CHAPTER 6

RESEARCH MODEL AND HYPOTHESIS

6.1 Research Model

The research model shown the conceptual framework of this study in the context of Electronics Manufacturing Service (EMS) provider.

This study is designed to evaluate the success factors of New Product Introduction (NPI) in Electronics Manufacturing Service (EMS) provider by answering the folowing questions:

1. Do company's capabilities have significant affect and contribute to the fast and effective new product introduction process; thus leading to a successful new product introduction process?

2. Which improvements should be implemented to improve these practices?

The framework of this study consists of five constructs. Successful New Product Introduction (NPI) is the **dependent variable**. The **independent variable** are firm's capailities which include Knowledge Integration, Problem Solving and Uncertainty Reduction, Continuous Concurrency, and Simplicity.

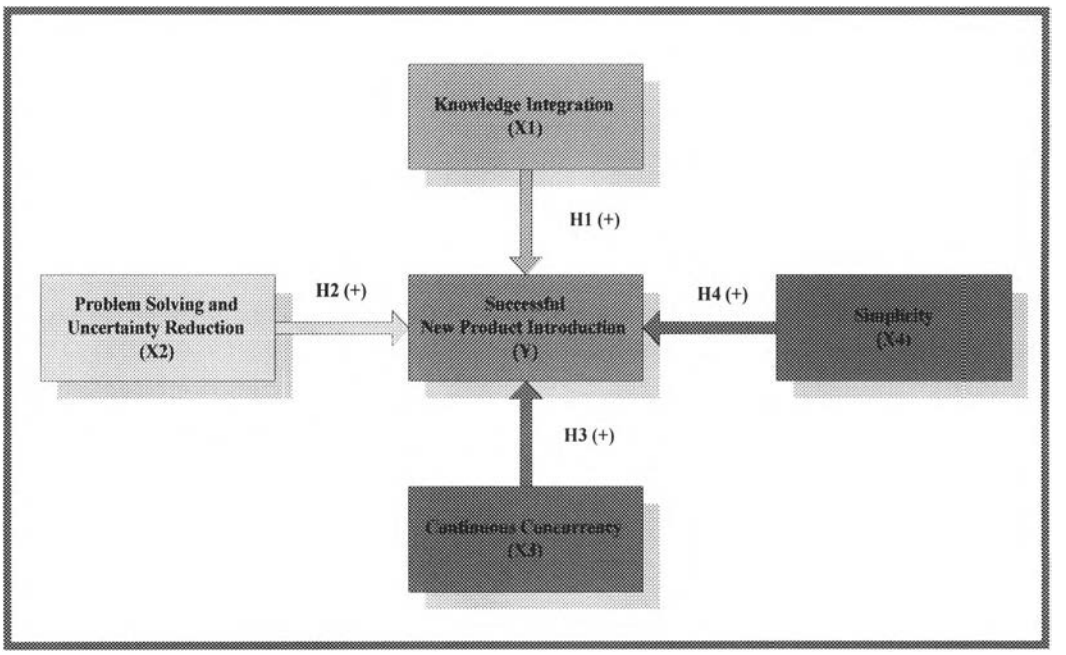

Figure 6.1: Research Framework

6.2 Variables

1. **Dependent Variable: Successful New Product Introduction**

   Successful new product introduction in this study is focused on fast and efficient new product introduction process.

2. **Independent Variables:** Knowledge Integration, Problem Solving and Uncertainty Reduction, Continuous Concurrency, and Simplicity

2.1 Knowledge Integration

A company's ability to integrate and embed in shared knowledge, learning and communication and information evaluation.

2.1.1 Shared knowledges in this study are shared knowledge of customer, supplier, and internal capabilities.

- **Shared knowledge of customer** refers to the extent of a shared understanding of current *customers*' needs and future value to customer creation opportunities among product development members.

- **Shared knowledge of supplier** refers to the extent of the shared understanding of *suppliers'* design, process, and manufacturing capabilities among product development team members.

- **Shared knowledge of internal capabilities** refers to the extent of a shared understanding of the firm's internal design, process and manufacturing capabilities among product development members.

2.1.2 Learning in this study is the ability to sustain significant improvements in development over long periods of time rests on the capability to learn from experience.

2.1.3 Communication and information evaluation capability refers to the ability to has effectively use of communication and information flow between the team.

2.2 Problem Solving and Uncertainty Reduction

A company's ability to identify and solve problems early and the ability to avoid and reduce uncertainty already in the early phases by applying quality management practices such as lean, TQM, and countinuous improvement principles.

2.3 Continuous Concurrency

A company's ability to overlap tasks in the early phases and keep relevant people and functions continuously involved from the early to the late phases under the supportive from top management. By the use of cross-functional or multidiscipline team, close relationship with customers and suppliers, top management commitment and visible support will lead to successful continuous concurrency.

2.4 Simplicity

A company's ability to *reduce complexity* in products, processes, systems, documentation, and organization, and by this reducing the overall development task and making the individual tasks simpler, thus enabling the other capabilities. By applying the following tools and practices will promote two strategic capabilities, cross-functional integration and an efficient and effective NPD process, which can then become a source of competitive advantage.

6.3 Hypotheses

Based on the research objectives and the literature review, four main research hypotheses are formulated to guide the objectives of this study. Four propositions are also developed for this study. The propositions and hypotheses of the study are:

Proposition 1: A company's ability to integrate and embed in shared knowledge, learning and communication and information evaluation have significants positive effect on successful New Product Introduction.

X_1 : A team's ability to integrate and embed in shared knowledge and understanding of current *customers*' needs and future value to customer among product development members have significants positive effect on successful New Product Introduction.

X_2 : A team's ability to integrate and embed in shared understanding of *suppliers*' design, process, and manufacturing capabilities among product development team members have significants positive effect on successful New Product Introduction.

X_3 : A team's ability to integrate and embed in shared understanding of the firm's internal design, process and manufacturing capabilities among

product development members has significants positive effect on successful New Product Introduction.

X_4 : A team's ability to integrate and embed in sustain significant improvements in development over long periods of time rests on the capability to learn from experience has significants positive effect on successful New Product Introduction.

X_5 : A team's ability to has effectively use of communication and information flow between the team has significants positive effect on successful New Product Introduction.

Proposition 2: A company's ability to identify and solve problems early and the ability to avoid and reduce uncertainty already in the early phases by applying quality management practices such as lean, TQM, and countinuous improvement principles have significants positive effect on successful New Product Introduction.

X_1 : A team's ability to identify and solve problems in the early phases is essential to succession of the NPI project has significant positive effect on successful New Product Introduction.

X_2 : A team's ability to avoid and reduce uncertainty already in the early phases is essential to succession of the NPI project has significant effect on successful New Product Introduction.

X_3 : Applying quality management practices such as lean, TQM, and countinuous improvement principles will lead to succession of the NPI project has significant effect on successful New Product Introduction.

Proposition 3: A company's ability to overlap tasks in the early phases and keep relevant people and functions continuously involved from the early to the late phases under the supportive from top management by the use of cross-functional or multidiscipline team, close relationship with customers and suppliers, top management commitment and visible support have significants positive effect on successful New Product Introduction.

X_1 : A team's ability to overlap tasks in the early phases has significant positive effect on successful New Product Introduction.

X_2 : A team's ability to keep relevant people and functions continuously involved from the early to the late phases by the use of cross-functional or multidiscipline team has significant positive effect on successful New Product Introduction.

X_3 : Supportive from top management or team champion/ leader has significant positive effect on successful New Product Introduction.

Proposition 4: A company's ability to *reduce complexity* in products, processes, systems, documentation, and organization by applying the standardize tools and practices have significants positive effect on successful New Product Introduction.

X_1 : A team's ability to *reduce complexity* in products, processes, systems, documentation, and organization by reducing the overall development task and making the individual tasks simpler have significants positive effect on successful New Product Introduction.

X_2 : Applying the standard tools and practices such as Design for Manufacturability, Design of Experiments, Computer-based tools, Prototype, etc. have significants effect on successful New Product Introduction.

6.4 Methodology of the study

This thesis will addresses the success factors in New Product Introduction process through a thorough review of literature and field interview. An analysis of the current situation will be performed by questionnaire to selected personnel from corporate management and new product introduction team.

The analysis will reveal some important improvement points for the new product introduction process. And strategies for implementing an improved new product introduction process will be suggested.

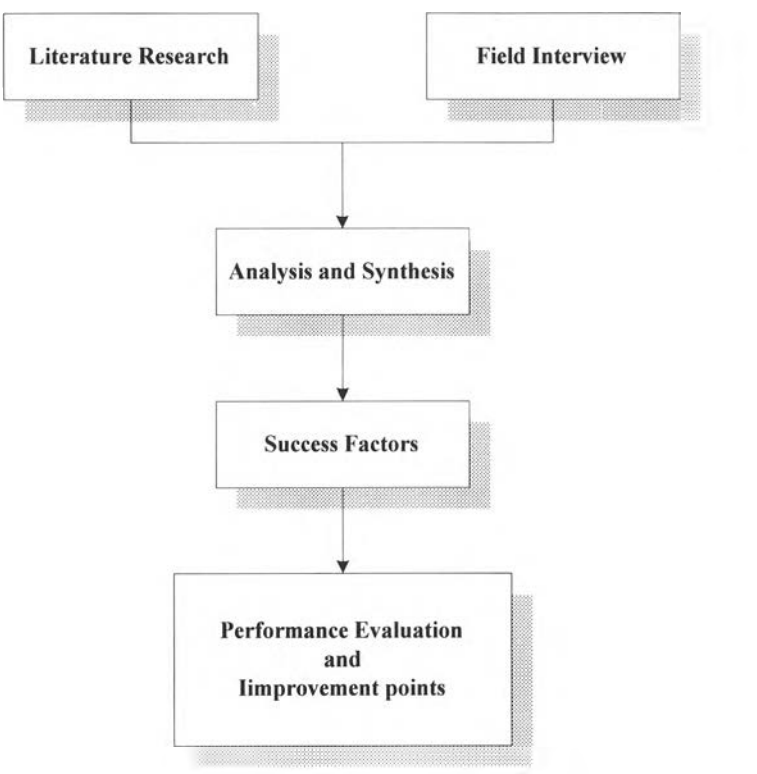

Figure 6.2: Methodology for identifying NPI success factors and performance evaluation and improvement

6.5 Research Design

The research design includes population, sampling method, survey instrument, pre-test of survey instrument, and data collection.

1. Population

Thai Electronics Manufacturing Service providers (EMS), Fabrinet Co., Ltd, will be used as the population. Sampling frame for this study is the NPI projects in the company, totally 17 projects. People concerning in all projects are 140 people.

2. Sampling Method

Sampling method for this study will be used questionaire survey to all projects in the case company. The total sample size in this study is 140 people which equal to the population.

3. Survey Instrument

The survey instrument was developed to investigate factors influential in successful new product introduction. The survey questionnaires were developed from the following researchers;

- Jenny C. Lövsund and Thomas H. Spiegelberg, "Communicating Knowledge in Globally Dispersed Teams", 2002.

- Robert de Graaf, "Assessing Product Development: Visualizing Process and Technology Performance with RACE (the Readiness Assessment for Concurrent Engineering)", 1996.

- Sarah Jane Caffyn, "The scope for the application of continuous improvement to the process of new product development", 1998.

The survey instrument consisted of the cover letter and four parts. The cover letter contained the reason for this study and explained its role focusing on

academic research. The questionnaire contained five sections designed to attain the required information for the purpose of the study.

This survey divided into 4 sections:

Section 1: New Product Introduction Personnel Background

Section 2: New Product Introduction Project Background

Section 3: New Product Introduction Performance Evaluation

Section 4: New Product Introduction Success Factor Evaluation

The cover letter and survey instrument were distributed to the individuals target in the case company by hand in order to encourage their coorperation.

4. Pretest of the measurement Instrument

A pretest of the measurement instrument was conducted in two stages. First, the survey questionnaire was distributed to several new product introduction team members including top managements. Each participant was asked to provide comments after completing the questionnaire regarding the layout, wording, and ease of understanding of the measurement items (Zikmund 2000). The feedback was then taken into account in the second revision of the questionnaire. Second, the revised questionnaire was tested through a group of convenience samples consisting of new product introduction team members in the case company, totally 20 peoples. The survey questionnaires received were reviewed against research objectives then revised and considered in the final revision of the survey instrument.

5. Data Collection

Data will be collect from two major sources as following details.

a. Primary data

Primary data will be obtained from questionaire survey

b. Secondary data

Secondary data will be obtained from literature survey such as academic journals or textbooks.

6.6 Scoring of the scale

As emphasized by Dawes (1992), scoring must be consistent. Thus if it is decided that on a positive statement a high score of 5 is for Strongy Agree, then a score of 1 should be for Strongly Disagree. Negative statements must be scored with a 1 for Strongly Agree and a 5 for Strong Disagree.

It is important to take note of such reversals. On the Likert-type scale constructed for this particular study, responses were graded for each statement, and were expressed in term of the following five catergories,

Question which evaluate the new productintroduction performance will scoring as;

1: Never
2: Rarely
3: Casually
4: Nearly Always
5: All the Time

Question which evaluate the new product introduction success factors will scoring as;

1: Strongly Agree
2: Agree
3: Undecided
4: Disagree
5: Strongly disagree

The use of the 5-point Likert scale gave the participants a wider choice of options to their reponses. The scoring system helped to indicate inappropriate responses. The chief advantage of the Likert scale is that it is based on the

repondent's perspectives rather than on researcher's construction. Coding and categorizing such data is easy and manageable.

6.7 Validity and Reliabilty of the Instruments

Validity and reliability of the questionnaires for success factor evaluation and performance evaluation are analyzed by using Cronbanch's Alpha method to verify internal consistency of the questionnaire instrument. Good reliability of questionnaire instrument should be nearly or equal 1. Below are the results of Cronbanch's Alpha test of each questionnaire.

Section 3, New Product Introduction Performance Evaluation;

- Cronbanch's Alpha test result for reliability of questionnaire regarding performance evaluation in knowledge integration, table 1, shown reliability coefficients = 0.8332 which indicated a high reliable of the instrument.
- Cronbanch's Alpha test result for reliability of questionnaire regarding performance evaluation in problem solving and uncertainty reduction, table 2, shown reliability coefficients = 0.8279 which indicated a high reliable of the instrument.
- Cronbanch's Alpha test result for reliability of questionnaire regarding performance evaluation in continuous concurrent, table 3, shown reliability coefficients = 0.7828 which indicated a high reliable of the instrument.
- Cronbanch's Alpha test result for reliability of questionnaire regarding performance evaluation in simplicity, table 4, shown reliability coefficients = 0.9024 which indicated a high reliable of the instrument.

Section 4, New Product Introduction Success Factor Evaluation;

- Cronbanch's Alpha test result for reliability of questionnaire regarding success factor evaluation, table 5, shown reliability coefficients = 0.9254 which indicated a high reliable of the instrument.

From above Cronbanch's Alpha test results, all questionnaires from table 1, 2, 3, and 4 indicated a high reliable of the instruments.

6.8 Data Analysis

To effectively complete an analysis of the data, a quantitative method of analysis was applied. The hypotheses corresponding to the study objectives were analyzed using Statistical Package for Social Sciences Program (SPSS, V. 10.0). All results were considered to be statistically significant at the .05 or better probability level.

Several steps were taken to explore the study objectives and test the hypotheses. Descriptive statistics was performed on all variables to obtain frequencies, mean, maximum and minimum value. Chi-square tests of independence were also used. The chi-square statistic (i.e., cross-tabulations) was chosen to test the non-continuous data variables because of its proven ability to accurately evaluate the discrepancy between a set of observed frequencies and a set of expected frequencies.

To check agreement or performance of the team, average results from question 1 – 13 of each respondent in section 3 and section 4 will be calculated and statistically evaluated the agreement or performance level by using the following concepts;

Agreement or Performance Interval = (maximum value – minimum value) / total level

From above concepts, the team agreement or performance levels are as below;

Interval = (5 – 1) / 5 = 0.8

Very High	4.21	to	5.00
High	3.41	to	4.20
Middle	2.61	to	3.40
Low	1.81	to	2.60
Very Low	1.00	to	1.80

To check the proposition and hypotheses, results of team's performance in Knowledge Integration, Problem Solving and Uncertainty Reduction, Continuous Concurrency, and Simplicity will be statically evaluated against evaluation results of company success factors in order to verify their correlation.

The correlation between two variables reflects the degree to which the variables are related. The most common measure of correlation is the Pearson Product Moment Correlation (called Pearson's correlation). When measured in a population the Pearson Product Moment correlation is designated by the Greek letter rho (ρ). When computed in a sample, it is designated by the letter "r" and is sometimes called "Pearson's r." Pearson's correlation reflects the degree of linear relationship between two variables. It ranges from +1 to -1. A correlation of +1 means that there is a perfect positive linear relationship between variables. The scatterplot shown below depicts such a relationship. It is a positive relationship because high scores on the X-axis are associated with high scores on the Y-axis.

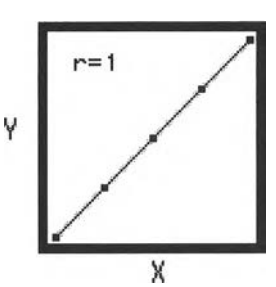

Figure 6.3: The scatterplot of positive linear relationship between two variables

A correlation of -1 means that there is a perfect negative linear relationship between variables. The scatterplot below shown to the right depicts a negative relationship. It is a negative relationship because high scores on the X-axis are associated with low scores

on the Y-axis. A correlation of 0 means there is no linear relationship between the two variables.

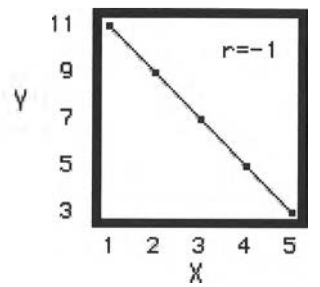

Figure 6.4: The scatterplot of negative linear relationship between two variables

The below graph shows a Pearson correlation of 0, correlations are rarely if ever 0, 1, or -1.

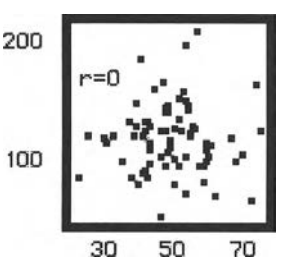

Figure 6.5: The scatterplot of no linear relationship between two variables