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An Analysis of Intention to Use in Innovative Product Development Model through TAM Model

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In 2013 China announced the "One Belt and One Road" policy, including the "Silk Road Economic Belt" and the "21st Century Maritime Silk Road." The purpose of the two plans aims to establish a new connection of trade transportation between China, Central Asia and Europe, "this is by far the most massive regional infrastructure plans we have seen." In 2015 China again proposed the "Made in China 2025" plan, which identifies "smart manufacturing" and applies technology innovation as the core development of equipment manufacturing, and thereby implementing major projects such as the national manufacturing innovation center. Nonetheless the predicament of industrial OEM model and the invasion from the rise of the red supply chain in China have led to considerably urgent demand for transition of manufacturing industry. The study objects comprise of manufacturers in transition to manufacturing servitization under the strong advocacy by Taiwan and applies TAM model to verify the user intention and suggestions for manufacturers in such innovative product development model. This conclusion is in accord with previous studies on new product development thinking model, which suggests that when users perceive ease of use and ease of learning, the innovative product development model will be considered to help performance improvement. The model allows first-line and entry-level employees to comprehend and understand they key execution, which is the best solution for perceived usefulness in supporting attitudes toward use and reducing risk concern factors.

Keywords: manufacturing servitization, TAM Model, product development model, intention to use, attitude, perceived ease of use

INTRODUCTION

China announced "One Belt and One Road" policy in 2013 with content referring to the "Silk Road Economic Belt and "21st Century Maritime Silk Road." The policy is more than an entity and mechanism but a concept and advocacy for cooperation and development, which fully grounds on the existing bilateral and multilateral mechanism between China and affiliated countries through the existing and effective regional cooperation platform. "One Belt and One Road" runs through the Eurasia, connecting with Asia-Pacific Economic Rim to the east and entering the European

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Economic Rim to the west. Regardless of economic development and livelihood improvement or coping with crisis and speeding up the pace in adjustment, many countries along the line share the same interests as Taiwan as we hold the same global new manufacturing economic thinking of the new century.

In 2015 China again proposed the full text of the action plan for "Made in China 2025," which identifies the development path in the Three-Step Development Strategy for China's manufacturing industry to "grow bigger and stronger." This is the first ten-year action plan for China to implement the strategies of evolving into a powerful manufacturing country and the first-step plan is projected for China to rise as one of the "powerful manufacturing countries" by 2025.

Countries in Asia now face with China's plan for manufacturing economic policy in the next 10 years while the predicament of industrial OEM model and the invasion from the rise of the red supply chain in China have led to considerably urgent emand for transition in manufacturing industry.

State of the literature

- Manufacturing servitization is an emerging product development process which lacks a uniform model in market use.
- Manufacturing industries in transition to servitization lies on the manifestation and integration of Design and Development Department
- The two most foremost important values in design, namely the innovation trends and marketing strategies.

Contribution of this paper to the literature

- The agreement with the change of cooperation model. Such communication and coordination are quite difficulty and require much identification of interest allocation.
- In the process of innovation, core technology is still the main ground for competition while new development model is merely a result to make up for the deficiency.
- The small and medium manufacturers should strengthen their understanding on the application of innovative product development model for development simplicity (namely ease of use), They will increase perceived usefulness of innovative product development model.

Motives for research

The relevant research on manufacturing servitization conducted by the author reveals that the majority of design service emphasize on the deliberation and persistence in work models in the past, which eventually drives the business territory of the industries to shift under the intensely competitive market pressure. The industries for some in time have even extended to the back-end CAD/CAM, printing, molding and other manufacturing engineering field. Nonetheless the author perceives the two most foremost important values in design, namely the innovation trends and marketing strategies. Hence, the author suggests developing "transition" towards the foremost front-end "market research" or the final "marketing" of the industry train, which not only extends the professionalism in design but also more "clearly" creates values for customers.

The following is the development process on "how to develop under manufacturing servitization" by listing out seven concepts using industrial transition to strengthen customer identity, which the current industries adopt to strengthen the value between manufacturing and services as well as apply as the key indicators in product development process.

1. Produce professional and exquisite company profile and website to leave a good first impression on customer.
2. Fully understand customers' products and market, providing best solutions for customers.
3. Apply project management technology, conduct design quality control, and emphasize on expertise.
4. Receive special market performance or award records to increase the industry's value identify in services.
5. Create media publicity, list media report and produce third-party word-of-mouth marketing.

6. Work release with specific support.
7. Strategy services.

In general, the design department should also strengthen it capability in resource management and communication apart from creativity. The design department shall design products with unique features but also enhance the possibility of customers in future production and marketing.

Derivation model

The study concludes the key to manufacturing industries in transition to servitization lies on the manifestation and integration of Design and Development Department, which requires the reverse derivation from physical and virtual channel thinking (as shown in Figure 1) for the innovative product development process to face with the new trends in future manufacturing servitization through the following conclusions:

1. Validate the importance for the product R&D Department of manufacturers (Design Department) serving as the role in cluster communication and coordination.
2. Apply service design thinking for manufacturing servitization as the future cluster industry development trend.
3. A successfully cluster development is determined by the integration efficiency of all internal organizational chains.
4. Clustered thinking model features advantages in creating added-value, innovation and transaction cost saving.
5. Resolve the innovation service development model for intention to use that has not been mentioned by previous studies according to the company flowchart for product development model operation and the interview with the person in charge of the manufacturers (Min-Wei Hsu, 2014).

Purpose of research

Manufacturing servitization is an emerging product development process which lacks a uniform model in market use. On contrary, the value of innovation technology exists in the use by small and medium manufacturers. The type of new model adopted by small and medium manufacturers and influence factors will concern whether if the new product development model can successfully cross the gap. For this reason the

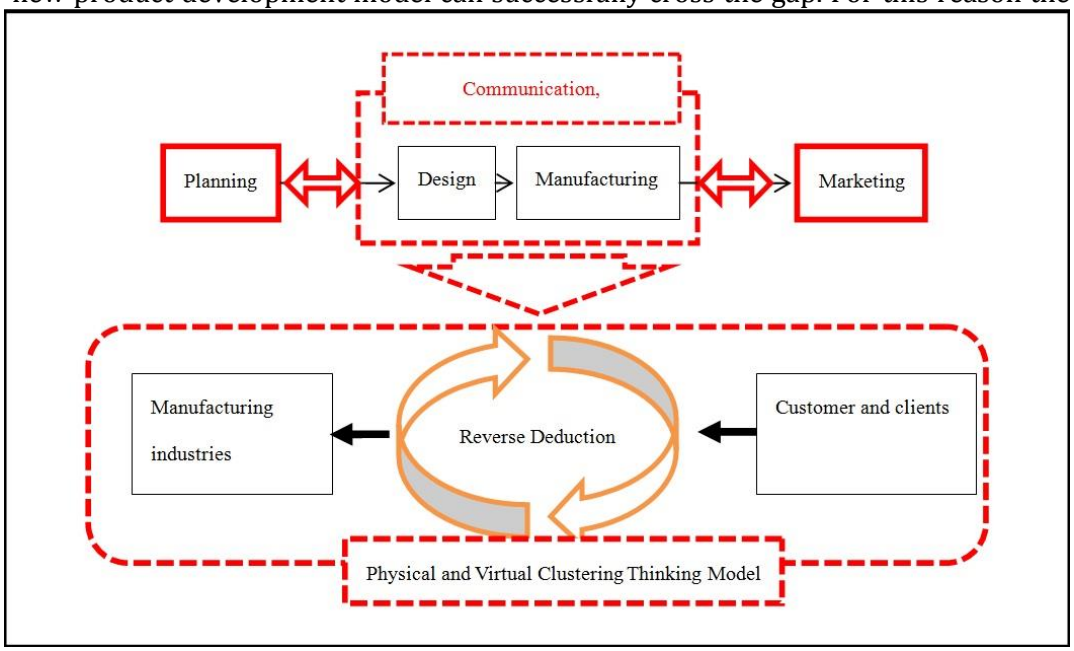

Figure 1. Innovative Product Development Thinking Model (Min-Wei Hsu, 2014)

study takes the perspective of small and medium manufacturing companies to explain and predict the influence factors on small and medium manufacturers in terms of new product development model through a TAM model.

Ajzen & Madden (1985) discovered that empirical studies show that "plant behavioral theory" performs better than "rational behavior theory in terms of explanation power to behavior. Many empirical studies also support that TPB is a rigorous behavior theory with information technology and acceptance for intention to predict (Schifter & Ajzen, 1985; Ajzen & Madden, 1986; Mathieson, 1991; Taylor & Todd, 1995a, b; Harison et al., 1997). The study intends to understand the intention adopted by small and medium manufacturers on the manufacturing servitization of product development model. Moreover the study explores into the belief that leads the small and medium manufacturers to apply manufacturing servitization with suggestions to improve the behavior of small and medium manufacturers. Consequently the study applies TPB as the theoretical foundation explore into the influence on the intention to accept innovative product development model from small and medium manufacturers in terms of manufacturing servitization. (Hsu M.W, 2011)

LITERATURE REVIEW

Technology Acceptance Model (TAM)

Technology Acceptance Model (TAM) was proposed by Fred Davis in 1986 and 1989 as a tool for evaluating or predicting users' acceptance towards new product development model (Davis, 1986; Davis, el at., 1989; Sancar-Tokmak, Surmeli, & Ozgelen, 2014). The foundation of theory originated from the Theory of Reasoned Action (TRA) proposed by Fishbein and Ajzen in 1975. According to the Theory of Reasoned Action, a person's engagement in specific behavior is subject to the influence from the intention to execute such behavior while behavioral intention is subject to the influence from the individual's attitude and subjective norm (Fishbein & Ajzen, 1975).

The individual's attitude towards behavior is determined by the main belief for the behavior consequence and the evaluation of these results. On contrary, individual's subjective norm is determined by normative beliefs and motivation for obedience. Subjective norms will affect the key stakeholders to hold agreeing or opposing opinions towards the said behavior in addition to affecting the perception of stakeholders. Attitude refers to the positive or negative evaluation of specific behavior, activity and event from an individual, whereas the user intention reflects the individual's intention towards the engagement in certain behavior (Fishbein & Ajzen, 1975; Psycharis et al., 2013; Wang, 2013; Wang, & Hsieh, 2015).

When developing the Technology Acceptance Model (TAM), Davis et al., (1989) explained individual's behavior towards information technology acceptance by using the causality in rational behavior theory, providing basic theoretical foundation to understand the influence of external factors on the internal beliefs, attitude and intention to use in users. The user's acceptance behavior for product development model is subject to the influence of individual's internal belief: perceived usefulness and perceived ease of use. These two beliefs further affect users' attitude and intention toward product development model and thereby affecting the usage of such technological behavior by users.

The main purpose of TAM is to explore into the factors affecting user's acceptance for product development model under the organizational environment. Model constructing is also applied to provide general explanation of model to fit into the acceptance of system users in product development model. The revised TAM model is shown in Figure 2.

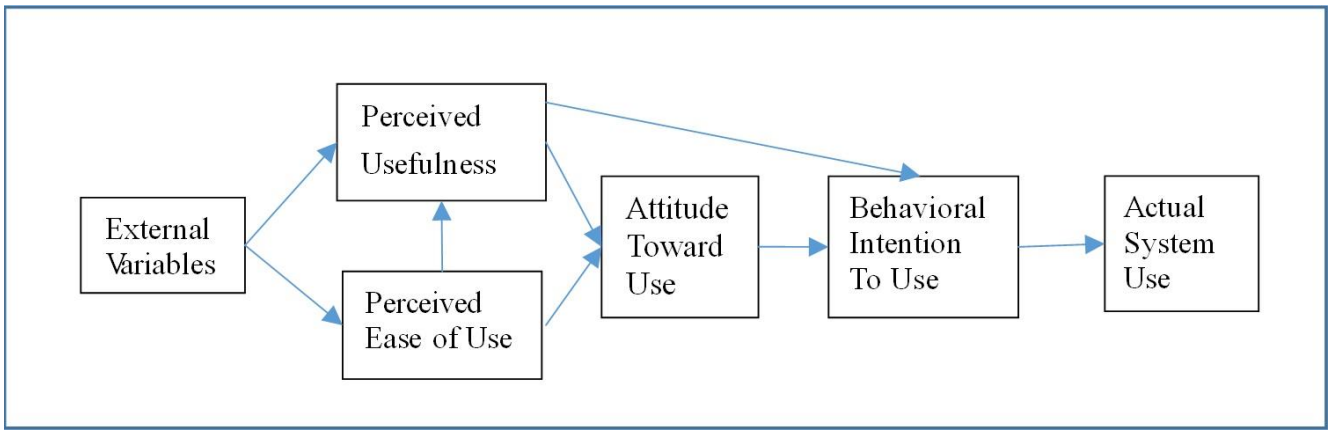

Figure 2. Technology Acceptance Model (TAM), Davis et al., 1989

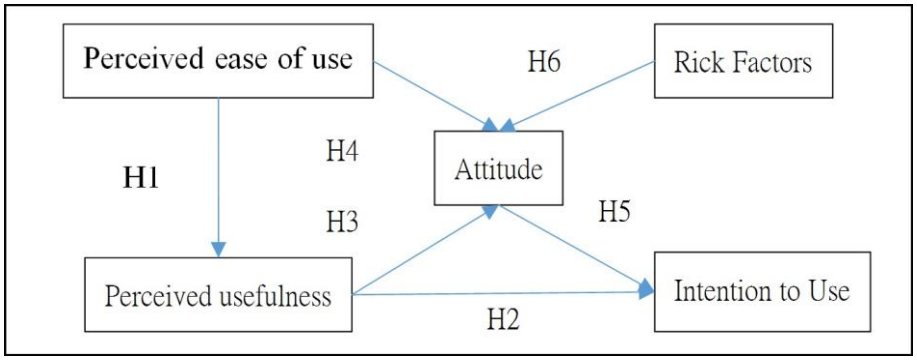

Figure 3. Reseearch hypothesis framework

Research design and methods

According to the purpose of the study and the results of literature review, the study applies the perceived usefulness, perceived ease of use, attitude, and intention to use as the foundation of TAM model and analyzes the intention to use and attitude for small and medium manufacturers in the manufacturing servitization of innovative product development model, from the risk dimension.

In this chapter, the study first discusses the relation of each research construct and further establishes the study framework and hypotheses, followed by proposing operational definition on the results of literature review in addition to singing questions for the questionnaire. Finally the study describes the research objects, sampling design, statistical analysis and methods, in the following details of content. (Min-Wei Hsu, 2013).

Research framework and hypotheses

The study emphasizes on the research hypothesis framework established for issues related to the intention to use in innovative product development model for small and medium manufacturers in manufacturing servitization, as shown in Figure 3 From the perspective of small and medium manufacturers, the study suggests the intention to use as the influence factor for small and medium manufacturers in the manufacturing servitization of innovative product development model. In the TAM model, perceived ease of use affects perceived usefulness while attitude construct can be summarized in three items, including perceived usefulness, perceived ease of use, and Risk factor. On contrary, among the factors affecting the intention in the manufacturing servitization of innovative product development model, the construct

of intention to use can be summarized in three items, namely perceived usefulness, attitude and risk factor.

The research hypotheses derived from the study according to the aforementioned research framework, are described below:

H1: The perceived ease of use in small and medium manufacturers for manufacturing servitization of innovative product development model positively affects perceived usefulness.

H2: The perceived usefulness in small and medium manufacturers for manufacturing servitization of innovative product development model positively affects the intention to use.

H3: The perceived usefulness in small and medium manufacturers for manufacturing servitization of innovative product development model positively affects attitude.

H4: The perceived ease of use in small and medium manufacturers for manufacturing servitization of innovative product development model positively affects attitude.

H5: The attitude in small and medium manufacturers for manufacturing servitization in innovative product development model positively affects the intention to use.

H6: The risks associated with small and medium manufacturers for the manufacturing servitization of innovative product development model positively affects the attitude.

Research design

The study adopts questionnaire survey to collect data needed and the questions of the questionnaire are prepared with reference on relevant theoretical literatures to attain the objectivity of data in questionnaire quality.

(1) Pre-Test

Upon completing the preliminary draft of questionnaire design and to avoid the problems in which the respondents not understanding the wording of questionnaire and consequently providing wrong answers and affecting the validity of the questionnaire, the study releases pre-test before the formal questionnaire to validity of questionnaire.

(2) Formal questionnaire

The measurement of the formal questionnaire adopts, Likert's Five-Point Scale, evaluating from the "high disagreed" to "highly agreed." The scoring method adopts 1 to 5 points to indicate the evaluation value, where higher score suggesting higher agreement for the description of the questionnaire (See Table 1).

The questionnaire is divided into four sections, where the first section describes he information related to the small and medium manufacturers in the manufacturing sertivitization of innovative product development model since most people are not familiar with the concept of this model. The second section of the paper describes the factors affecting small and medium manufacturers in the adoption of manufacturing servitization of innovative product development model. The third section measures the perceived belief in respondents on the constructs of "Ease of Use Compatibility" and "Risk Factors" for the manufacturing servitiziation of innovation product development model and the respondents' attitude towards intention to adopt the manufacturing servitization of innovative product development model. The fourth section describes the basic information of the respondents, including gender, age, occupation, and education as well as the behavior to use product development process, namely whether if the respondents use service design, S.E.E model and the

Table 1. Content of questions from the questionnaire

Construct	Q. NO.	Description of Question
Risk	**2-11**	I think the application of manufacturing servitization of innovative product development model for new product development will easily make mistakes and cause financial loss for the company.
	2-12	I think the application of manufacturing servitization of innovative product development model for new product development will cake too much time and lead to time loss.
	2-14	I think the application manufacturing servitization of innovative product development model comes with too many risks in uncertainty.
	2-15	I think the application of manufacturing servitization of innovative product development model for secondary review is troublesome.
Perceived Usefulness	**2-4**	I think the application of manufacturing servitization of innovative product development model with the use of service design will facilitate product development.
	2-5	I think the application of manufacturing servitization of innovative product development model with the use of service design will facilitate product development in faster pace.
	2-6	I think the application of manufacturing servitization of innovative product development model with the use of service design will make product development easier.
	2-16	I think the application of manufacturing servitization of innovative product development model for product development is beneficial.
Perceived Ease of Use	**2-1**	I think the application of manufacturing servitization of innovative product development model for product development is easy for developing products.
	2-2	I think the operational methods for application of manufacturing servitization of innovative product development model is easy to learn.
	2-3	I think it is easy to familiarize with the payment method for manufacturing servitization of innovative product development model.
Attitude	**2-7**	I think the application of manufacturing servitization of innovative product development model for product development is suitable for my work model.
	2-8	I do not consider there is conflict between the manufacturing servitization of innovative product development model and the current methods used for my product development.
	2-9	I think the use of service design to solve product development related issues is valuable.
	2-10	I think the application of manufacturing servitization of innovative product development model can meet the small and medium manufacturer's demand for R&D method.
	2-13	I think the application of manufacturing servitization of innovative product development model may not work as effective, quick and convenient for corporate R&D as expected.
Intention to Use	**1-3**	Will I apply manufacturing technology to product R&D due to the function of manufacturing technology combined with service design?
	1-4	Will I use manufacturing technology combined with service design to save time?
	1-5	Will I apply manufacturing technology combined with service design to directly coordinate the R&D development?
	1-6	Will I apply manufacturing technology combined with service design due to the need for physical clustering model?
	1-7	Will I apply manufacturing technology combined with service design to enhance communication?
	1-8	Will I apply manufacturing technology combined with service design to enhance coordination?
	1-9	Will I apply manufacturing technology combined with service design to improve management mechanism?
	1-10	Will I apply manufacturing technology combined with service design to increase external information?
	1-11	Will I apply manufacturing technology combined with service design to enhance internal coordination?
	2-17	Will I apply manufacturing technology combined with service design to integrate reverse derivation?

Source: The study

views towards manufacturing servitization of innovative product development model.

(3) Sampling method

The users for manufacturing servitization of innovative product development model is a collection of massive small enterprises, which leads to an enormous estimation if the research population. Hence the study defines the population as the

small and medium manufacturers having proposed industry-academia cooperation projects with the Ministry of Science and Technology and the Ministry of Economic Affairs in order to clearly present the objects of the study.

(4) Questionnaire recovery

The questionnaire has been reviewed and validated of content by the advisor, IT supervisor, and figures from the industries to contain certain content validity. The study then conducts pre-test to assure the questionnaire can reflect the connotation of expression to test the questionnaire's reliability. With regards to the reliability test, the study takes the standard suggested by Nunnally to set the Cronbach's α value of each variable to at least 0.7 (Nunnally, 1967).

In December 2013, the study distributed questionnaire in written form to the attendants of one routine industry meeting held for small and medium manufacturers during the monthly conference of Manufacturers' Society. A total of 33 questionnaires were distributed with 28 questionnaires recovered. After deleting one invalid questionnaire, the total valid questionnaire was 27. The results of research variables through reliability analysis are shown in Table 2. It is discovered that the Cronbach's α values of all variables of the study, except for one risk item as 0.69, all others are approaching or greater than the threshold value of 0.7, which suggests excellent reliability of the questionnaire.

The formal questionnaire was distributed for a period of two weeks, from April 7th to April 21st of 2014 to sample the personnel from the design department and manufacturing department of the manufacturers for investigation. The questionnaire was implemented via two methods, namely via the Google questionnaire online survey and the distribution of questionnaire in written worm for respondents of the company supervisors. A total of 230 questionnaires were distributed, deducting invalid questionnaires with omitted replies or repeated selection, a total of 218 valid questionnaires were received, reaching a 94.8% of recovery rate for valid questionnaire.

Data analysis methods

The number of recovered samples for the study was smaller than 300, which still contains applicability to the analysis of smaller samples using partial least squares (PLS) (Chin, Marcolin, & Newsted, 2003). Hence the study adopts the Visual PLS 1.04 statistics software package developed by Fu, Jen-Ruie in 2006 as the statistics analysis tool for analyzing the measurement model (for reliability and validity analysis) and the structural model. The description of the aforementioned statistics analysis method is provided below:

(1) Descriptive statistics analysis

The questionnaires are measured through the calculation of questions and number of constructs, means, and standard deviations. The questions with higher means suggest that the more respondents agree with the questions while the standard deviation is a consistency indicator in measuring the recovered samples to the

Table 2. Pre-questionnaire reliability scale

Constructs	Cronbach's α Value
Risks	0.69
Perceived Usefulness	0.83
Perceived Ease of Use	0.82
Attitude	0.84
Intention to Use	0.76

question, whereas the smaller the standard deviation of the sample is, the more it is suggested that the respondents hold more consistent view on that particular question.

(2) Reliability analysis

The internal value (Cronbach's α) of factor construct is derived from the research variables to test the consistency of the study with regards to the scale measurement of the questions. Cronbach's α value is one of the most frequently used reliability test indicator in research, where high α value denotes high internal consistency in all variables. In general the α value must reach at least 0.7 or higher to derive acceptable factor (Nunnally, 1967).

(3) Validity Analysis

Validity is the accuracy of measuring tools, namely whether if the measuring tools can measure the real problems which the researcher intends to find out. There are four validities, including internal validity, construct validity, statistical conclusion validity, and external validity. In particular, the construct validity is divided into convergent validity and discriminant validity. AVE (average variance extracted) and cross loadings are common indicators. The average variance extracted (AVE) needs to be greater than 0.5 to address the construct with sufficient convergent validity (Fornell & Larcker, 1981).

(4)Visual PLS

The analysis of PLS model is divided into two stages, namely the measurement model and structural model. The first stage tests the reliability and validity analysis of measurement model while the second stage tests the prediction for the significance and R-square (R2) for the path coefficient, β value, of the structural model. The second stages aims to validate whether if the measurement construct contains reliability and validity, followed by testing the relationships of all constructs (Hulland, 1999). The individual question reliability is tested through factor loading while the threshold should be greater than 0.5(Anderson, Tatham, & Black, 1998). The composite reliability and Cronbach's α must be greater than 0.7 to assure the level of internal consistency (Chin & Newsted, 1999). The average variance extracted (AVE) must be greater than 0.5 to address the construct as with sufficient convergent validity (Fornell & Larcker, 1981). The discriminant validity can be tested through two methods: the first one is to examine if the individual question loading for all constructs in the cross-loading matrix is higher than the loading of other constructs (Fornell & Larcker, 1981). The second method takes the square root of the average variance extracted (AVE) of the individual construct and places in the relevant coefficient matrix of all constructs. The correlation between each variable and other variables from the measurement of the same construct shall be greater than the correlation coefficient between the construct and the other constructs of the model (Chin & Newsted, 1999).

Upon completing the reliability and validity test on PLS measurement model, the study analyzes the structural model for the explanations and prediction of PLS model. With regards to the structural model, the model explanation is primarily used to test the significance in path coefficient for relationships between various research constructs (Bollen & Stine, 1992) while the prediction of model is determined by R2 indicator (Fornell & Larcker, 1981).

RESEARCH ANALYSIS AND RESULTS

This Chapter conducts analysis on the data of recovered questionnaires to describe the results of data analysis. More importantly this section determines from the

analytical results to acquire further understanding on the study objects and thereby to test the completion of research purpose. The content is divided into descriptive statistics, reliability and validity analysis, and structural model analysis as described below:

The purpose of this Chapter aims to conduct statistical data analysis and interpret the significance of results using SPSS on the 218 valid questionnaires recovered. The study distributed 230 questionnaires over a two-week period between April 7th and April 21st of 2014, deducting invalid questionnaires with omitted replies or repeated selection, a total of 218 valid questionnaires were received, reaching a 94.8% of recovery rate for valid questionnaire.

In the analysis of measurement model, the study will apply Confirmatory Factor Analysis (CFA) to test the questionnaire reliability and validity.

Reliability and Convergent Validity Analysis

The reliability of individual question is analyzed through factor loading with threshold greater than 0.5 (Hair, et al., 1998), and composite reliability and Cronbach's α greater than 0.7 to assure internal consistency (Chin & Newsted, 1999). The average variance extracted (AVE) must be greater than 0.5 to address the construct with sufficient convergent validity (Fornell & Larcker, 1981).

The study applies CR value to test the internal consistence in all variables, and refer to Tables 3 and 4 for the individual reliability. Such results reveal that the overall variables have value over 0.7 and the questionnaire contains consistency. With regards to validity, the AVE value on Table 3 first shows values greater than 0.5. Secondary, the results of cross-loading shows that (Table 5) load value for the measurement of each potential variable is greater than other potential variables, which supports for further path analysis. Finally the analysis on Kaiser-Meyer-Olkin (KMO) shows that the quantity of sampling applicability for each variable approaches 0.7 or higher (Table 3), indicating all have reached the acceptable value of 0.6. Moreover with regards to the Bartletts' spherical test, all values show significance ($p<.001$). The correlation between factors is presented in Table 4, where sufficient correlation is present and suitable for taking the path analysis in the next step.

Table 3. Reliability and validity analysis

	AVE	Composite Reliability (CR)	Cronbach's Alpha
Perceived Ease of Use	0.715	0.886	0.804
Perceived Usefulness	0.784	0.912	0.846
Attitude	0.732	0.902	0.865
Intention to Use	0.684	0.948	0.912
Risk Factors	0.645	0.845	0.786

Source: The Study

Table 4. Correlation coefficient of variables

	Perceived Ease of Use	Perceived Usefulness	Attitude	Risk Factors	Intention to Use
Perceived Ease of Use	1	0	0	0	0
Perceived Usefulness	0.678	1	0	0	0
Attitude	0.671	0.262	1	0	0
Intention to Use	0.774	0.573	0.736	1	0
Risk Factors	-0.403	0.042	-0.578	-0.436	1

Source: The Study

Table 1. Cross-loading relationship

Question Code	Perceived Ease of Use	Perceived Usefulness	Attitude	Risk Factors	Intention to Use
easy1	0.852	0.423	0.786	-0.515	0.678
easy2	0.921	0.556	0.67	-0.462	0.795
easy3	0.759	0.768	0.134	0.054	0.456
useful1	0.631	0.886	0.21	0.021	0.452
useful2	0.489	0.782	0.257	0.032	0.548
useful3	0.632	0.89	0.183	0.042	0.468
attitude1	0.634	0.241	0.921	-0.632	0.674
attitude2	0.645	0.342	0.926	-0.431	0.672
attitude3	0.638	0.218	0.93	-0.668	0.736
attitude5	0.26	-0.012	0.612	-0.139	0.424
risk1	-0.121	0.24	-0.303	0.812	-0.184
risk2	-0.154	0.163	-0.286	0.65	-0.12
risk3	-0.518	-0.118	-0.652	0.886	-0.535
intention1	0.732	0.545	0.7	-0.421	0.928
intention2	0.717	0.495	0.613	-0.337	0.856
intention3	0.685	0.593	0.574	-0.335	0.746
intention4	0.694	0.49	0.634	-0.392	0.878
intention5	0.668	0.525	0.584	-0.286	0.832
intention6	0.544	0.582	0.326	-0.094	0.794
intention7	0.62	0.463	0.423	-0.253	0.835
intention8	0.542	0.514	0.514	-0.303	0.87

Source: The Study

Structural Model Analysis

The study tests the research hypotheses using structural equation modeling and applies the suggestions of test results to prepare a comprehensive description on the construct relationship of test results. The structural model of the study analyzes the path coefficient of construct relationships with the result of structural model analysis shown in Figure 4. The perceived usefulness in small and medium manufacturers for the manufacturing servitization of innovative product development model is subject to the significant and positive impact from perceived ease of use (path coefficient is 0.668, t value is 13.378, $p<0.001$). The attitude is subject to the significant and positive impact from perceived ease of use (path coefficient is 0.635, t value is 7.139, $p<0.001$). The intention to use in small and medium manufacturers for the manufacturing servitization of innovative product development model is subject to the significant and positive impact from perceived usefulness (path coefficient is 0.405, t value is 8.783, $p<0.001$). The intention to use is subject to the significant and positive impact from attitude (path coefficient is 0.625, t value is 18.435, $p<0.001$). The risk factors of previous hypothesis is subject to the significant and negative impact from attitude (path coefficient is -0.345, t value is 5.358, $p<0.001$). The attitude in small and medium manufacturers for the manufacturing servitization of innovative product development model did not receive significant support for

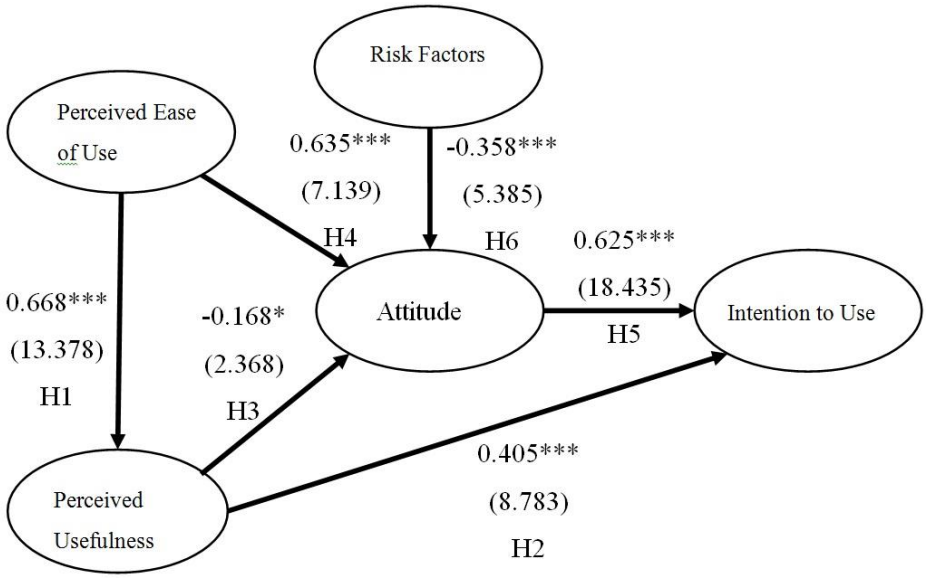

Figure 4. Comparison between the results and research hypotheses for path coefficients (t value) and explanatory variables

*Notes: Figures outside of parenthesis denote path coefficient; figures inside the parenthesis denote t-value. *p<0.05(t>1.645) ;**p<0.01(t>2.326) ;***p<0.001(t>3.090).*

Table 2. Summary of research hypotheses and test results

Research Hypotheses		Construct Relationship	Path Coefficient	t Value	Test Results
H1	The perceived ease of use in small and medium manufacturers for manufacturing servitization of innovative product development model will have positive impact on perceived usefulness.	EASY->USE	0.668	13.378	Supported
H2	The perceived usefulness in small and medium manufacturers for manufacturing servitization of innovative product development model will have positive impact on perceived intention to use.	USE->INT	0.405	8.783	Supported
H3	The perceived usefulness in small and medium manufacturers for manufacturing servitization of innovative product development model will have positive impact on intention to use.	USE->AT	-0.168	2.368	Unsupported
H4	The perceived usefulness in small and medium manufacturers for manufacturing servitization of innovative product development model will have positive impact on attitude.	EASY->AT	0.635	7.139	Supported
H5	The attitude in small and medium manufacturers for manufacturing servitization of innovative product development model will have positive impact on intention to use.	AT->INT	0.625	18.435	Supported
H6	The risks in small and medium manufacturers for manufacturing servitization of innovative product development model will have positive impact on attitude.	RISK->AT	-0.358	5385	Unsupported

Source: The Study

perceived usefulness (path coefficient is -0.153, t value is 3.342, p<0.001).Hence the results of PLS structural model analysis show that among the research hypotheses proposed by the study, four out of six hypotheses are supported. The research hypotheses, construct relationship, path coefficient, t value, and test results for all tests are summarized in Table 6.

CONCLUSION

The research result show that the attitude affecting small manufacturers using innovative product development model mainly consists of perceived ease of use, while perceived usefulness, risk and attitudes do not have positive impact. Apart from attitude, the factors affecting customers' intention to use also include perceived usefulness, perceived ease of use and risk factors with the use of variables.

Findings from final interview

The study questions three senior managers with the analytical results through conducting interview with experts in addition to applying verbal protocol analysis to derive the model with the following significant suggestions in corporate use:

(1) Priority on marketing effects

For the manufacturers, the ultimate goal is profit seeking and hence in the introduction of product development model to service design, the manufacturer should identify the ratio between market planning and promotional methods by increasing the establishing of virtual mall (online promotion or shopping cart model), in addition to allying and integrating with existing stores to reduce expenses and costs while developing more marketing lines or taking free ride on other industry for product promotion. Once the marketing is confirmed, the manufacturer shall infer to how to change and produce in terms of manufacturing and design to accomplish the subsequent success benefits.

(2)Internal coordination and identify of company

During the interview, the manufacturers admit that corporate culture could be one barrier in reforms and the authority must identify with reforms and coordinate the internal education training with the departments while the upstream/midstream/downstream stakeholders can coordinate to agree with the change of cooperation model. Such communication and coordination are quite difficulty and require much identification of interest allocation. A good planning model usually takes time to acquire agreement from all employees in terms of internal coordination of the company and hence the best execution requires searching for the key executer and compromisers for cooperation.

Due to the difficulty in coordination, it is suggested that the employees to form new company or new department with development of new production and sales line in order to break away from the existing tradition of the company.

(3)Importance of technology and manufacturing

In the process of innovation, core technology is still the main ground for competition while new development model is merely a result to make up for the deficiency. In transition from OME to ODM or OBM, the core competition of the company may vary due to costs and benefit consideration while taking care of the partners from startup stage. The small and medium manufacturers need to strengthen their service level through acquiring patent for technology application and maintaining the technical competitiveness, followed by allocating a ratio of capital surplus on promotion and marketing.

Suggestions for manufacturing sertivization value

In view of the findings from the research results, the study proposes the following issues related to innovative product development model with suggestions for the application and manufacturing servitization value:

1. The study suggest that the manufacturing industry should not emphasize only on the innovative product development model to reduce costs and

expenditure but should help small and medium manufacturers to understand more the effectiveness of innovative product development model. Such clear and explicit understanding of innovative product development model can help boost the efficiency and product acceptance for product development. It is believed that the small and medium manufacturers will improve the perceived usefulness of innovation product development model. Moreover, the small and medium manufacturers should strengthen their understanding on the application of innovative product development model for development simplicity (namely ease of use), and consequently the small and medium manufacturers will increase perceived usefulness of innovative product development model.

2. The study results show that small and medium manufacturers tend to have more intense intention to use the product model when they discover the new development models can better meet their current requirement, past experiences, values, and development models. Hence the study suggest that relevant research institutes (or planning department) should help small and medium manufacturers to understand there is not much difference between new product development model and traditional development methods (the difference lies only on the different proportion of keys), consequently receiving the same perception as before. The study suggests that the current marketing channel and service design application lack diversity and such situation could lower the perception of compatibility in small and medium manufacturers, and thereby the study suggests the planning department to expand the education on the scope of service design application in order to effectively promote the development mechanism for new product development model.
3. Small and medium manufacturers often could not accept unfamiliar new product development process immediately, mainly because of the unfamiliarity with the new product development process. To reduce such situations, the promotion and training through advertising and government related agencies or the holding of case sharing will help small and medium manufacturers intending to try or are using to form subjective norms unknowingly. Consequently small and medium manufacturers will show more intention to adopt innovative product development model.
4. It is suggested that more planning consulting company or planning departments should understand the types of effects which the adopting of innovative product development model can bring to the small and medium manufacturers, in order to increase the cope of application of innovative product development model without constraining to specific manufacturers, and thereby improving the intention to use the model in small and medium manufacturers.
5. Enhance the emphasize on consumer-service orientation to help the industries fully apply service design advantage in transition to analyze consumer demand, and thereby applying reverse derivation thinking to bring product development even closer to the situations and user mindset of consumers.

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