Information Technology and Business Performance: A Case Study on Small Food Processing Firms

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ABSTRACT

Small and medium enterprise (SME), including small food processing firm (SFF), based on its unit numbers and the number of involved labors, has the potentials to play an important role in the Indonesia's economy. However, its contribution to the national economy (i.e., GDP) has been minimal as to compare with its unit numbers and number involved labor. This indicates that improvement of SME's productivity is required. Information technology, especially internet technology, application within SMEs is regarded to have significant impact on their business performance. This study is intended to investigate factors that affect internet adoption and the impact of internet adoption on business performance within small food processing firm operators. Modified Supply Process Model, 100 SFF operators—from which primary data were collected, and path analysis were used in this study. It was found that internet adoption was significantly affected by perceived usefulness, perceived ease of use, internet self efficacy, and internet anxiety. Firms' business performance, however, was not significantly affected by internet adoption..

KEYWORDS: Internet technology adoption, small food processing firm, firm performance, perceived ease of use, perceived usefulness, internet self efficacy, internet anxiety.

1. INTRODUCTION:

As reported by the *Ministry of Cooperatives and Small and Medium Enterprises* (CSME) in 2004 the number of small business was 43,158,468 units (99.85% of total businesses) involving 70,919,385 workers (89.24% of total workers in industry sector). However, its contributions to the nation's Gross Domestic Product (GDP) and export values has been minimal as to compare with its number of business units and workers involved. Contributions of small, medium, and large enterprises to GDP were, respectively, IDR820,491,528 millions (40.36%), IDR315,372,815 millions (15.51%), and IDR896,960,557 millions (44.12%). Small enterprises' contribution to export values was IDR23,775,942 million (4.05%) which is smaller than those of medium enterprises (IDR67,904,169 million or 11.57%) and large enterprises (IDR495,173,009 million or 84.38 %).

The role of information technology in improving small businesses' contribution to the nation's economy is of importance. However, the use of information technology in Indonesia has generally been lower than those of most countries. Availability of information technology infrastructure, number of unit of

computers owned by enterprises, and internet access indicate this. As reported by the World Bank (2002), Indonesia's profile in information and communication technology (ICT) application was as follows: ratios of computer to population were 9.9 per 1,000 residents; telephone connection was 91 per 1,000 residents; internet hosts was 0.8 per 10,000 residents; and internet users was 2 millions. Investment in ICT, meanwhile, was USD3.54 billion (2.2% of GDP) which is equivalent to USD16.6 per capita.

A number of weaknesses of small businesses operators in Indonesia have been identified. The most significant weaknesses, according to the Department of Trade and Industry (2002), include lack in (i) aggressiveness and capability in accessing market, and (ii) use of information technology in developing small businesses. In relation to these weaknesses, encouraging small business operators and/or owners to utilize information technology to support their business is relatively difficult. There are three main problems in encouraging small business operators to use information technology. These include perception that information technology is expensive and, therefore, it could not be afforded by small business operators; limited technological resources and lack in information technology infrastructure; and both quantity and quality of human resources.

The profound research on the information technology in the small-scale is important to analyze the aspects of information technology application in Indonesia, particularly to identify how far the above problems become the determining factors in the application of information technology and what are their implications towards the performance of small businesses in Indonesia. The success of information technology application brings a wide range of dimensions which cover the parameters used to measure the effectiveness of the information technology functions and also parties or groups utilizing the applications of information technology. To the small-scale businesses, the major party that dominantly concerns with the decision making is the owner and the executives. They embrace important roles in the decision making which utilizing information technology in their companies. Besides, their involvement in the process of technology adoption holds important factors in improving the intensity of the use of information technology.

2. THEORETICAL BACKGROUND

A number of behavioral theories have been applied to examine the process of information technology adoption by end-users. Some of which are *Theory of Reason Action (TRA), Theory of Planned Behavior (TOB), Task-Technology Fit Theory (TTF),* and *Technology Acceptance Model (TAM).* Amongst these theories, Technology *Acceptance Model* (TAM) was found as a model that has been widely used in various studies on adoption process of information technology. Following these models, in 2003, Venkantesh and his colleagues developed a new model called *Unified Theory of Acceptance and Use of Technology (UTAUT).*

This model (i.e., UTAUT) was developed based on previous models on adoption of information technology, which include TRA, *TPB, TTF*, and primarily *Technology Acceptance Model* (TAM). TAM model, which initially developed by Davis in 1986, is an adaption from TRA which was specifically developed for modeling of user adoption of information systems. According to Davis (1989), the primary objective of TAM was to provide fundamentals for investigating impacts of external factors on belief, attitude, and user intention. Correlations among these variables are depicted in Figure 1 which follows.

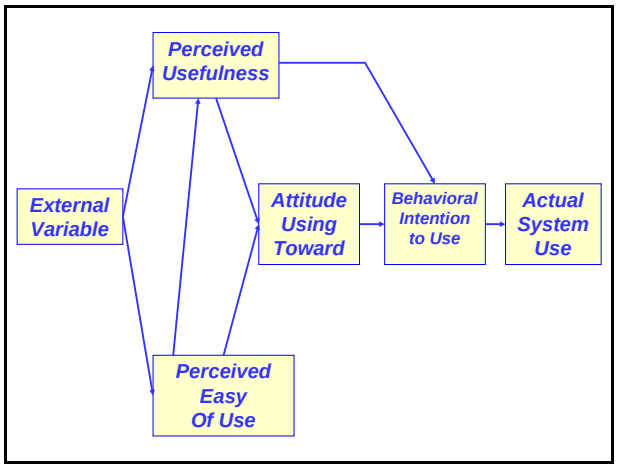

Figure 1. Technology Acceptance Model (Source: Davis, 1989)

In the theoretical model of UTAUT as stated by Venkatesh *et al.* (2003), gender, age, experience, and user characteristics, which are correlated to user occupation or position within the firm, provide moderating effect on information systems utilization. Its predictor variables are performance expectancy, effort expectancy, social influence, and facilitating condition. The UTAUT model is showed in Figure 2.

Studies on the application of information technology within small and medium enterprises have been limited as to compare with the application of this technology within corporations or large enterprises. Small business operators or owners are individuals who play important roles in directing the business' policies and directions. Research results show that there is a strong relation between small business owners' perception toward information technology and computer system and its actual application within their business operations (Heilman, Finnel, and Glorfeld, 1999). The impact of characteristics of information technology users on adoption processes, meanwhile, was investigated by Igbaria *et al.* (1997), Gefen and Straub (1997), Foong (1999), Hubona and Jones (2003), Venkantesh *et al.* (2003), and Kleijnen, Wetzels and Ruyter (2004). On theoretical model UTAUT (*Unified Theory of Acceptance and Use of Technology*) which was reported by Venkatesh *et al.* (2003), gender, age, experience, and application characteristics relating to user position within the firms (compulsory or optional), serve as moderating effect on use of information technology. Its predictor variables are performance expectancy, effort expectancy, social influence, and facilitating condition. Lee and Runge (2001) concluded that the company's innovation possessed actual influence toward the adoption of information system by SMEs; nonetheless in the case of internet adoption, those variables had no influences. Lee stated (2004) that the adoption of e-mail by SMEs owners or managers is influenced by their innovative ability.

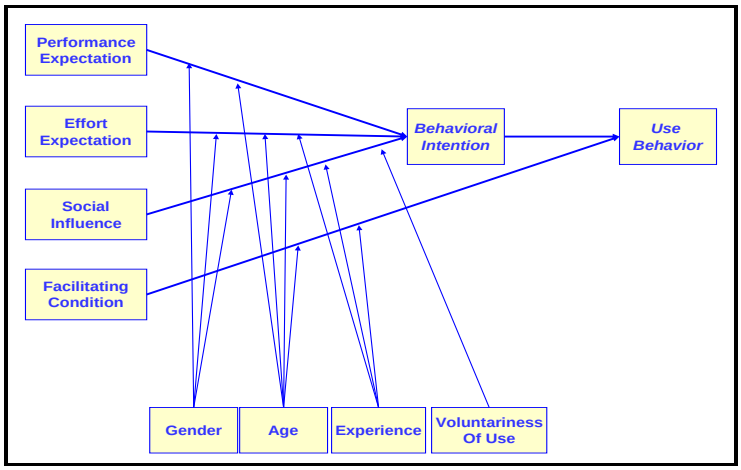

Figure 2. Model UTAUT (Source: Venkatesh *et al.*, 2003)

Characteristics of application of information technology within small enterprises, according to Riemenschneider and Mykytyn (2000), are as follow (1) financial and accounting activities are two majors information technology application, (2) information technology training programs are provided for managers, (3) top management support and involvement are of importance to the success of information technology application, and (4) in line with the majority of findings of studies on information technology, end-user involvement is a key aspect when the ultimate satisfaction of end-user was achieved. OECD (2004), identified inhibiting factors of information technology application within SMEs. These factors include (a) unmatched business processes, (b) lack of knowledge in managerial skills and information technology application, (c) costs of electronic systems management and maintenance, (d) computer and communication network infrastructure problems, (e) problems with information technology application security, (f) regulation uncertainty, and (g) various challenges related to electronic business process adoption.

Riemenschneider and Mykytyn (2000) stated that key persons of small business as end user of information technology tend to take into account computer self-efficacy, i.e., training and computer system application skills. Beside self-efficacy, Brown (2002), in his research on web based technology adoption in developing countries includes computer anxiety as an additional variable. His research results show that there is a strong effect of computer anxiety on adoption of this type of technology. According to Wetzels and Ruyter (2004), computer skills serve as moderating variable to PEOU. Mirchandani and Motwani (2001) found that computer skills serve as predictor variable in e-commerce adoption by small-scale businesses, with positive correlation coefficient. Bresnahan, Brynjolfsson, and Hitt (2000), found that level of education and computer skills of end-user are weakly related to computerized work and intensity of use of technology by end-user.

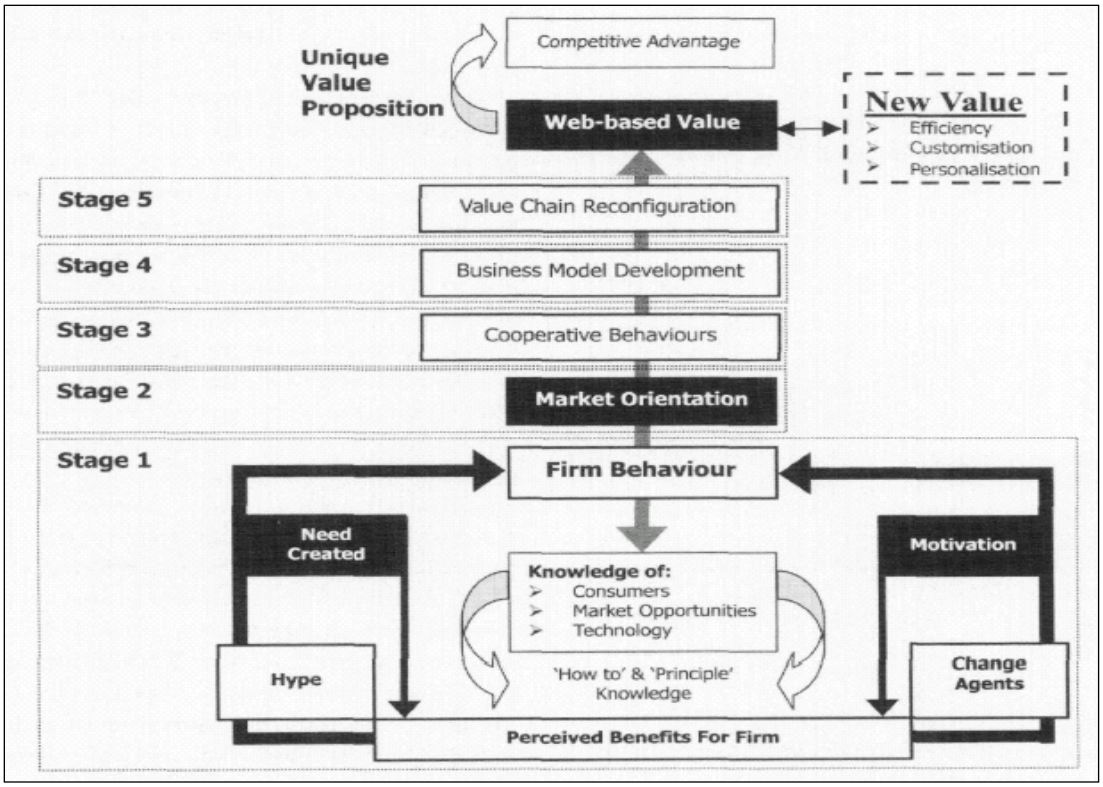

Figure 3. Internet adoption model within small enterprises (Source: Jones *et al*., 2003)

The majority of the used level of adoption variable are categorical i.e., adopter and non adopter. In several publication, partial adopter and full adopter terms were used. Van Akkeren and Cavaye (1999) classified small enterprises, in relation to information system adoption and/or application, into three groups: non-adopter; adopter; and full-adopter. The application on information technology in a firm will start from individuals. Referring that key individuals in a firm is the owner, intensity of information technology application by firm's owners is assumed to have significant effect on intensity of information technology application within the firm. The existence of this inter-chain effect, following Myers and Kappelman (1997), will be investigated in this study. The ultimate end of this inter-chain effect is the effect of information technology application intensity on small firm performance. The process of internet technology adoption by small enterprise operators was explained by Jones *et al*. (2003) through Figure 3.

Impacts of internet technology on small enterprises' performance were investigated by Dulipovici (2002) in Canada. All independent variables, including internet application, significantly affect all dependent variables which include (1) improvement in firm performance as to compare with previous year, and (2) the expected firm performance improvement in the following year. These independent variable include internet use or application (binary variables), province, industry sector, firm's age, number of labor, and business location (urban or village). Bitler (2001) investigated the relationship between information technology investment and small firms' performance, using regression model. Results of his study found that there was a significant performance difference between firms adopting information technology and those who are non-adopting information technology.

3. **RESEARCH METHODS**

Subjects of the research are 100 SFF operators who are associated with the Indonesia's Association of Small Business Operators (HIPKI), which were randomly selected. Respondents are small manufacturing firm operators producing a variety of food processed products such as, for example, banana crackers, cassava crakrers, sweet pottato crackers, and variety of fruit crackers. Their ages ranged from 21 to 60 years with an average of 38 years; education ranged from elementary school (year 6) to masters degree, mostly Senior High School graduates (51%); and income from IDR1 million (approx. USD100) to IDR30 million (approx. USD3000) per month averaging at IDR5 million (approx. USD500) per month. From 100 respondents who filled the questionnaire only 88 whose answers can be further analyzed in this study. Accordingly, only 88 samples are used in this preliminary study. Independent variables include (i) perceived internet usefulness, (ii) perceived ease of internet use, (iii) internet self efficacy, and (iv) internet anxiety. Two dependent variables are internet adoption and firm business performance. Level of internet adoption consists of three levels: adopter; potential adopter; and nonadopter. Firm performance was measured based on respondent perception regarding their firm conditions which include (i) comparison between current and previous firm performances, (ii) expected better future firm performance, (iii) productivity improvement, (iv) sales growth, (v) profit increase, (vi) product innovation, and (vii) process innovation.

Self-reported approaches were used in measuring independent variables. Reliability test on self-reported measurement indicated that Cronbach's alpha of research variables ranged between 0.8562 (i.e., internet anxiety—INX) and 0.9611 (i.e., perceived ease of internet use—PEOU). Construct validity test results indicated that research variables were found to have a high construct validity. These were indicated by (i) loading factors which were convergent into one component, (ii) KMO values were larger than 0.5, and (iii) Bartlett test result was significant. The lowest KMO value was 0.7676 (i.e., perceived ease of internet use—PEOU) and the highest KMO value were 0.8243 (i.e., internet anxiety—INX). All items in each variables were grouped into one factor or convergent based on their associated loading factor values.

Path analysis was used to investigate the effect of independent variables on dependent variables. Path model which shows correlation pattern among research variables is as follow.

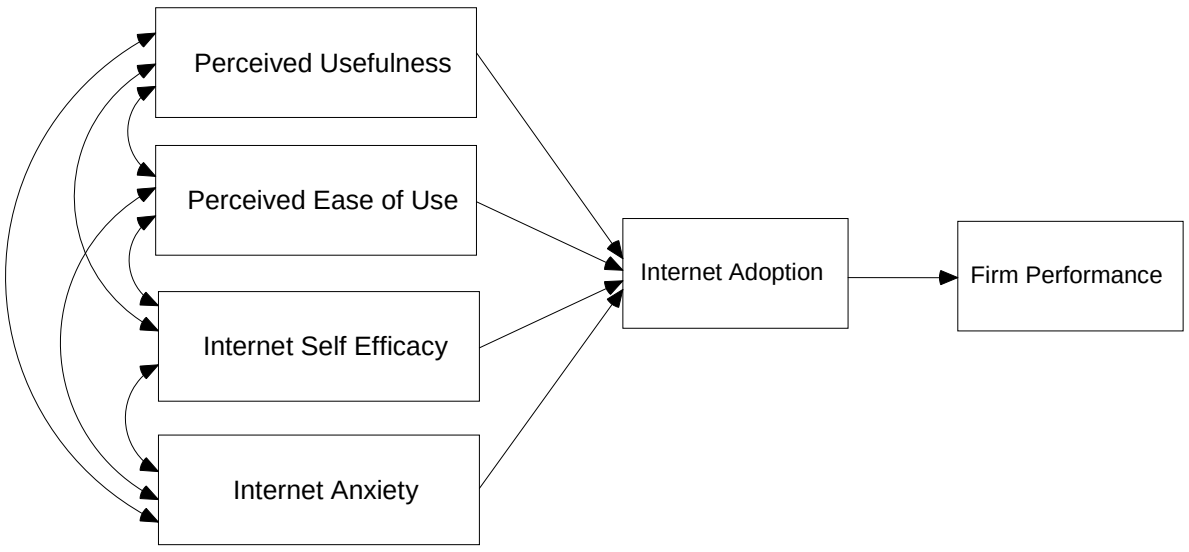

Figure 4. Path model (Source: Adapted from Davis, 1989)

Hypotheses to be tested are: (i) internet adoption is affected by—either simultaneously or partially—perceived usefulness, perceived ease f use, internet self efficacy, and internet anxiety, and (ii) firm business performance is affected by internet adoption.

4. RESULTATS AND DISCUSSION

Descriptive statistics of research variables, which include mean, median, standard deviation, coefficient of variation, and minimum and maximum values, are depicted in table below.

Table 1. Descriptive statistics of research variables

Statistics	Research variables[1]					
	PU	**PEOU**	**ISE**	**ANX**	**IA**	**FP**
Mean	4.79	2.79	3.91	4.61	1.53	5.25
Median	5.17	3	4.4	5	1	5.71
Std. Deviation	0.75	1.11	1.20	0.60	0.59	0.90
C of Variation	15.70	39.82	30.76	13.02	38.21	17.13
Minimum	2	1	1	3	1	2
Maximum	6	5	5	5.5	3	6

Note:

PU:	Perceived Usefulness	ANX:	Internet Anxiety
PEO	Perceived Ease of Use	IA:	Internet Adoption
ISE:	Internet Self Efficacy	FP:	Firm Business Performance

Respondents tend to belief that internet is useful for their business. They found that learning internet technology is not that easy, however, they are confident that they—supported by adequate training internet technology—will be able to learn it. Interestingly, respondents, on average, still belief and understand that internet technology is difficult to learn and, more than that, to some extent is "frightening". These are indicated through the mean values of the following variables: perceived usefulness (4.79—out of maximum value of 6), perceived ease of use (2.79), internet self efficacy (3.91), and internet anxiety (4.61).

The majority of respondents are categorized as both internet non-adopter (51.14%) and internet potential adopter (44.32%). Only 4.55% respondents can be categorized as internet adopter. Firm business performance, as reported by respondents, are found to be good. As shown in Figure 5, more than 50% respondents belief that their firm business performance will be improved with internet technology application. This indicates that respondents who are not categorized as internet technology adopter (i.e., mostly non-adopters and potential adopters) understand that internet technology has the potentials to improve their firm business performance.

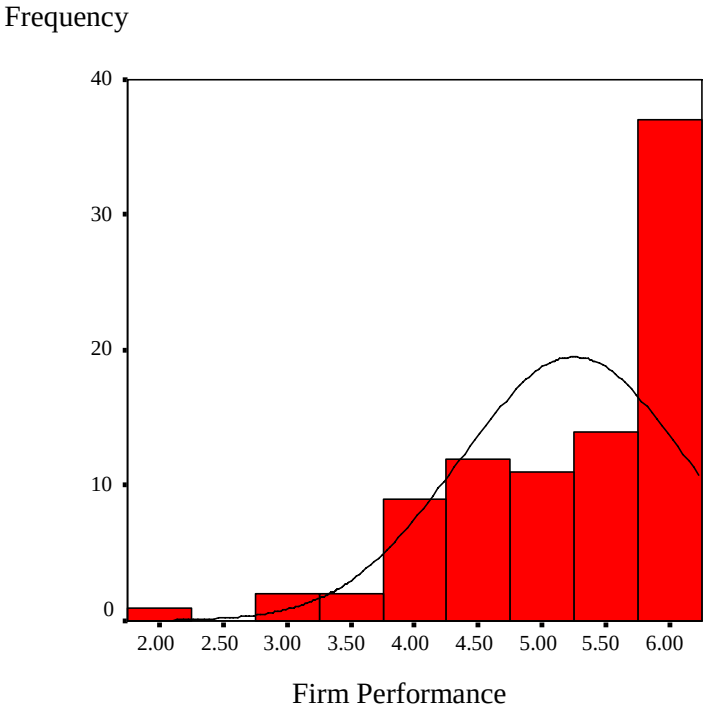

Figure 5. Firm business performance

Results of path analysis on the relationships between independent variables (i.e., perceived usefulness, perceived ease of use, internet self efficacy, and internet anxiety) and dependent variables (i.e., internet technology adoption and firm business performance) are depicted in Figure 5 and 6.

As shown in Figure 6, patterns and magnitudes of relationships between independent variables (perceived usefulness, perceived ease of use, internet self efficacy, and internet anxiety) and dependent variable (internet technology adoption—submodel 1) and between independent variable (internet technology adoption) and dependent variable (firm business performance—submodel 2) are represented by the following regression equations.

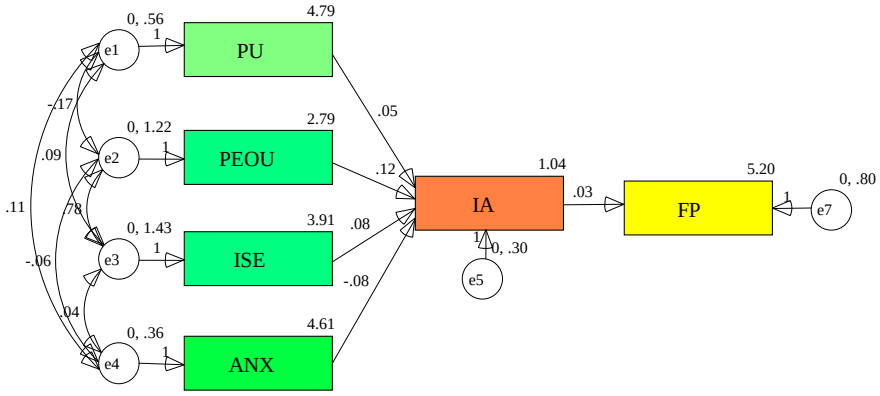

Figure 6. Path analysis results (unstandardized coefficients)

Internet Adoption = 1.04 + 0.05PU + 0.12PEOU + 0.08ISE – 0.08ANX (1)

Firm Business Performance = 5.20 + 0.03IA (2)

where: PU (perceived usefulness); PEOU (perceived ease of use); ISE (internet self efficacy); ANX (internet anxiety); IA (internet adoption); and FP (firm business performance).

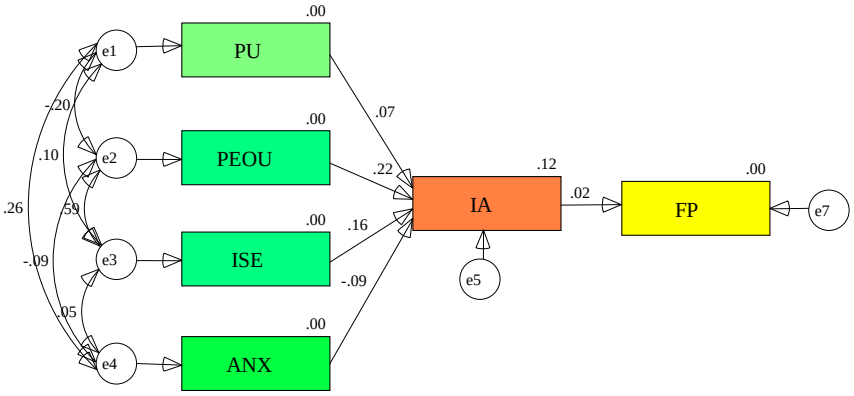

Figure 7. Path analysis results (standardized coefficients)

Coefficient determinants (R^2) for each equation are, respectively, 0.12 and 0.00, as can be seen in Figure 7.

Analysis of variance (ANOVA) for each submodel is shown in Tables 2 and 3. As clearly shown in Table 2, internet technology adoption is significantly ($p<0.05$) affected by the four mentioned independent variables: perceived usefulness (positive); perceived ease of use (positive); internet technology self

efficacy (positive); and internet technology anxiety (negative). However, their ability to explain the variability of internet technology adoption is relatively low (i.e., 12 per cent). This means that there a number of factors that have the potential to affect the level of internet technology adoption within small business operators. These include social influence (i.e., customer influence), competitor pressure, facilitating conditions (i.e., information technology infrastructure), and users' demographic characteristics (i.e., gender, age, level of education, and experience).

Table 2. Analysis of variance submodel (1)

Source of variance	Sum of Squares	df	Mean Square	F	Sig.
Regression	3.654447243	4	0.913611811	2.889493	0.027142
Residual	26.24328003	83	0.316184097		
Total	29.89772727	87			

Predictors: (Constant), Internet Anxiety, Internet Self Efficacy, Perceived Usefulness, Dependent Variable: Adoption Internet

Firm business performance, on the other hand, as seen in Table 3, is not significantly affected by internet technology adoption. This means that internet technology application, according to perceptions of SFF operators, has nothing to do with their firm business performance. In other words, there was no difference in firm business performance between firms which use information technology—in this case internet technology (i.e., internet adopter or potential adopter) and those which do not use it (internet non-adopters). This finding is different from Bitler's finding (2001), which found that information (internet) technology adoption significantly affect firm business performance.

This finding and its difference from Bitler's (2001) findings could be explained this way. Most of respondents in this study (i.e., small manufacturing firm operators) are categorized as either internet non-adopters or internet potential adopters. However, they belief and understand that internet technology will—to some degree—be able to improve their firm business performance. This could be caused by the existence of gaps or differences between their theoretical knowledge regarding the technology and its associated advantages and their practical experience utilizing this technology.

Table 3. Analysis of variance submodel (2)

Source of variance	Sum of Squares	df	Mean Square	F	Sig.
Regression	0.02750	1	0.027504	0.03367	0.854843
Residual	70.25204	86	0.816884		
Total	70.27955	87			

Predictors: (Constant), Internet Anxiety, Internet Self Efficacy, Perceived Usefulness, Dependent Variable: Adoption Internet

5. CONCLUSION

Level of internet technology adoption by SFF operators is affected by their perceived usefulness, perceived ease of use, internet self efficacy, and internet anxiety. This indicates that these predictors (independent variables)—even they partially do not significantly affect internet adoption—are regarded as important variables that should be carefully taken into account in developing internet technology education and/or training programs for small business operators. Firm business performance is not affected by internet technology adoption. Since firm business performance was measured using self-

reported approaches (e.g., whether adopting and utilizing internet technology will improve their firm business performance), this finding can be regarded as an indicator that internet technology education and/or training is of importance for small manufacturing firm operators as well as other sectors of small business operators.

REFERENCES

Anderson, John E. and Paul H. Schwager. (2004) "SME Adoption of Wireless LAN Technology: Applying the Utaut Model." Proceedings of the 7th Annual Conference of the Southern Association for Information Systems.

Barki, Henri and J. Hartwick. (1994) "Measuring User Participation, User involvement, and User Attitude." MIS Quarterly; 18, 1; p. 59.

Bitler, Marianne P. (2001) "Small Businesses and Computers: Adoption and Performance." (www.document). http://www.frbsf.org/publications/economics/papers/2001/ (accessed 15 July 2007).

Chambers, Todd A. and Craig M. Parker. (2000) Factors Motivating and Inhibiting the Use of Web Commerce by Rural Small Business. School of Management System, Deakin University.

Chau, Patrick Y K and P. J. H. Hu. (2001) "Information Technology Acceptance by Individual Professionals: A Model Comparative Approach." Decision Sciences; Fall 2001; 32, 4; pg. 699.

Compeau, Deborah, C.A. Higgins, and S. Huff. (1999) "Social Cognitive Theory and Individual Reactions to Computing Technology: A Longitudinal Study." MIS Quarterly 23, no. 2 (June): 145.

Fichman, Robert G. (2004) "Going Beyond the Dominant Paradigm for Information Technology Innovation Research: Emerging Concepts and Methods." Journal of the Association for Information Systems Vol. 5 No. 8 (August): 314-355.

Foong, Soon Yau. (1999) "Effect of End User Personal and System Attributes on Computer Based Information System Success in Malaysian SMEs." Journal of Small Business Management 37, no. 3: 81.

Gardner, Christina and D.L. Amoroso. (2004) Development of an Instrument to Measure the Acceptance of Internet Technology by Consumers." Proceedings of the 37th Hawaii International Conference on System Science.

Gefen, David and Detmar Straub. (2000) "The Relative Importance of Perceived Ease of Use in IS Adoption: A Study of E-Commerce Adoption." Journal of The Association for Information System: Volume 1, Article 8 (October).

Gera Surendra and W. Gu. (2004) The Effect of Organizational Innovation and Information Technology on Firm Performance." International Productivity Monitor, No. 9 (Fall).

Jones, C., R. Hecker, and P. Holland (2003), "Small Firm Internet Adoption: Opportunities Forgone, a Journey Not Begun", Journal of Small Business and Enterprise Development 10, no. 3: 287.

Kleijnen, Mirella, M. Wetzels, K.D. Ruyter. (2004) "Consumer Acceptance of Wireless Finance." Journal of Financial Services Marketing 8, no. 3: 206-217 (www document) http://arno.unimaas.nl/show.cgi?fid=2719 (accessed 15 April 2007).

Klopping, Inge M. and E. McKinney. (2004) "Extending the Technology Acceptance Model and the Task-Technology Fit Model to Consumer E-Commerce." Information Technology, Learning, and Performance Journal 22, no. 1 (Spring): 35.

Kohli, Rajiv and S. Devaraj. (2003) "Measuring Information Technology Payoff: A Meta-Analysis of Structural Variables in Firm-Level Empirical Research." Information Systems Research 14, no.2 (June): 127.

Kraemer, Kenneth L., J. Gibbs and J. Dedrick. (2002) Impacts of Globalization on E-Commerce Adoption and Firm Performance: A Cross-Country Investigation. Center for Research on Information Technology and Organizations, University of California, Irvine.

Kula, Veysel and Ekrem Tatoglu. (2003) "An Exploratory Study of Internet Adoption by SMEs in an Emerging Market Economy." European Business Review15, no. 5: 324.

Lee, Younghwa, K.A. Kozar, and K. R.T. Larsen. (2003) The Technology Acceptance Model: Past, Present, and Future." Communication of the Association for Information System 12, no. 50: 752-780.

Lee, Jungwoo. (2004) "Discriminant Analysis of Technology Adoption Behavior: A Case of Internet Technology in Small Business." The Journal of Computer Information Systems 44, no.4: 57.

Lee, Jungwoo and Janet Runge. (2001) "Adoption of Information Technology in Small Business: Testing Drivers of Adoption for Entrepreneurs." The Journal of Computer Information Systems 42, no. 1: 44.

Riemenschneider and Mykytyn (2002) "What Small Business Executives Have Learned about Managing Information Technology." Information & Management 37: 257-269

Riquelme, Hernan. (2002) "Commercial Internet adoption in China: Comparing the experience of small, medium and Large Business." Internet Research 12, no. 3: 276.

Rosen, Peter A. (2004) "The Effect of Personal Innovativeness in the Domain of Information Technology on the Acceptance and Use of Technology: A Working Paper". Oklahoma State University.

Straub, Detmar; Marie-Claude Boudreau, and David Gefen. (2004) "Validation Guidelines For Is Positivist Research." Communications of the Association for Information Systems 13: 380-427.

Van Akkeren, Jeanette and Angèle L.M. Cavaye. (1999) "Factors Affecting Entry-Level Internet Technology Adoption by Small Business in Australia: An Empirical Study." Proceedings 10th Australasian Conference on Information Systems.

Venkatesh, Viswanath, Michael G. Morris, Gordon B. Davis, Fred D. Davis. (2003) "User Acceptance of Information Technology: Toward A Unified View." MIS Quarterly 27, no. 3: 425-478.