial Intention (EI), was modified and replaced with IT Adoption (IA), which was derived from the work of Venkatesh et al. (2003). As used in this study, IT adoption refers to the actual usage of a particular entrepreneurial technology (system) in business by a farm-based enterprise for entrepreneurial development (Higon, 2011; Saleh & Burgess, 2009). The use of a personal computer to make up a grocery sales invoice and the use of a website to place an order for raw beef and cows milk from a Dutch farm in Holland are good examples of IT use in agribusiness.

RESULTS

The findings show that most of the enterprises fell under the individual or partnership-owned companies category, and they accounted for 50% (n = 25) of the respondents. Family-owned enterprises accounted for 32% (n = 16) while group-owned companies accounted for 18% (n = 9) of the SMEs. Most (66%, n = 33) of the enterprises had been established for more than nine years, 28% (n = 14) had been doing business for five to nine years, while only 6% (n = 3) of the enterprises had been doing business for less than five years. Nearly half (48%, n = 24) of the enterprises

belonged in the crop-based category while most 32% (n = 16) of them were food-based. Furthermore, most (62%, n = 31) of the enterprises were within the annual sales turnover range of RM250,000 (USD58,775) to RM10 million (USD2,351,000), while 24% (n = 12) of them had a turnover of RM10 million (USD2,351,000) to RM25 million (USD5,877,500). Whereas only 8% (n = 4) of the enterprises earned above RM25 million annually, fewer (6%, n = 3) of them earned an annual turnover of less than RM250, 000[1] (USD58, 775[2]).

Many (48%, n = 24) of the enterprises had between five and 50 employees. Those that had 51 to 150 employees were 38% (n = 19), while those that had more than 150 employees were only 8% (n = 4). Only 6% (n = 3) of the enterprises had less than five employees.

Table 1 shows the survey items that were used to identify the indices of IT adoption by the respondents. The mean and standard deviation analyses of each item is clearly outlined, which was obtained after running a descriptive analysis of the data based on a five-point Likert scale. This scale was adopted so that the higher the mean value of an item for a particular IT adoption index, the higher its adoption rate; and that identifies the particular category (basic or advanced) of entrepreneurial ITs that the entrepreneurs adopted mostly.

[1] RM = Malaysian currency (the Ringgit Malaysia)

[2] USD = United States Dollar (All values reflected in US Dollar are estimated equivalents of the sum in the Ringgit Malaysia, which depends on existing exchange rates.

Table1 shows that the cumulative mean value (M = 4.29, SD = 0.99) of IT adoption index number one achieved by the enterprises (which represents the basic and essential functions of IT adoption) was very high. Similarly, IT Adoption Index number two (which is single departmental IT usage) recorded a very high cumulative mean value (M = 4.04, SD = 0.99), suggesting that the achievement of IT adoption index number two by the enterprises was good; although it was slightly lower than IT Adoption Index number one. IT adoption index number three, (which represents cross-department/ multi-department IT integration) recorded a high cumulative mean value (M = 3.10, SD = 1.04). Similarly, the achievement of IT adoption indices numbers four and five (enterprise integration process (EIP) and IT for B2B collaborative commerce) by the farm-based SMEs scored high cumulative mean values (M = 3.59, SD = 1.32) and (M = 3.77, SD = 1.14) respectively. Generally however, the overall cumulative mean value of the IT Adoption Indices (M = 3.69, SD = 1.12) was high.

Factor analysis of the data revealed two main determinants (factors) that influence the adoption of IT among the selected farm-based enterprises, namely, 'System Support' and 'Readiness and Perceived Benefits'. Each factor was reduced to five items. Under the System support construct, five items loaded below the cut-off point of 0.50 while under the Readiness and perceived benefits construct, 10 items loaded poorly and (all) were therefore, eliminated from further analysis, as suggested by Hair, et al. (2010). In addition, the perceived usefulness

construct had five items, and all of them loaded weakly (below the 0.50 cut-off mark), hence the construct was eliminated from further analysis. Collectively however, both factors could account for 70.670% of the variation in IT adoption/usage as shown in Table 2.

The first factor, System Support and Readiness consists of five items, and this factor emerged as the leading determinant of IT adoption among the farm-based enterprises. This factor accounted for 37.535 of the variance. The item "In my enterprise, IT department provides IT system support"

Table 1
Indices of IT Adoption among Farm-based Enterprises (n = 50)

S/No	IT Adoption Index	Item	Mean	SD
1	*Essential Function	Computers in my enterprise are equipped with basic software such as Microsoft Office.	4.34	0.95
		In my enterprise, IT tools are used for their basic functions.	4.29	1.05
		Computers in my enterprise are used to archive basic documentation.	4.23	0.96
Cumulative Mean			4.29	0.99
2	*Single Department	In my enterprise, there are computer-based information systems for one type of operation process (e.g., personnel management system and accounting information system).	4.04	0.98
Cumulative Mean			4.04	0.99
3	*Cross Department/ Multi Processes Integration	In my enterprise, Intranet is used for flow of information across several departments.	3.97	1.14
		In my enterprise, other IT tools are used to improve internal communication across departments.	3.89	0.99
Cumulative Mean			3.10	1.04
4	**Enterprise Integration Process (EIP)	In my enterprise, enterprise resource planning software (ERP) is used to support organisation-wide business activities.	3.65	1.28
		In my enterprise, customer relation management software is used to manage interaction with current and future customers.	3.53	1.36
Cumulative Mean			3.59	1.32
5	**B2B Integration / Collaborative Commerce	In my enterprise, system that has inter-firm links with other collaborative manufacturers, designer, suppliers and customers are used.	3.89	0.99
		In my enterprise, inter-organisational system (IOS) has been used to conduct Inter-firm communication and transactions.	3.65	1.28
Cumulative Mean			3.77	1.14
Overall Cumulative Mean			3.69	1.12

Note: B2B: Business to business; n = Sample size; * Basic IT; ** Advanced IT

recorded the highest factor loading value of 0.913. It was followed by "In my enterprise, there are adequate skilled IT personnel to solve IT-related problems", which had a factor loading value of 0.875. The next item was "In my enterprise, the top management provides support for IT usage in business activities".

Furthermore, "In my enterprise, there are adequate skilled IT personnel to solve IT-related problems" recorded a factor loading of 0.743. This was followed by "In my enterprise, the top management provides support for IT usage in business activities", which recorded a factor loading of value of 0.739. That item was followed by "My organisation has enough human capital for IT adoption" that recorded a factor loading value of 0.739. Importantly furthermore, IT system support and organisational IT adoption readiness was the factor that this study discovered to have influenced IT adoption among the farm-based enterprises to a greater degree.

Perceived benefits of IT adoption in running a farm-based enterprise was the second factor that affected the adoption of IT by the selected farm-based enterprises and, similarly, the construct loaded five items. The loading of the items arranged in descending order is as follows: "IT enhances my enterprise's access to market information

Table 2
Factors Affecting IT Adoption among Farm-based Enterprises

Items	Component 1	Component 2
System support and Readiness		
In my enterprise, IT department provide IT system support.	0.913	
In my enterprise, employees have the required skills/knowledge to use IT in their work.	0.875	
In my enterprise, there are adequate skilled IT personnel to solve IT-related problems.	0.743	
In my enterprise, the top management provides support for IT usage in business activities.	0.739	
My organisation has enough human capital for IT adoption.	0.739	
Perceived Benefits		
IT enhances my enterprise's access to market information and knowledge.		0.862
I believe IT can ease communication constraints.		0.814
IT helps to facilitate new ways of managing and enterprise's business.		0.717
IT enables my enterprise to increase speed and reliability of business services and production.		0.685
IT makes it easier to coordinate communication between firms/ business partners.		0.641
Eigen values	7.925	1.583
Percentage of total variance	37.525	33.145
Cumulative variance	37.525	70.670
Cronbach's alpha	0.903	0.854

and knowledge" recorded a factor loading value of 0.862. That was followed by "I believe IT can ease communication constraints", which recorded a factor loading of value of 0.814. "IT helps to facilitate new ways of managing an enterprise's business" which recorded a factor loading value of 0.717 factor loading. The next item, which scored a factor loading value of 0.685, was "IT enables my enterprise to increase speed and reliability of business services and production". Lastly, "IT makes it easier to coordinate communication between firms/ business partners" recorded a factor loading value of 0.641.

The internal consistency reliability (Cronbach alpha coefficient) of the factors, which ranged between 0.8 and 0.9, was very high. This indicates that there was high internal consistency among the items that predicted IT adoption (as indicated in the factor analysis matrix in Table 2).

DISCUSSION

Considering the trend of the mean scores, the mean values of items for each of the indices of IT usage by the farm-based enterprises are decreasing progressively from the top to the bottom of the table (as shown in Table 1), especially from IT Adoption Index number one to number three. This suggests that the use of ITs for basic operations in the organisations was progressively becoming low, giving a prelude about the readiness of the firms to use ITs in higher business operations. Then, suddenly, the mean values of the two advanced IT indices (numbers four and five) rose slightly, signalling a new shift in the category as well as operations of ITs being used by the firms, from predominantly basic to moderately advanced technologies.

The farm-based enterprises achieved the medium category of IT adoption index (IT adoption index number three), which is the usage of IT as information-sharing tools across several departments within an enterprise, with a high mean score (M= 3.10, SD = 1.04). Interestingly, however, the enterprises had managed to achieve IT Adoption Indices numbers four and five, which are grouped under advanced ITs in this study, with slightly higher mean scores (M = 3.59, SD = 1.32) and (M = 3.77, SD = 1.14) respectively. Although the result indicates that the enterprises had ventured into the adoption of moderately higher technologies slightly, the most frequently used entrepreneurial ITs by the farm-based enterprises belonged to the basic entrepreneurial IT category such mobile phone, e-mail and document processing. This can be understood better when the total cumulative mean score (M = 3.81, SD = 1.00) of the basic ITs (which was higher) was compared with that of the advanced ITs (M = 3.68, SD = 1.23). Hence, IT is yet to become a source of competitive advantage to a majority of the farm-based enterprises in Selangor since most of them rarely used advanced ITs such as e-commerce, enterprise resource management (ERP) and customer relationship management (CRM) applications in their businesses. Most of them did not have the capital, required skills and knowledge to adopt advanced ITs

in their businesses. Collectively, however, the overall mean value of the IT Adoption Indices as achieved by the enterprises was also high (M = 3.69, SD = 1.12) as shown in Table 1.

Furthermore, the results of the study indicate that the farm-based enterprises were unable to adopt advance IT due to the lack of skilled employees. However, most of the enterprises had realised that IT is capable of enhancing speed and reliability in business as well as easing communication constraints between them and their business partners and employees. In addition, they had realised that IT could enhance their access to market information and knowledge. Therefore, in order to boost farm-based enterprises in the Malaysian market and food security, more effort needs to be made towards providing them easier and cheaper access to advanced and latest ITs such as e-commerce, free and open-source software (FOSS) and cloud technology, IT usage skills (e.g., through training) and provision of soft loans.

CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS

The Malaysian farm-based sector is facing many challenges, which include adoption of advanced entrepreneurial ITs, capital and IT usage skills. However, those challenges could be overcome with successful IT adoption. The challenges include the need to increase food production in order to feed the growing population in a situation where natural resources are depleting. However, the role of IT to enhance food security is increasingly being recognised. For example, the World Summit on the Information Society (WSIS) 2003-2005, endorsed the role of IT in food security.

The adoption of IT in agriculture could alleviate some of the major problems faced by agro-based enterprises. IT plays an increasing role as an enabler of change and transformation especially in the farm-based sector, for instance production/processing of improved seed varieties, farm produce processing, storage and marketing. The potential of ITs in ensuring food production and food security is limitless. In addition, ITs have been identified as having the potential of being used as a tool for risk management by farm-based entrepreneurs. In short, IT adoption in farm-based enterprises could enhance food security (Higon, 2011) by increasing the rates and reducing the production/processing duration of agro-food and other farm-based produces, which could ensure adequate food supply during unforeseen natural disasters, for instance.

This study concludes that the of IT system support and system readiness in addition to perceived benefits will continue to influence IT adoption for business purposes among farm-based enterprises in the country. Furthermore, most farm-based SMEs in the country have not been able to adopt advanced entrepreneurial ITs in their businesses due to financial constraint, lack of skilled labour and risks associated with system crash, cyber security, and entrepreneurial sustainability. However, this study outlines three key implications of these outcomes. Most of the enterprises will continue to be reluctant to adopt advanced

ITs in their businesses so long as one or all of the following persist:

i. if the (long-run) perceived benefits of adopting advanced ITs remained elusive due to capital and operational risks that loom over the market;

ii. if IT systems support and readiness software with their related accessories are exorbitant to procure, install, service and maintain; and

iii. the indices of IT adoption by the enterprises will continue to remain basic if the farm-based sub-sector is left to be dominated by semi-literate and semi-skilled labour and if most of the farm-based enterprises continued to deal in semi-processed or unprocessed, direct consumables (rather than processed/ manufactured products).

Therefore, this study recommends that the government should firstly develop pro-active entrepreneurial IT policy that is capable of turning around the agricultural (farm-based) sub-sector and secondly, declare a state of emergency in the sub-sector in order to bring a comprehensive and lasting solution to the myriad of challenges that face it.

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