THESIS APPROVAL

GRADUATE SCHOOL, KASETSART UNIVERSITY

Doctor of Engineering (Industrial Engineering)

DEGREE

Industrial Engineering — **FIELD**

Industrial Engineering — **DEPARTMENT**

TITLE: Productivity Measurement and Analysis: Adapting Intellectual Capital for Manufacturing Firms

NAME: Mr. Narongsak Comepa

THIS THESIS HAS BEEN ACCEPTED BY

-- **THESIS ADVISOR**

(Associate Professor Kongkiti Phusavat, Ph.D.)

-- **THESIS CO-ADVISOR**

(Mr. Pornthep Anussornnitisarn, Ph.D.)

-- **THESIS CO-ADVISOR**

(Associate Professor Bordin Rassameethes, Ph.D.)

-- **DEPARTMENT HEAD**

(Associate Professor Anan Mungwattana, Ph.D.)

APPROVED BY THE GRADUATE SCHOOL ON --

-- **DEAN**

(Associate Professor Gunjana Theeragool, D.Agr.)

THESIS

PRODUCTIVITY MEASUREMENT AND ANALYSIS: ADAPTING INTELLECTUAL CAPITAL FOR MANUFACTURING FIRMS

NARONGSAK COMEPA

A Thesis Submitted in Partial Fulfillment of
the Requirements for the Degree of
Doctor of Engineering (Industrial Engineering)
Graduate School, Kasetsart University
2012

Narongsak Comepa 2012: Productivity Measurement and Analysis: Adapting Intellectual Capital for Manufacturing Firms. Doctor of Engineering (Industrial Engineering), Major Field: Industrial Engineering, Department of Industrial Engineering. Thesis Advisor: Associate Professor Kongkiti Phusavat, Ph.D. 214 pages.

This research aims to examine whether the intellectual capital (IC) measurement can be used for productivity measurement. Given the increasing importance of intangible assets in an organization, traditional productivity measurement techniques and practices which were derived from tangible assets may not be applicable and appropriate. This is highlighted by the use of emerging terms such as creative or knowledge-based economy. Therefore, IC has become an important factor in an organization. This research consists of two parts. The first part deals with productivity measurement while productivity analysis is the prevailing efforts for the second part.

For the first part, the IC measurement tools are VAIC and the IC index. The correlation technique was used to validate the IC measurement tools. The findings show that both VAIC and the IC index are suitable for measuring productivity at manufacturing firms. The VAIC is a lagging indicator, and the IC index is considered as a leading indicator. For the second part, the IC development roadmap is developed to help analyze productivity information. This roadmap is derived from knowledge management cycle (KMC), learning organization (LO), self-directed learning (SDL), innovation generation process (IGP), customer knowledge management (CKM), and knowledge management system (KMS). This model shows how the IC is generated. Finally, this IC roadmap model is referred as the SMILE model.

____________________ ____________________ ___ / ___ / ___

Student’s signature | Thesis Advisor’s signature

ACKNOWLEDGEMENTS

I would sincerely like to thank my advisor Associate Professor Dr. Kongkiti Phusavat for giving me the opportunity to do postgraduate research. For his expert and advice, this research always goes to the correct way and high quality.

My thanks also go to Dr. Pornthep Anussornnitisarn, Dr. Rapee Kanchana, and Associate Professor Dr. Bordin Rassameethes for their kind help and useful guidance.

Special thanks to my colleague who always go with me to collect the data, and all respondents who participate in the questionnaire.

Finally, I would also like to thank my family who always give me warm support.

Narongsak Comepa

March 2012

TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

Page

LIST OF TABLES

LIST OF TABLES (Continued)

Appendix Table **Page**

LIST OF FIGURES

Figure **Page**

LIST OF ABBREVIATIONS

AICRS	=	Austrian Intellectual Capital Research Center
CE	=	Capital employed
CFI	=	Comparative Fit index
CI	=	Confident interval
CKM	=	Customer knowledge management
CRM	=	Customer relationship management
df	=	Degree of freedom
EVA	=	Economic value added
FiMIAM	=	Financial method of intangible asset measurement
GDP	=	Gross domestic product
GFI	=	Goodness-of-Fit Index
GNI	=	Gross national income
HQ	=	Head quarter
HU	=	Human capital
IC	=	Intellectual capital
IGP	=	Innovation generation process
IOC	=	Item-Objective Congruence Index
IT	=	Information technology
JIT	=	Just in time
KM	=	Knowledge management

LIST OF ABBREVIATIONS (Continued)

KMC	=	Knowledge management cycle
KMS	=	Knowledge management system
KPI	=	Key performance index
LO	=	Learning organization
MLE	=	Maximum likelihood estimation
MS	=	Mean square
N	=	Number of sample
NFI	=	Normed Fit Index
OECD	=	Organization for Economic Co-operation and Development
RMSEA	=	Root Mean Square Error of Approximation
ROA	=	Return on asset
ROE	=	Return on equity
ROI	=	Return on investment
SC	=	Structural capital
SDL	=	Self-directed learning
SEM	=	Structural equation modeling
STVA	=	Value added efficiency of Structural capital
SS	=	Sum square
S.D.	=	Standard deviation

LIST OF ABBREVIATIONS (Continued)

S&P	=	Standard & Poor's
TLI	=	Tucker Lewis Index
TQM	=	Total quality management
U.S.	=	United State of America
VA	=	Value added
VACA	=	Value added efficiency of capital employed
VAHU	=	Value added efficiency of human capital
VAIC	=	Value added intellectual coefficient
$	=	Dollar

PRODUCTIVITY MEASUREMENT AND ANALYSIS: ADAPTING INTELLECTUAL CAPITAL FOR MANUFACTURING FIRMS

INTRODUCTION

In this chapter, the motivation for investigating intellectual capital management is discussed, together with introductions into intellectual capital definition, classification, measurement and roadmap model. Moreover, the basis of productivity is described which related to the intellectual capital.

Background

Market globalization, technology rapidly change, product life cycle shorter and customer demand rapidly change drive a firm more and more strongly related to the ability to satisfy customer's perception (Schiuma and Lerro, 2008). These reasons force firms to improve their capability to create and deliver value to the customer. Knowledge is the main force which enhances the organization's performance and productivity.

Knowledge is the part of a criterion of Performance Excellence of Malcolm Baldrige National Quality Award (MBNQA). The Measurement, Analysis, and Knowledge Management category the main criterion which examines how organization selects, gathers, analyzes, manages, and improves its data, information, and knowledge assets and how organization manages its information technology. It is an important issue to manage knowledge as Drucker (1999) identified knowledge is the key of driving economic growth in 21^{th} century.

Knowledge is a one kind of intangible asset of organization. Intangible asset becomes important and high contribute value to the firm as trend chart in Figure 1. Figure 1 presents an increasing trend of firm's intangible asset in the United States of America.

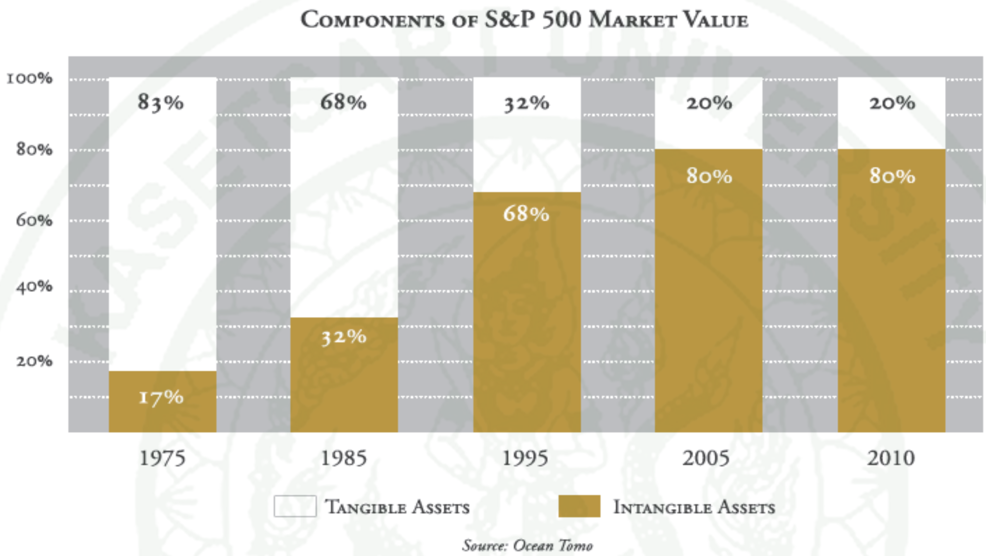

Figure 1 Trend of Intangible asset of U.S. firm (Source: Ocean Tomo.com)

Current knowledge asset is combined to the human capital. Other intangible assets such as brand, goodwill, management philosophy, etc. are combined to structural capital. Human capital and structural capital are a component of Intellectual capital.

Current knowledge economy, Intellectual capital (IC) is a main driving the growth of productivity and a firm's financial performance (Chen *et al*. 2005; Chan 2009; Phusavat *et al*. 2011). Moreover, Marr and Schiuma (2001) and, Carlucci and Schiuma (2007) defined IC as a bundle of knowledge assets, represents an essential factor for best enhancement and support an organization performance improvement. Firm develops IC same as the firm enhance the growth of productivity and organization's performance. So the research question is

Can measuring Intellectual capital be used as a substitute for productivity measurement?

To answer the research question, the concern questions are published. There questions are

What is intellectual capital and how to measure intellectual capital?

What is a relationship between intellectual capital and productivity?

The answers of these questions will answer the research question. If the assumption of the research question is true, the intellectual capital development roadmap will be provided. The intellectual capital development roadmap is useful for enhancement the productivity.

A relationship between productivity and intellectual capital

The productivity shift from labor worker to knowledge worker (Drucker, 1999) in knowledge economy, the growth of productivity is enhanced by knowledge worker as the result in Table 1. Table 1 shows a percentage of knowledge worker trend compare with national productivity in developed region.

Table 1 Percentage of knowledge worker and the national productivity

North America	% Knowledge worker	GNI per capita (US $)
Year: 2000	35.25%	33638
Year: 2001	36.23%	34195
Year: 2002	57.14%	34660
Year: 2003	57.66%	36971
Year: 2004	58.02%	40654
Year: 2005	58.27%	43495
Year: 2006	58.84%	45309
Year: 2007	59.54%	46195

Source: World Bank.org

The percentage of knowledge worker is the proportion of labor force that has a tertiary education, as a percentage of the total labor force.

Knowledge worker was first presented by Peter Drucker (1959). Knowledge worker is a worker who works primarily with information or develops and uses knowledge in the workplace. Knowledge worker acquire knowledge through education background, organization database system (Duffy, 2001), experience and personal interaction (Nonaka, 1994). Moreover, they spent their knowledge to achieved organization's goal.

To manage knowledge worker in the organization, firm needs to understand what are the key different between manual work and knowledge work. Table 2 presents the comparison and contrast between Taylor's thinking on manual work with Drucker's on knowledge work:

Table 2 Compare and contrast between Taylor's thinking on manual work with Drucker's on knowledge work

Frederick Taylor on Manual Work	Peter Drucker on Knowledge Work
Define the task	Understand the task
Command and control	Give Autonomy
Strict standards	Continuous innovation
Focus on quantity	Focus on quality
Measure performance to strict standard	Continuously learn and teach
Minimize cost of workers for a task	Treat workers as an asset not a cost

Source: Phusavat *et al*. (2009)

Knowledge of worker is an intangible asset in the organization. In addition, knowledge is an intangible asset of human capital. Human capital represents all intangible asset of human such as attitude, motivation, skill, experience, knowledge etc. Base on Table 2, organization needs to provide goal (management philosophy), learning system, IT system and some strategic tools for enhancement the productivity of knowledge worker. The management of philosophy, learning system, IT system, etc. are also the intangible asset in the organization. The name of this kind of intangible assets called structural capital. Human capital and structural capital are the component of intellectual capital. Thus organizations measure intellectual capital meanwhile they measure the productivity at the upstream level.

Intellectual capital definition

Since the word "Intellectual capital" has been used, many researchers attempted to define and get agreement for its definition. By the way, it’s not concluded yet. In order to more understanding, the summary of definitions from many researchers can be concluded as following;

Intellectual capital is the intangible assets of the organization.

Intellectual capital is generated from human and resources.

Intellectual capital contributes to the firm value.

In this research, the definition of intellectual capital can conclude as following;

"Intellectual capital is the intangible assets of organization, which are generated from human (Knowledge, motivation etc.) and resources (Equipment, Computer, IT etc.), and contribute to the firm's value"

Intellectual capital classification

A component of intellectual capital is important. The classification of intellectual capital can help researchers and practitioners better understanding a component of Intellectual capital. In this research, intellectual capital consists of two main capitals. There are the human and structural capitals. A definition of each capital as following;

A. Human Capital is defined as the combined knowledge, skill, innovativeness, and ability of the company's individual employees to meet the task at hand.

B. Structural Capital consists of customer, innovation and process capital.

1. Customer capital is defined as the combined value of the relationships with customers, suppliers, industry associations and markets.

2. Innovation capital is that which creates success in the future and includes intellectual assets and intellectual property.

3. Process capital includes the techniques, procedures, system, and programs that implement and enhance the delivery of goods and services.

Based on the classification of intellectual capital (IC), this research concluded the IC has four components. There are human capital, customer capital, innovation capital, and process capital. The components of IC are used to define the IC key indicators. These IC key indicators will used to establish the strategic of IC development roadmap. On the other hand, organization may apply the IC key indicators for measuring IC at the direct sources.

Problem Statement

Productivity is simply the relationship between the outputs generated from a system and the inputs at the same period of time (Sink, 1985). The concept of productivity should be considered on the levels of national economy, sector level, and firm level (Masayoshi *et al*., 1991). Example of productivity level shows in Figure 2.

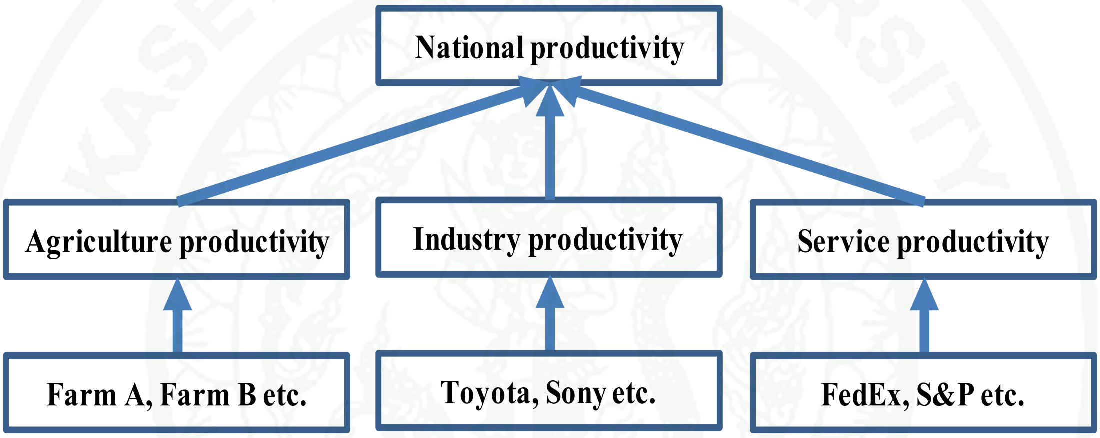

Figure 2 Productivity level

National productivity is combined the agriculture, industry, and service productivity sector. Each productivity sector combined from firms' productivity. Firm increase productivity (firms' wealth) means the national productivity (National wealth) increase. How to know productivity increase or decrease? This question leads to the first reason why we need to measure productivity. Second reason, organization (firm and country) need to benchmark their productivity to the other competitor for improves (plan, manage, evaluate) productivity.

National level, productivity growth is a source of growth in living standards (Wikipedia.org). For firm level, productivity growth means more value is added in production (Wikipedia.org) and enhances firms' wealth.

Developed countries have high productivity and wealth (GDP per capita > 17,000 US$, World economic forum.org), what is the main factor driving productivity growth in developed country? If the number of worker, machine, land or other tangible input factors are the keys of productivity development, why India and China who have highest natural resource (labor, machine etc.) are still in developing country level? Moreover, their GDP per capita are lower than 17,000 US$.

On the other hand Singapore and Taiwan have low natural resource but they are wealth (GDP per capita > 17,000 US$) (Chen et al., 2005). Drucker (1999) identified knowledge worker is the key of driving economic growth in developed country. Currently theorists call knowledge economy. Is that true? So in this chapter, two premises of problem background are provided.

Premise 1: Does current economy shift from labor productivity to knowledge productivity?

Proposal: To prove knowledge that is a main driving of current economy.

Sample procedure: All developed regions are selected. There are North America and OECD members.

Statistical method*:* Simple regression analysis (This hypothesis concerns on trend analysis, so regression analysis is selected for answer the first hypothesis).

Dependent variable is the region value added productivity (GNI per capita, source from World Bank database, the year 1997-2007).

Independent variable is the percentage of labor force with tertiary education per total labor force. (Labor force with tertiary education is the proportion of labor force that has a tertiary education, as a percentage of the total labor force. Data source from World Bank database, the year 1997-2007).

A statistical result proved “Percentage of tertiary education workforce” can be represented as knowledge worker. The detail of statistical result shows in the appendix part (Appendix A).

The details of all variables are shown in Appendix A.

Result:

Regression Statistics	
Multiple R	0.8909
R Square	0.7938
Adjusted R Square	0.7835
Standard Error	3612.5412
Observations	22

ANOVA

	df	SS	MS	F	Significance F
Regression	1	1004938287	1004938287	77.0041	0.000
Residual	20	261009083.40	13050454.17		
Total	21	1265947370			

Note: Simple regression equation is significant at 95% CI.

	Coefficients	Standard Error	t Stat	P-value
Intercept	8517.13	2708.98	3.1440	0.0051
Knowledge worker	570.863	65.05	8.7752	0.0000

Note: There is a high correlation between knowledge worker and national productivity at 95% CI.

Base on statistical result, we have got an acceptance predict equation as follow:

National productivity = 8517.12 + 570.86(Percentage of knowledge worker)

In developed region, they increase knowledge worker 1%, meanwhile national productivity increase 8517.12 US$. Based on the statistical result, the knowledge worker is a main driving the growth of productivity. Current economy has been shift from labor to knowledge productivity especially in developed region. An answer of premise 1 is yes, current economy is a knowledge economy. In developed region, they spend knowledge to enhance the productivity.

Premise 2: Is knowledge high positively affected to Industrial and Service sector productivity?
Proposal: To prove knowledge is a main driving of current industrial and service sector.
Sample procedure: All developed regions are selected. There are North America and OECD member.
Statistical method: Correlation test (Test on a relationship, so the correlation test is selected).
Variable: Agriculture value added productivity, Industrial value added productivity, Service value added productivity, and the percentage of labor force with tertiary education (Source from World Bank database, the year 1997-2007).

Variable data is showing in appendix B.

Result:

	Agri.	Indus.	Serv.
Indus.	0.3940		
	0.0700		
Serv.	0.1990	0.9600	
	0.3750	0.0000	
KW	0.1950	0.8210	0.9030
	0.3840	0.0000	0.0000

Contents: Pearson correlation
P-Value

Note: P-value < 0.05 means correlate significant at 95% CI.

In developed region, knowledge worker highly correlated with Industrial (82%) and Service sector (90%). The statistical result related to the first premise, and can conclude “knowledge is the key driving of national wealth and it most valuable on Industrial and Service sector”. This evident show and support the tertiary education work force can represent in term of knowledge worker and their knowledge asset highly affected to the growth of productivity (National wealth).

Developed country is wealth and high growth on productivity. This trend synchronizes with the growth on intangible assets of firm (See Figure 1). The firm of developed country aware on IC, and they try to measure and manage IC for enhancement their productivity. IC drives the firm productivity level and the firm productivity affected to the national productivity level. Thus the measurement and management of IC in firm are the keys practice of developed country in new era of productivity management. Firm of developing country needs to be considered for measuring and managing IC same as the firm of developed country.

Generally, capital is asset that will produce future cash flows. The most well-known asset type is the tangible in nature. Tangible capital refers to the physical and financial assets of the firm. The value of tangible asset is easily defined. Tangible asset is easy to measure, report and manage. Intangible assets (Intellectual capital) on the other hand, such as the knowledge of employee and its organization management strategic, are increasingly important towards driving future value added and productivity. However, they are much harder to define their intangible assets, harder to measure and harder to manage.

In conclude, the problem statements of the research are synchronized with the research question as following problem assumption;

1. What is IC? And how to measure IC?
2. What is IC role and impact on the organization’s productivity?
3. How to develop IC in the organization?

The research aims to introduce the definition and the dimension of IC. Then, provide the IC measurement tool by verify a relationship between IC and the productivity. At the final the research process, the IC development roadmap model is introduced. The IC development roadmap provides the procedure how to enhance the productivity through managing the IC. Moreover, the role of IC development model as a function of productivity analysis.

OBJECTIVES

Based on the important of IC in current economy, management level needs to understand in IC's characteristics, the research aims to gain managerial insights and eventually develop a definition and classification of IC. This characteristic of IC would help to define the IC key indicator (Leading indicator) and a measurement tool of IC (Lagging indicator). The IC key indicator is used to develop an IC development roadmap as a role of leading indicator. In addition, the IC measurement tool is used to measure a performance of organization's productivity as a role of lagging indicator. Both IC leading and lagging indicators are used to test a relationship between IC and productivity. In short, the research has three majority objectives.

The objectives of this research are

1. To provide a summary of the IC definition and classification.
2. To verify IC key indicator and IC measurement tool (Productivity measurement).
3. To provide an IC development roadmap (Productivity analysis)

The first output of the research is the conclusion of IC definition and the IC classification. This output can help practitioner to understand the concept of intangible assets in the organization. Moreover, the output also help practitioner aware on how IC contribute value and productivity to the manufacturing firms. The first output is presented in the introduction chapter of this research (Problem background section).

The second, output of the research is the suitable IC measurement tool. This measurement tool can be used to benchmark with other competitors by referring the data in the annual report. This measurement tool helps manufacturing firm to monitor an efficiency of investment in IC. At this stage of research, the answer of the research question is provided through a relationship between IC and productivity.

The final output of the research is the extension of the IC key indicator. The IC strategic roadmap model is introduced in this stage. Manufacturing firm can apply the IC development roadmap model to enhance the organization's productivity.

Research Framework

This research involves the intangible assets of manufacturing organization. These intangible assets are combined and called IC. Start from the first step, a definition of IC would clarify before proceed to the next step. In addition, a classification of IC should be completed also in the first step. Second step is proved a relationship between IC and the organization's productivity. This step is used to verify a usefulness of measurement on IC and answer the research question.

After IC is verified and result shows IC is important and affected to the manufacturing organization's productivity. Then management level should be known how to measure, manage, and develop IC in the organization. First and second steps show how to measure IC in the organization. In addition, the third step shows how to enhance productivity through the IC development roadmap model.

This research starts from define a definition and classification of IC, and then provides a suitable tool for measurement IC in the organization. The IC measurement tool is verified by testing a relationship between IC and organization's productivity. At the end of the research process, IC development roadmap model is constructed by literature review on IC, and the model is verified by using the structural equation modeling technique. The research process shows as a research framework in figure 3.

Intellectual capital definition and classification: To answer

- What is IC? And Why IC is important in new economy?

↓

Intellectual capital measurement tool: To answer

- What is the suitable measurement tool of IC?
- What is the relationship between IC and manufacturing firm's productivity?

↓

Roadmap Model for enhancing Intellectual capital: To answer

- How to develop IC in the organization?

Figure 3 Research framework

The research framework is based on "Engineering Process", which consists of analysis and synthesis processes.

Analysis process is concerned with resolving something into its basic elements (Concerned with existing systems).

Synthesis process is concerned with combining elements into a whole (Concerned with a new or improved system).

This research starts from define a definition of IC and then decompose it into an IC's component (Analysis process). At the final, IC improvement system is provided by IC development roadmap model (Synthesis process).

Based on the research framework, the hypothesis of the research as following;

Research hypothesis 1: IC has a strong positive correlation with the productivity.
Research hypothesis 2: Refer to the construction of the IC development roadmap.

The construction of the IC development roadmap based on the literature review. The directions of arrow represent a relationship between variables in the model. These variable relationships are the hypothesis of the research hypothesis 2.

IC development roadmap model and Hypothesis

The IC development roadmap model conceptual called "SMILE" model. "SMILE" model is from,

S	=	**S**elf-directed learning
M	=	**M**anage employee and customer knowledge
I	=	**I**nnovation generation process
L	=	**L**earning organization
E	=	**E**lectronic information data base and communication system

Figure 4 represents the construction of SMILE model (Conceptual model).

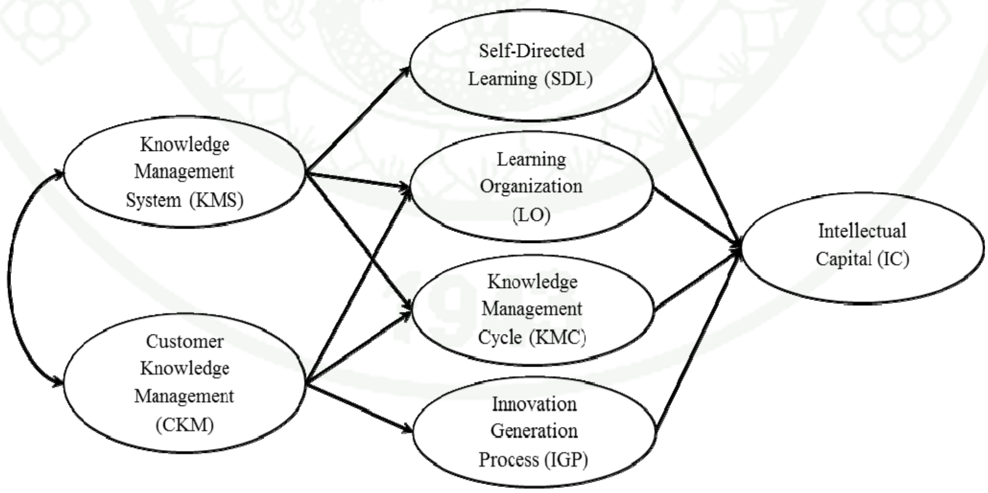

Figure 4 Structural modeling of SMILE model

Table 3 presents the research hypothesis 2 of this research.

Table 3 Hypothesis and theory support

Hypothesis of the research	Authors reference
H1: KMS positive associated with CKM	Lin, 2007; Lopez-Nicolas and Molina-Castillo, 2008; Reychav and Weisberg, 2009; Liao *et al*., 2010
H2-1: KMS positively affects SDL	Svensson *et al*., 2004; Park and Wentling, 2007; Daniel *et al*., 2007; Thompson, 2011
H2-2: KMS positively affects LO	Tynjälä and Häkkinen, 2005; Turban *et al*., 2007
H2-3: KMS positively affects KMC	Duffy, 2001; Gupta *et al*., 2000; Marwick, 2001; Turban *et al*., 2007
H3-1: CKM positively affects LO	Sinkura *et al*., 1997; Gibbert *et al*., 2002
H3-2: CKM positively affects KMC	Gibbert *et al*., 2002; Dimitrova *et al*., 2009
H3-3: CKM positively affects IGP	Gibbert *et al*., 2002; Dimitrova *et al*., 2009
H4-1: SDL positively affects IC	Koenic, 1997; Roos *et al*., 1998; Petty and Guthrie, 2000
H4-2: LO positively affects IC	Koenic, 1997; Roos *et al*., 1998; Petty and Guthrie, 2000; Tovstiga and Tulugurova, 2009
H4-3: KMC positively affects IC	Koenic, 1997; Roos *et al*., 1998; Petty and Guthrie, 2000
H4-4: IGP positively affects IC	Roos *et al*., 1998; Petty and Guthrie, 2000; Tovstiga and Tulugurova, 2009.

To develop IC, a structural equation modeling is used to construct a road map model. Structural Equation Modeling (SEM) is a multivariate technique which used to confirm the theory. SEM is combined between path analysis and factor analysis technique. SEM is used to describe a casual model with latent variables. IC is an intangible asset and difficult to direct measure. Thus this research purposes IC as a latent variable, and the IC key indicators are the observed variables of IC. This is a reason why this research applied SEM technique to develop the IC road map.

LITERATURE REVIEW

This literature review begins with a basis of the Intellectual capital (IC) and a measurement method of IC. IC is an indicator that can used to define the value of intangible asset in the firm. It is the one which enhance a firm's value and sustain the advantage competitive. Because IC is an intangible asset thus, it is difficult to interpret into number. Then, many researchers try to define the definition, the classification and the measurement tool of IC. In this research, researcher gives an up-to-date a review and a summary of the IC definition, the IC classification, the IC measurement tool. In addition, the case studies of how their researchers and practitioners apply the IC measurement tool to the firm.

Currently the knowledge of organization is very important to help firm to enhance the efficiency and sustain the competitive advantage of the firm in the turbulence economic. Based on the information technology is rapidly development and people can easily to access their knowledge sources in database. This force drive people develop their knowledge and then they can spend their knowledge to enhance firm's value and productivity. The firm's value consists of the tangible and the intangible asset. The tangible assets are building, machine, computer etc. and the intangible assets are goodwill, image, human created, and customer relationship, etc.

Stewart (1975) has tracked the first to use of the term "Intellectual Capital" to GR Farwell in The Intellectual Capital of Michael Kalecki attributed to John Kenneth Galbraith, who in a letter to economist Michael Kalecki 1969 wrote: "I wonder if you realize how much those of us in the world around have owed to the intellectual capital you have provided over these past decades". Then the word "Intellectual capital" is widely to use and nowadays intellectual capital substitutes to the intangible assets.

In 1995, Skandia Company is the first firm that use the word “Intellectual capital” replaces to the "Intangible assets" in the annual report. In terms of managers and academics, IC is one of the important competitive advantages to the firms (Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997). Then, Intellectual capital is the subject of increasing research by both academics and practitioners (Petty and Guthrie, 2000). It is also an area of increasing government interest and funding (MERITUM, 2002).

Since the word "Intellectual capital" has been used, many researchers attempted to define and get agreement for its definition. By the way it cannot be concluded. Below table is the summary of the definitions of the intellectual capital.

Intellectual capital (IC) Definition

Table 4 IC definition summary

Author	Concept	Definition
Stewart (1991)	Intellectual capital	"the sum of everything everybody in your company knows that gives you a competitive edge in the market place”
Edvinsson and Sullivan (1996)	Intellectual capital	"Intellectual capital as knowledge that can be converted into value"
Brooking (1997)	Intellectual capital	"IC is the term given to the combined intangible assets which enable the company to function"
Edvinsson and Malone (1997)	Intellectual capital	“Intangible assets are those that have no physical existence but are still of value to the company”

Table 4 (Continued)

Author	Concept	Definition
Stewart (1998)	Intellectual capital	IC is intellectual material – knowledge, information, intellectual property, experience – that can be put to use to create wealth – collective brainpower
Brennan and Connell (2000)	Intellectual capital	“Knowledge-based equity of a company”
Harrison and Sullivan (2000)	Intellectual capital	“Knowledge that can be converted into profit”
Sullivan (2000)	Intellectual capital	“IC is knowledge that can be converted into profit”
Heisig *et al*. (2001)	Intellectual capital	“IC is valuable, yet invisible”
Petty and Guthrie (2000)	Intellectual capital	IC are indicative of the economic value of two categories (organization and human capital) of IA of a company
Pablos (2003)	Intellectual capital	“A broad definition of intellectual capital states that it is the difference between the company’s market value and its book value. Knowledge based resources that contribute to the sustained competitive advantage of the firm from intellectual capital”
Rastogi (2003)	Intellectual capital	“IC may properly be viewed as the holistic or meta-level capability of an enterprise to co-ordinate, orchestrate, and deploy its knowledge resources towards creating value in pursuit of its future vision”

Table 4 (Continued)

Author	Concept	Definition
Mouritsen *et al*. (2004)	Intellectual capital	IC mobilizes ‘things’ such as employees, customers, IT, managerial work and knowledge. IC cannot stand by itself as it is merely provides a mechanism that allows the various assets to be bonded together in the productive process of the firm.
Andriesssen and Stem (2004)	Intellectual capital	"IC is all intangible resources that are available to an organization, that give a relative advantage, and which in combination are able to produce future benefits"
Youndt *et al*. (2004)	Intellectual capital	"IC is the sum of all knowledge that an organization is able to leverage in the process of conducting business to gain competitive advantage"
Marr (2005)	Intellectual capital	"IC is a multi-disciplinary concept and the understanding of it varies across different business-related disciplines"
Roos *et al*. (2005)	Intellectual capital	"Intellectual capital as all non-monetary and non-physical resources that are fully or partly controlled by the organization and that contribute to the organization’s value creation"
ICS (2005)	Intellectual capital	"Intellectual capital as any intangible resources or transformations of those resources, which are under some level of control of the company that adds to a company’s value creation"

Note: Modified from Kaufmann and Schneider (2004)

After analyzed from all definitions in Table 4, IC definition can define as following;

"Intellectual capital is the intangible assets of organization, which are generated from human (knowledge, motivation etc.) and resources (equipment, computer, IT etc.), and contribute to the firm's value"

Based on the definition of IC, IC can be classified into two components. There are human and non-human. Currently theorists try to define a classification of IC also, but it is not concluded. Hence the next part is a discussion of the IC classification.

Intellectual capital (IC) Classification

Based on literature review, Table 5 represents a summary of IC classification.

Table 5 Summary of IC classification

Developed by (year)	**Framework**	**Classification**
Brooking (1997)	Intellectual capital	Market assets
		Human-centered assets
		Intellectual property assets
		Infrastructure assets
Edvinsson (1997)	Intellectual capital	Human capital
		Organizational capital
		Customer capital
Edvinsson and Malone (1997)	Intellectual capital	Human capital
		Structural capital
Roos *et al*. (1997)	Intellectual resources	Human capital
		Structural capital

Table 5 (Continued)

Developed by (year)	**Framework**	**Classification**
Skandia (1997)	Intellectual capital	Human capital
		Structural capital
Sveiby (1997)	Intellectual capital	Internal structure
		External structure
		Personnel competence
Stewart (1998)	Intellectual capital	Human capital
		Structural capital
		Customer capital
Bontis *et al*. (1999)	Intellectual capital	Human capital
		Structural capital
Brennan and Connell (2000)	Intellectual capital	Internal structure
		External structure
		Human capital
Petty and Guthrie (2000)	Intellectual capital	Human capital
		Organizational (structural) capital
		Employee competence
MERITUM (2002)	Intangibles and Intellectual capital	Human resources
		Structural resources
		Relational resources
Bontis (2002)	Intangible capital	Human capital
		Structured capital
		Relational capital
Mouritsen *et al*. (2001)	Intellectual capital	Human capital
		Organizational capital
		Customer capital

Table 5 (Continued)

Developed by (year)	**Framework**	**Classification**
Pablos (2003)	Intellectual capital	Human capital
		Organizational capital
		Relational capital
Abeysekera and Guthrie (2003)	Intellectual capital	Internal capital
		External capital
		Human capital
Chen *et al*. (2004)	Intellectual capital	Human capital
		Structural capital
		Innovation capital
		Customer capital
Jacobsen *et al*. (2005)	Intellectual capital	Organizational structural capital
		Human capital
		Relational structural capital
Torres (2006)	Intellectual capital	Human capital
		Structural capital
		Relational capital
Joia (2007)	Intellectual capital	Human capital
		Organizational capital
		Innovation capital
		External capital
Lu *et al*. (2009)	Intellectual capital	Human capital
		Process capital
		Innovation capital
		Customer capital

Note: Modified from Choong (2008)

Based on IC classification summary in Table 5, the classification of IC is categorized into three groups. All three groups have the human capital in the classification. By the way the non-human capitals of each group are different. The details of IC classification are described as following;

Group 1: IC consists of two main capitals. There are human capital and structural capital. The structural capital has some sub capitals that some researchers bring the sub capitals into the main capitals.

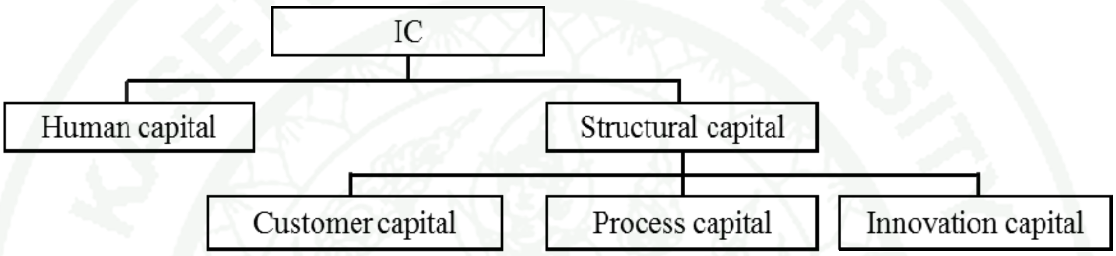

Figure 5 IC classification group 1

Classification	Definition
Human capital	Human Capital is defined as the combined knowledge, skill, innovativeness, and ability of the company's individual employees to meet the task at hand. It also includes the company's values, culture, and philosophy. (Bontis, 2001)
Structural capital	Structural capital includes customer and organizational capital that relates to the external and the internal focus of structural capital. (Edvinsson and Malone, 1997)
	Customer capital is defined as the combined value of the relationships with customers, suppliers, industry associations and markets.
	Organizational capital includes the organization philosophy and systems for leveraging the organization's capability.

Innovation capital is that which creates success in the future and includes intellectual assets and intellectual property.

Process capital includes the techniques, procedures, and programs that implement and enhance the delivery of goods and services.

Group 2: IC consists of three main capitals. There are human capital, structural capital and relational capital. They remain the human capital and structural capital same as group 1, and they increase the relational capital into a main capital. By the way this new capital is similar to a customer capital in group 1.

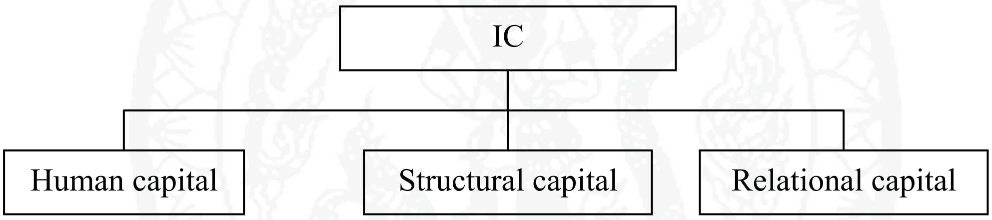

Figure 6 IC classification group 2

Classification	Definition
Human capital	Human Capital is defined as the combined knowledge, skill, innovativeness, and ability of the company's individual employees to meet the task at hand. It also includes the company's values, culture, and philosophy. (Bontis, 2001)
Structural capital	Structural capital comprises all kinds of "knowledge deposits", such as organizational routines, strategies, process handbooks, and databases (Boisot, 2002; Pablos, 2004; Walsh and Ungson, 1991).

Relational capital	Relational capital comprises the knowledge embedded in all the relationships an organization develops, whether it is with customers, competitors, suppliers, trade associations or government bodies (Bontis, 1999).

Group 3: IC consists of three main capitals. There are human capital, internal capital and external capital. They remain only human capital and then separate the structural capital into internal and external capitals.

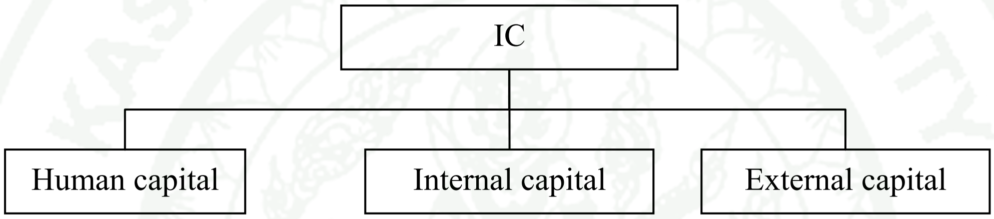

Figure 7 IC classification group 3

Classification	Definition (Sveiby, 1997)
Internal capital	Internal capital consists of a wide range of patents, concepts, models, and computer and administrative systems.
External capital	External capital consists of relationships with customers and suppliers, brand names, trademarks and reputation, or "image".
Human capital	Human capital represent as individual competence. Individual competence is people's capacity to act in various situations. It includes skill, education, experience, values and social skills.

Based on the three group of IC classification, Group 1 is widely covered the other entire group. IC classification is used to define the scope of IC and the scope of each capital of IC is used to define an IC key indicator. Table 6 presents the IC key indicators based on IC classification and literature review.

Table 6 Summary of the IC key indicators

IC component	Key indicator	Authors
Human capital	- Employee capability	Bontis, 2001; Bozbura, 2004; Chen *et al*., 2004; Huang *et al*., 2007
	- Retention of key personnel	Morey *et al*., 2000; Bozbura, 2004; Chen *et al*., 2004; Huang *et al*., 2007
	- Ability to attract talented people	Morey *et al*., 2000; Dumay, 2009
	- IT literacy	Roos *et al*., 1998; Morey *et al*., 2000; Dumay, 2009
	- Training	Bozbura, 2004; Chen *et al*., 2004; Huang *et al*., 2007; Dumay, 2009
	- Employee satisfaction	Bozbura, 2004; Chen *et al*., 2004; Huang *et al*., 2007
	- Employee commitment	Morey *et al*., 2000; Huang *et al*., 2007
Innovation capital	- R&D expenditure	Bozbura, 2004; Chen *et al*., 2004; Huang *et al*., 2007
	- R&D workforce	Bozbura, 2004; Chen *et al*., 2004; Huang *et al*., 2007
	- Product freshness	Chen *et al*., 2004; Huang *et al*., 2007
	- Intellectual property	Edvinsson and Malone, 1997; Brooking, 1996
Process capital	- Document system	Morey *et al*., 2000; Huang *et al*., 2007
	- Communication system	Morey *et al*., 2000; Chen *et al*., 2004; Huang *et al*., 2007
	- Information system	Morey *et al*., 2000; Chen *et al*., 2004; Huang *et al*., 2007

Table 6 (Continued)

IC component	Key indicator	Authors
Customer capital	- Quality system	Morey *et al*., 2000; Huang *et al*., 2007
	- Customer satisfaction	Bozbura, 2004; Chen *et al*., 2004; Huang *et al*., 2007
	- Customer retention	Roos *et al*., 1998; Bozbura, 2004; Chen *et al*., 2004
	- Product/Service quality	Morey *et al*., 2000; Bozbura, 2004; Huang *et al*., 2007
	- Market share	Morey *et al*., 2000; Bozbura, 2004; Huang *et al*., 2007
	- Repeat orders	Morey *et al*., 2000; Bozbura, 2004; Huang *et al*., 2007

Intellectual capital Measurement Tool

Referring to the Deming's speech; "You cannot manage what you cannot measure." "You cannot measure what you cannot define." "You cannot define what you do not understand." At the beginning of this chapter, a definition and classification of IC are defined. Thus the next step after defined the IC definition and IC classification is the IC measurement.

Measurement of IC and knowledge management practices will result in significant benefits to the organization that will help determine business strategy, process design as well providing a competitive advantage. In addition, firm measures the IC for manage and enhance the firm's value. Listed companies always publish the annual report to show overall performance. Some information in the annual report can be used to define the IC value of the firm.

The benefit will become to the firm who want to measure and compare their IC value to the best in class. Kamath (2008) studied the IC value in Pharmaceutical industry in India by using VAIC tool and the result showed that domestic company had the performance better than the others and the human capital was the major impact on profitability and productivity. Kamath (2007) studied the IC value in banking sector in India by using VAIC and the result showed that the overall top performers in the value creation efficiency analysis were the foreign banks. Wang (2008) studied IC value of the company in S&P500 and the conclusion described that the IC had a positive relationship to the market value of the company. The US electronic companies had knowledge intensive and utilize IC to create their market capitalization. Chen, Cheng and Hwang (2005) also studied IC value in the Taiwan listed company by using the VAIC and the result showed that firm's intellectual capital had a positive impact on a market to book value and a financial performance. Moreover the R&D was the one component of structural capital which had a positive effect on the company value and the profitability. Kannan and Aulbur (2004) provided the benefit of measure the IC as below,

- Identification and mapping of intangible assets.
- Recognition of knowledge flow patterns within the organization.
- Prioritization of critical knowledge issues.
- Acceleration of learning patterns within the organization.
- Best practice identification and diffusion across the firm, by presenting a strong business case for the best practice.
- Constant monitoring of asset value and finding ways of increasing value.
- Increase understanding of how knowledge creates interrelationships.
- Understand organizational social networks and identifying change agents.
- Increase in innovation.
- Increase collaborative activities and a knowledge sharing culture.
- Increase employee self-perception of the organization and increased motivation.
- Create a performance-oriented culture.

A usefulness of measurement IC is valid but the issue is how to measure IC in the organization? Is it suitable for a manufacturing firm? Many researchers provided the IC measurement tool as the summary in Table 7 that is a summary of IC measurement tool.

Table 7 IC measurement tool summary

Measurement tool	Developed by	Description of measure	Measurement metric
Skandia navigator	Edvinsson and Malone (1997)	Intellectual capital is measured by using 112 metrics to measure on five focus are Financial focus, Customer focus, Process focus, Renewal and development focus, and Human focus.	KPI to measure in each area as below sample, - Financial focus: revenues/employee ($) - Customer focus: days spent visiting customer (#) - Process focus: PCs/employee (#) - Renewal focus: average age of patents (#) - Human focus: annual turnover of staff (%)
Technology broker	Brooking (1996)	Provide the IC questionnaire audit in four area of asset and then transform to the ranking score. Four assets are market asset, human assets, intellectual property asset, and infra-structure assets.	Qualitative transform to score ranking.

Table 7 (Continued)

Measurement tool	Developed by	Description of measure	Measurement metric
IC-index	Roos *et al.* (1997)	Consolidates all individual indicators representing intellectual properties and component into a single index. Changes in the index are then related to changes in the firm's market valuation.	Single index by refer firm's market valuation.
Intangible asset monitor	Sveiby (1997)	Intellectual capital is measured by define measure metric on three assets. There are human competency, internal capital, and external capital. And each asset has three topics to measure. There are efficiency, growth/renewal and stability.	KPI to measure in each asset as below sample, - Growth/renewal: education level, investment in internal structure, profitability per customer. - Efficiency: value-added per professional, proportion of support staff, sales per customer. - Stability: Professional turnover rate, support staff turnover, proportion of big customers.
Market capitalization method	Steward (1997)	Intellectual capital of company can be obtained by subtracting the company's net asset value from its observable market value.	Difference between market and book value.

Table 7 (Continued)

Measurement tool	Developed by	Description of measure	Measurement metric
Economic Value Added (EVA)	Stewart and Stern (1994)	EVA as "the difference between net sales and the sum of operating expenses, taxes and capital charges where capital charges are calculated as the weighted average cost of capital multiplied by the total capital invested".	EVA = Net sales - operating expenses - taxes - capital charges
Value added intellectual coefficient (VAIC)	Pulic (2000)	Measures how much and how efficiently intellectual capital and capital employed create value based on the relationship to the three major components. There are capital employed (CE), human capital (HU) and structural capital (ST).	VAIC = VACA + VAHU + STVA where VACA is indicator of value added efficiency of CE. VAHU is indicator of value added efficiency of HU. STVA is indicator of value added efficiency of ST.
Financial method of intangible asset measurement (FiMIAM)	Rodov and Leliaert (2002)	Measure how much and how efficiently intellectual capital in term of monetary value base on the relationship to the three major component. There are human capital, customer capital and structural capital.	There are six steps to calculate FiMIAM, Step 1: determining the "Realized intellectual capital" (Realized IC = market value - book value) Step 2: identify the relevant components of IC. Step 3: assigning relative weights to IC component. Step 4: justification of the coefficients.

Table 7 (Continued)

Measurement tool	Developed by	Description of measure	Measurement metric
			Step 5: assigning value. The monetary value of IC components is calculated by multiplying the coefficients to the realized IC. Step 6: Finally a new "market to book value bottom line" is created by adding these IC value to the firm's book value.

Pike and Roos (2004) provided the conditions which used to validate the efficiency of the business measurement tool. These conditions are synchronized with the measurement theory (Sink, 1985). There are,

1. Completeness. If the system to be measured is the whole company then the attributes of the company which are to be the subject of measurement must completely describe the company. The meanings of the attributes of business performance must be fully defined and their aggregate must reflect all the resources used by the firm and the ways in which they are used.

2. Distinctness. This is a simple requirement aimed at eliminating double counting. An attribute is acceptable as an entity to be measured if there is no element of its meaning that is contained within the meaning of any other attribute.

3. Agreeability. The issue of agreeability concerns the mapping from the empirical to the numerical system. This means requires that the meaning of the attribute in the empirical system is fully reflected in the numerical system where the

measurement is actually taken. In other words, the attribute must not be represented in the numerical system by a proxy which has a different meaning.

4. Commensurability. To make the measurements and subsequent aggregation valid, they must be observed using a ratio scale and be normalized onto a common scale. Failure to do this will render meaningless many of the conclusions drawn from the data. Where measures are readily observable physical measures, such as temperature, the correct scale is easily chosen and applied.

For the commensurability, the measurement system can be defined as following,

Nominal: A classification of the object.
Ordinal: A ranking of the object.
Interval: Differences between values are meaningful, but not the values of the measure itself.
Ratio: There is a meaningful "zero" value and the ratios between values are meaningful.

Refer from measurement theory, the IC measurement tools can be verified as result in table 8.

Table 8 IC measurement tool verify summary

IC Measurement tool	Complete	Distinct	Agreeable	Scale
Skandia navigator	Unknown	No	No	Interval
Technology broker	Possible	Unlikely	Context specific	Ordinal
IC-index	No	Probably	Probably	Ratio
Intangible asset monitor	No	Possible	Possible	Ratio
Market capitalization method	No	No	No	Interval
EVA	Possible	No	Possible	Interval

Table 8 (Continued)

IC Measurement tool	Complete	Distinct	Agreeable	Scale
VAIC	Yes	No	Yes	Ratio
FiMIAM	Yes	Yes	Probably	Interval

By the way Marr (2004) agreed to do a benchmarking on IC, and a benchmarking is seen as a tool for identifying, understanding, and adopting best practices in order to increase operational performance.

Benchmarking is a multifaceted technique to identify operational and strategic gaps, and to search for best practices that can be applied to close any existing gaps (Yasin, 2002). It is generally recognized as a tool that enables a company to understand its current performance levels and set future targets (Camp, 1989). So the benchmarking should be adding as the one criterion for selecting the IC measurement tool. Table 9 presents a summary of IC measurement tool benchmark capability.

Table 9 IC measurement tool benchmark capability

IC Measurement tool	Benchmark capability
Skandia navigator	No
Technology broker	Limited
IC-index	Limited
Intangible asset monitor	No
Market capitalization method	Yes
EVA	Internal only
VAIC	Yes
FiMIAM	Limited

The IC measurement tools which have benchmark capability are Market capitalization method, and VAIC. However, in order to accurately calculate market capitalization, the historical financial statements must be adjusted for the effects of inflation or replacement costs. Therefore, using historical data may distort the measurement, particularly in industries with particularly large balances of old capital assets. In this research, VAIC is selected for IC measurement. VAIC has an IC benchmark capability property and the value express in ratio as efficiency reflect in monetary term. By the way, IC also needs to measure in term of non-monetary (IC measurement at direct source) which this research called the IC key indicator. These IC key indicators are used to develop an IC strategic plan (Leading indicator role). Thus the IC key indicator in table 1 is used to measure IC in non-monetary term. In addition, VAIC is used to monitor the efficiency after firm develops an IC (Lagging indicator role). Two IC measurement tools are applied in this research.

Self – directed learning (SDL)

Knowledge of worker is an intangible asset in organization. The knowledge is an intangible asset of human capital. Human capital represents all intangible assets of human such as attitude, motivation, skill, experience, knowledge etc. Organization needs to provide a goal (management philosophy), learning system, IT system and many tools for enhancement productivity from the knowledge worker. The term of nonhuman intangible assets named structural capital. Human capital and structural capital are a component of IC. Increase the knowledge of worker enhances the knowledge asset of organization. Organization needs to understand the learning behavior of human nature. Cross (1981) estimated 70 percent of adult learning is self-directed learning and about 90 percent of all adults conduct at least one self-directed learning project per year (Tough, 1978). Thus Self-directed learning is a key of employee to increase their knowledge in organization. Self-directed learning is a process in which individuals take the initiative, with or without the help of others (Knowles, 1975). Many researchers (Ash, 1985; Bauer, 1985; Brockett and Hiemstra, 1985; Brookfield, 1985; Cross, 1978; and Reisser, 1973) suggest organization provide a good facilitates to enhance employee knowledge and work performance. Ho (2008) agreed self-directed learning is affected to an organization performance.

Many self-directed learners attempted to gain new skills, and knowledge to improve their work performance, or simply increase their intellectual capital. Self-directed learning has been described as "a process in which individuals take the initiative, with or without the help of others," to diagnose their learning needs, formulate learning goals, identify resources for learning, select and implement learning strategies, and evaluate learning outcomes (Knowles, 1975).

SDL is also regarded as a kind of process that demonstrates individuals' capability, personality, and learning pattern (Teng, 1995). Guglielmino (1977) claims SDL is an ability that represents individuals' voluntary, independent and continuous learning habits. By the way knowledge asset is needed to verify, distribute, store, manage and leverage value to the organization. So knowledge management cycle is considered as a tool for develop IC.

Knowledge management cycle

Knowledge is dynamically flow asset and it has age (Allard, 2003). Knowledge must be updated and it grows overtime. This is a reason why knowledge management as a cycle. Knowledge management cycle has 6 steps as follow (Bose, 2004; Turban *et al.*, 2007):

1. Create knowledge. The knowledge comes primarily from the experiences, education and skills of the employees. Knowledge is created as employee determines new ways of enhance or develop know-how. Sometimes if the knowledge is not residing in the organization, external knowledge is brought in as technology transfer.

2. Capture knowledge. The knowledge that is created needs to be stored in its raw form in an organization database.

3. Refine knowledge. New knowledge must be placed in context and actionable.

4. Store knowledge. Useful knowledge must be stored in an organization format which can be used later on and others in organization can access it.

5. Manage knowledge. Like a library, knowledge must be kept current. It must be reviewed to verify that it is relevant and accurate.

6. Disseminate knowledge. Knowledge must be made available in a useful format to anyone in the organization who needs it anywhere and anytime.

Based on the knowledge management flow, knowledge worker is a main create knowledge and applied in the organization. Knowledge worker never know what kind of knowledge which they should learn, if the organization does not provide a direction or goal. Knowledge worker understand goal means understand task. Then give them autonomy to develop know how, provide a problem solving, create new product or process. Clarity of goal and mission, empowerment, and experimentation are the component of “Learning organization” and it work as a knowledge increasing process. Thus, “Learning organization” is considered as one of the IC development tool.

Learning organization

Senge (1990) published The Fifth Disciplines and described learning organization as organization which have people continually expand their capacity to create the results they truly desired. A learning organization is an organization skilled at creating, acquiring, and transferring knowledge and at modifying its behavior to reflect new knowledge (Garvin, 1993). Goh and Richard (1997) presented a characteristic of learning organization as follow:

1. Clarity of purpose and mission. The degrees of which employee have a clear vision/mission of the organization and understand how they can contribute to its success and achievement. As Senge (1990, 1992) demonstrated "building a shared vision" is a one key of learning organization.

2. Leadership commitment and empowerment. The roles of leaders in the organization with encourage employee to learn and empowering them to make decision and take some risk (Garvin, 1993; Slocum *et al*., 1994).

3. Experimentation and rewards. The freedom to experiment with new methods and innovative processes are encourage and supported from organization (Senge, 1990; Garvin, 1993; Slocum *et al*., 1994).

4. Transfer of knowledge. The systems that enable employees to learn from others both internal and external organization (Garvin, 1993; Shaw and Perkins, 1991).

5. Teamwork and group problem-solving. The degree of building the teamwork in the organization to solve problems and generate innovative ideas (Senge, 1990, 1992; Garvin, 1993).

Based on the characteristic of learning organization, one output of learning organization is innovation. Innovation capital is a component of IC. How to generate the innovation? Learning organization is not a main process of produce the innovation. Thus a process which is mainly producing an innovation called "Innovation generation process". This "Innovation generation process" is considered as the one IC contribution.

Innovation generation process

To explain on how organizations develop the new products and services, researchers explained the process model consist of many stages (Eisenhardt and Tabrizi, 1995; Damanpour and Gopalakrishnan, 2001; Frambach and Schillewaert, 2002). Cooper and Kleinschmidt (1986) define a thirteen step staged model starting with initial screening to market introduction. Gopalakrishnan and Damanpour (1997) conclude the process has five stages. There are idea generation, project definition, problem-solving, design and development, and marketing or commercialization. Similarly and recently, Bernstein and Singh (2006, 2008) identify four stages as idea generation, innovation support, innovation development, and innovation implementation. This research applies the innovation generation process with the Brandenburg (2002) model and details as following:

1. Idea generation. The degree of idea generate in organization as three type of innovation (Product, Process and managerial Innovation). There are idea generation for new product, idea generation for new process and idea generation for new management tool.

2. Innovation support. The roles of leaders in the organization with encourage employee to generate new product, process, and management tool.

3. Innovation development. The roles of organization with provide resource to develop new product, process, and new management tool.

4. Innovation implementation. The successful of new product, process and management tool can implement in organization or introduce into market.

Innovation is an output of innovation generation process. Innovation is in the innovation capital of IC. Before idea generation process, organization needs to provide information to employee to know the current situation of problem. In manufacturing organization, customer and other competitive are a good source of information. Firm cannot discuss directly to other competitive but customer can share the experience on their competitor product, process and service. Knowledge sharing from customer help organization understand what they want/need/expect on your product/process. This is a reason why “Customer knowledge management” is a new comer and support innovation generation process.

Customer knowledge management (CKM)

Firstly, CKM may seem just another name for Customer Relationship Management (CRM). In contrast, CKM managers require a different mindset along a number of key variables as details in table 10. Customer knowledge managers, first and foremost focus on knowledge *from* the customer (i.e. knowledge residing in customers), rather than focusing on knowledge *about* the customer, as characteristic of customer relationship management.

- Knowledge ‘about’ customer: Captures customers’ general background, motivation, gender, age, expectation, and preference for products or services (Garcia-Murillo and Annabi, 2003; Salomann *et al*., 2005).

- Knowledge ‘from’ customer: Understands customers’ needs/wants pattern and/or consumption experience of products and/or services (Davenport *et al*., 2001).

The Customer knowledge management consists of all processes and component technologies for capturing, sharing, and applying clients’ knowledge. Feng and Tiang (2005) argue that CKM is “a dynamic recycling process of acquiring and refining valuable customer knowledge by means of various paths and methods”.

Table 10 CKM versus CRM

	CRM	CKM
Knowledge sought in	Customer Database.	Customer experience, creativity, and (dis)satisfaction with products/services.
Axioms	'Retention is cheaper than acquisition.'	'If only we knew what our customers know.'
Rationale	Mining knowledge about the customer in company's databases.	Gaining knowledge directly from the customer, as well as sharing and expanding this knowledge.
Objectives	Customer base nurturing, maintaining company's customer base.	Collaboration with customers for joint value creation.
Metrics	Performance in terms of customer satisfaction and loyalty.	Performance against competitors in innovation and growth, contribution to customer success.
Benefits	Customer retention.	Customer success, innovation, organizational learning.
Recipient of Incentives	Customer.	Customer.
Role of customer	Captive, tied to product/service by loyalty schemes.	Active, partner in value-creation process.
Corporate role	Build lasting relationships with customers.	Emancipate customers from passive recipients of products to active co-creators of value.

Note: Gibbert *et al*. (2002)

Based on CKM details on table 10, CKM is supported both innovation and learning organization. This research identifies CKM as a tool to support Knowledge management cycle, innovation generation process, and learning organization. Thus this research purpose CKM as a customer capital (Customer knowledge and relationship) and indirect affected to IC through Innovation, Learning organization and Knowledge management cycle. By the way CKM also need the information system to store, sharing, and interaction between customer and firm. CKM must have a good relationship with the organization's information system. Not only CKM, Self-directed learning, Knowledge management cycle, and Learning organization also need organization's technology information system to supported such as gaining, sharing, communicating, storage, and distribute information/knowledge. Theorist calls this kind of tool as "Knowledge management system (KMS)".

Knowledge management system (KMS)

Theorists (Duffy, 2001; Gupta *et al*., 2000; Marwick, 2001) suggest KM needs the right methods, technologies, and tools for a successful implementation. A knowledge management system (KMS) facilitates KM by supporting and ensuring knowledge flow from the person(s) who know(s) to the person(s) who need(s) to know throughout the organization, while knowledge evolves and grows during the process (Bose, 2004). A variety of model IT tools and technologies make up a KMS (Bontis *et al*., 1999; Alavi and Leidner, 1999). The Internet, Intranets, data warehousing, decision support tools and groupware are some of the many technologies that make up the KMS. KMS facilitate knowledge and this reason why KMS support "Self-direct learning", "Learning organization" and "Knowledge management cycle". Knowledge management system consists of (Turban *et al*., 2007);

1. Communication and collaboration technologies. The first part of KMS, communication technologies allow employees to access needed knowledge and to communicate with each other-especially with expert. In addition, collaboration

technologies provide the means to perform group work. Groups can work together on common documents at the same time or different time; they can work at the same place or different place.

2. Storage and retrieval technologies. The second part of KMS, Storage and retrieval technologies meant using a database management system to store and manage knowledge.

A review of literature in the first section related to IC background, definition, classification and measurement tool. An overview of the IC development roadmap is provided in this section. By the way the research can't be completed if the research don't have statistical tool to test the research hypothesis. In next section, statistical techniques are described in the details. This research is applying the structural equation modeling technique.

Structural Equation Modeling

Structural equations modeling (SEM) represents a multivariate technique to specify, estimate and evaluate models of linear relationships among a set of observed variables in terms of a generally smaller number of latent variables. Structural equations modeling, including classical path analysis, used to help bridge the gap between empirical and theoretical research. SEM is a multivariate statistical technique that uses empirical evidence to estimate the strengths of a priori hypothesized structural relationships within a particular theory-derived model.

Structural equation modeling is characterized by two basic components; first is the structural model, and second is the measurement model. The structural model is the path model which relates independent to dependent variables. The model is guided by theory, prior experience etc. as for which dependent variables affect which independent variables. Important to acknowledge is that the structural model can place a dependent variable as an independent variable in a subsequent relationship; it is this property that gives rise to the interdependent nature of structural model. Moreover, many of the same variables will affect each of the dependent variables, but with differing effects. The proposed relationships are translated into a series of structural equations for each dependent variable.

The measurement model allows the researcher to use several variables (indicators) for a single independent or dependent variable, i.e. allow the use of latent variables. In the measurement model the researcher can assess the contribution of each scale item as well as incorporate how well the scale measures the concept into the estimation of the relationships between dependent and independent variables.

The resulting set of equations can be solved using second generation multivariate methods included in many software packages e.g. AMOS, LISREL, and EQS. Such methods simultaneously estimate the values of the variables as well as the relationships between all variables, based on actual covariance structure inherent in the dataset. The results are then compared to the covariance structure implied by the relationships in the structural model. The comparison renders several goodness-of-fit statistics, i.e. measures of how well the proposed model “fit” the data. Overall model fit includes both the structural and the measurement models.

Path Analysis is the statistical technique used to examine causal relationships between two or more variables. It is based upon a linear equation system and was first developed by Sewall Wright in the 1930s for use in phylogenetic studies. Path Analysis was adopted by the social sciences in the 1960s and has been used with increasing frequency in the ecological literature since the 1970s. In ecological studies, path analysis is used mainly in the attempt to understand comparative strengths of direct and indirect relationships among a set of variables. In this way, path analysis is unique from other linear equation models: In path analysis mediated pathways can be examined. Pathways in path models represent hypotheses of researchers, and can never be statistically tested for directionality.

Path analysis is a subset of Structural Equation Modeling (SEM), the multivariate procedure that, as defined by Ullman (1996), “allows examination of a set of relationships between one or more independent variables, either continuous or discrete, and one or more dependent variables, either continuous or discrete.” SEM deals with measured and latent variables. A measured variable is a variable that can be observed directly and is measurable. Measured variables are also known as observed variables, indicators or manifest variables. A latent variable is a variable that cannot be observed directly and must be inferred from measured variables. Latent variables are implied by the covariance among two or more measured variables. They are also known as factors, constructs or unobserved variables. SEM is a combination of multiple regression and factor analysis. Path analysis deals only with measured variables.

Defining a model. A model is a representation of a theory. Theory can be thought of as a systematic set of relationships providing a consistent and comprehensive explanation of phenomena. From this definition, theory is not the exclusive domain of academia, but can be rooted in experience and practice obtained by observation of real-world behavior. A model should not be developed without some underlying theory. Theory is often a primary objective of academic research, but practitioners may develop or propose a set of relationships that are as complex and interrelated as any academically based theory. Thus, researchers from both academia and industry can benefit from the unique analytical tools provided by SEM.

Although theory can be important in all multivariate procedures, it is particularly important for SEM because it is considered a confirmatory analysis. That is, it is useful for testing and potentially confirming theory. Theory is needed to specify relationships in both measurement and structural models, modifications to the proposed relationships, and many other aspects of estimating a model.

Parameter estimation technique. The most common SEM estimation procedure is maximum likelihood estimation (MLE). Simulation studies suggest that under ideal conditions, MLE provides valid and stable results with sample size as small as 50. As one moves away from conditions with very strong measurement and no missing data, minimum sample sizes to ensure stable MLE solutions increase when confronted with sampling error. Given less than ideal conditions, one study recommends a sample size of 200 to provide a sound basis for estimation. But it should be noted that as the sample size become large (> 400), the method becomes more sensitive and almost any difference is detected, making goodness-of-fit measures suggest poor fit. As a result, sample sizes in the rage of 100 to 400 are suggested.

Computer programs. Several readily available statistical programs are convenient for performing SEM. Traditionally, the most widely used program is LISREL (LInear Structural RELations). LISREL is a flexible program that can be applied in numerous situations and has become almost synonymous with structural equation modeling. LISREL is used to do SEM analysis in this research.

The basic of Goodness-of-Fit

Once a specified model is estimated, model fit compares the theory to reality by assessing the similarity of the estimated covariance matrix (theory) to reality (the observed covariance matrix). If a researcher's theory were perfect, the observed and estimated covariance matrices would be the same. The values of any Goodness-of-Fit measure result from a mathematical comparison of these two matrices. The closer the values of these two matrices are to each other, the better the model said to fit.

Chi-square (χ^2) Goodness-of-Fit

The difference in the observed and estimated covariance matrices is the key value in assessing the Goodness-of-Fit of any SEM model. The chi-square (χ^2) test is the only statistical test of the difference between matrices in SEM and is represented mathematically by the following equation:

χ^2 = (N – 1)(Observed sample covariance matrix – SEM estimated covariance matrix)

N is overall sample size.

Degrees of freedom (df)

As with other statistical procedures, degrees of freedom represent the amount of mathematical information variable to estimate model parameters. The number of degrees of freedom for a SEM model is determined by

$$\text{df} = \frac{1}{2}\left[(p)(p+1)\right] - k$$

Where p is the total number of observed variables and k is the number of estimated parameters. The model is accepted when χ^2 / df lower than 5.

Goodness-of-Fit Index (GFI)

The GFI was an early attempt to produce a fit statistic that was less sensitive to sample size. Even though N is not included in the formula, this statistic is still sensitive to sample size due to the effect of N on sampling distributions. No statistic test is associated with the GFI, only guidelines to fit. The possible range of GFI values is 0 to 1, with higher values indicating better fit. GFI values of greater than 0.90 is considered good. Recent development of other fit indices has led to decline in usage.

Root Mean Square Error of Approximation (RMSEA)

One of the most widely used measures that attempts to correct for the tendency of the χ^2 Goodness-of-Fit test statistic to reject models with a large sample or a large number of observed variables is the root mean square error approximation (RMSEA). Thus, it better represents how well a model fits a population, not just a sample used for estimation. Lower RMSEA values indicate better fit (Good fit: RMSE < 0.08 and Accepted fit: RMSE < 0.1).

Normed Fit Index (NFI)

The NFI is one of the original incremental fit indices. It is a ratio of the difference in the χ^2 value for the fitted model and null model divided by the χ^2 value for the null model. It ranges between 0 and 1, and a model with perfect fit would produce an NFI of 1 (Accepted at value > 0.90). One disadvantage is models that are more complex will necessarily have higher index values and artificially inflate the estimate of model fit. As a result, it is used less today in relation to either of the following incremental fit measures.

Tucker Lewis Index (TLI)

The TLI conceptually similar to the NFI, but varies in that it is actually a comparison of the normed chi-square values for the null and specified model, which to some degree takes into account model complexity. However, the TLI is not normed, and thus its values can fall below 0 or above 1. Typically though, models with good fit have values that approach 1 (Accepted at value > 0.95), and a model with a higher value suggests a better fit than a model with a lower value.

Comparative Fit index (CFI)

The CFI is an incremental fit index that is an improved version of the normed fit index (NFI). The CFI is normed so that values range between 0 and 1, with higher values indicating better fit. Because the CFI has many desirable properties, including its relative, but not complete, insensitivity to model complexity, it is among the most widely used indices. CFI values above 0.90 are usually associated with a model that fits well.

The prior research involves SEM and similar with the research,

Ho (2008) applied SEM to his research. His model has four latent variables. There are self-directed learning (SDL), organizational learning (OL), knowledge management capability (KMC), and organizational performance (OP). The results of his research show that SDL has a direct and significant impact on OL and KMC. SDL influences OP indirectly through OL and KMC. In addition, OL and KMC have direct and significant influences on OP.

A review of literature is related IC and the statistical technique. The research purposes to prove a role and impact of IC on manufacturing firm productivity. This literature review starts from a basis of productivity, knowledge worker through IC (First section of the literature review). Moreover, the final section (Second section of the literature review) describes a statistical technique which is a majority using in the research. Theory in first section is used to select the suitable IC measurement tool and construct an IC development roadmap model. Then SEM is a multivariate technique that used to test the hypothesis and validate the model.

MATERIALS AND METHODS

This chapter provides an overview of the research methodology including the data collection, analysis approaches, and a concept used to test the applicability of the hypothesis and the conceptual models.

Materials

1. Survey instruments
2. Personal Computer
3. Microsoft Office Application
4. Statistical Package for the Social Sciences (SPSS)
5. LInear Structural RELations (LISREL, Statistical software)

Methods

This section focuses on the methodology of this research. This research has three methodology phases.

First phase shows in Chapter I. The problem statement of phase 1 is “What is IC? And Why IC is important in new economy? A methodology of this phase is literature review. The output of first phase is a suitable IC measurement tool. The conclusion of first phase as following;

VAIC is a suitable tool of IC measurement in monetary term. VAIC is used to monitor an efficiency of firm’s IC investment. In addition, a role of VAIC is a lagging indicator.

The IC key indicator in table 4 is a suitable tool of IC measurement in non-monetary term. These IC key indicators are used to directly monitor at firm’s IC sources. These IC key indicators are useful for firm establish an IC development strategic roadmap. Moreover, a role of the IC key indicator is a leading indicator.

Second phase is IC measurement tool validation. This phase applied a correlation test analysis to study a relationship between IC and value added productivity. Value added productivity is a value added per number of employee (Masayoshi *et al*., 1991). In this phase, VAIC and IC key indicator is used to define an IC value. The study step as following;

A relationship between VAIC and Value added productivity

VAIC (Value Added Intellectual Coefficient)

Value Added Intellectual Coefficient (VAIC) is widely applied in the Intellectual capital research and it was presented by the Austrian Intellectual Capital Research Center (AICRS) under Pulic (2000).

VAIC Calculation method

Calculation formula: VAIC = VAHU + STVA + VACA

VACA is indicator of VA efficiency of capital employed = VA ÷ CE

VAHU is indicator of VA efficiency of human capital = VA ÷ HU

STVA is indicator of VA efficiency of structural capital = SC ÷ VA

Where

VA = Net sales revenue - Cost of goods sold - Depreciation (Riahi-Belkaoui, 2002)

CE = Total assets - Intangible assets (Pulic, 2000 and Firer and Williams, 2003)

HU = Total expenditure on employees (Pulic, 2000) and Firer and Williams, 2003)

SC = VA – HU (Pulic, 2000 and Firer and Williams, 2003)

Sample procedure: Top ten high market value manufacturing firm of Thailand stock market.

Data collection: All data are used from the firm annual report. These annual reports are validated by The Stock Exchange of Thailand.

Statistical method: Correlation test.

Variable: Value added productivity and VAIC (Average 4 years, the year 2006-2009).

Some researchers studied a relationship between VAIC and a firm's performance, below are the example.

1. Chen, Cheng and Hwang (2005) measure Taiwanese listed firm's IC by using VAIC. Then they studied a relationship between VAIC and a firm's financial performance. They concluded a firm's IC has a positive impact on financial performance (ROE, ROA, Growth in revenue and, Employee productivity).

2. Kamath (2008) measures India pharmaceutical firm's IC by using VAIC. Then she studied a relationship between VAIC and pharmaceutical firm's performance of India (ROA and productivity). She concluded a component of VAIC is significant affected to ROA and firm's productivity.

3. Chan (2009) measures Hong Kong listed firm's IC by applying VAIC. Then he studies a relationship between VAIC and firm's performance (Market valuation, Profitability, Productivity and ROE). He conclude only profitability is positive associate with VAIC.

This second phase is used to validate the VAIC. A statistical method applied a correlation test between VAIC and value added productivity. If VAIC positively related with value added productivity, its conclude VAIC suitable for measurement IC in the manufacturing organization. Thus a conclusion can draw up on a relationship between VAIC and value added productivity. This conclusion can assist management level to consider applying VAIC as the IC measurement tool. In addition, firm needs to measurement IC as a representative of a measurement of productivity in the manufacturing organization.

A relationship between IC index and Value added productivity

The IC index is an IC value which calculated from an average of the IC key indicators (Bozbura, 2004). The IC key indicators are from the score of survey instrument. The survey instrument as a questionnaire was applied in this research. In addition, a detail of questionnaire is presented in appendix C.

Sample procedure: Top ten high value added productivity manufacturing firm which has a manufacturing plant located in Thailand.

Data collection: Data are from two sources, IC indicators are from the survey instrument and the value added productivity calculated from the firm annual report. These annual reports are validated by The Stock Exchange of Japanese.

Statistical method: Correlation test.

Variable: Value added productivity and IC index (3 years, the year 2008-2010).

The IC key indicator will apply in the IC development roadmap. The correlation test between IC index and value added productivity is used to validated these IC key indicators are suitable for applying in the IC development roadmap model. If the correlation result shows IC index positively related with the value added productivity, these IC key indicators are suitable for applying in the IC latent variable of the IC development roadmap model.

Third phase is a confirmatory theory of the IC development roadmap model. This phase was applied a SEM technique to test a fit data of the model. The name of IC development roadmap model is SMILE model. The construct of model shows in figure 8. The details of the third phase as following;

Conceptual model: SMILE model

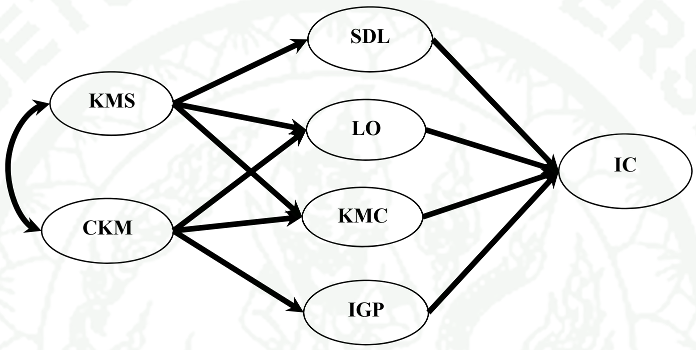

Figure 8 SMILE model

The IC development roadmap model begins with Knowledge Management System (KMS) and Customer Knowledge Management (CKM). Then KMS supports Self-directed learning (SDL), Learning Organization (LO), and Knowledge Management Cycle (KMC). The CKM supports Learning Organization (LO), Knowledge Management Cycle (KMC), and Innovation Generation Process (IGP). At the final stage, SDL, LO, KMC, and IGP support Intellectual capital (IC). This type of model called a casual model. The casual model is a part of structural equation modeling. The Structural equation modeling consists of casual model and measurement model. The Structural equation modeling is applied in this research due to this research need to confirm a model by referring the theory (The Deductive Approach Typically Used in Quantitative Research).

Latent variables of the model are KMS, CKM, SDL, LO, KMC, IGP, and IC. Total seven latent variables are in the conceptual model. Latent variable is difficult to measure, so the latent variables need to have the observed variable. In addition, observed variable is a representative of the latent variable. These observed variables are used to interpret to the questionnaire items.

Survey instrument: Questionnaire

A questionnaire has total 96 observed variables and each observed variable has five Likert scale. The questionnaire do content validity and reliability test before distribute to the firms. The details of questionnaire as following;

Latent variable: Knowledge Management System

Communication & Collaboration Technologies	Do you agree? Disagree				Agree
	1	2	3	4	5
1. People in your organization always send/receive information/data via Information Technology System such as e-mail, intranet, web board etc.					
2. People in your organization always access to organization's information data base system.					
3. Your organization always discuss/meeting information/data via net meeting, E-conference etc.					
4. Your organization's IT system always support group working such as groupware etc.					

Storage and retrieval technologies	Do you agree? Disagree			Agree	
1. Your organization has Information technology department to store organization's information/data.					
2. People in your organization always know where they can find the information/data in organization information/data warehousing.					
3. Your organization has document center department to manage information/data warehousing.					

Latent variable: Self-directed learning

Self-directed learning	Do you agree? Disagree 1	2	3	4	Agree 5
1. People in your organization always increase their knowledge or improve work performance by accessing organization information/data warehousing.					
2. People in your organization always increase their knowledge or improve work performance by working with workgroup.					
3. People in your organization can learn manufacturing process via organization information technology system (Website, Intranet etc.).					
4. Your organization always open new knowledge source for employee searching, finding, adapting new solution on their work.					

Latent variable: Learning organization

Learning organization practices	Do you agree? Disagree 1	2	3	4	Agree 5
Clarity of Purpose and Mission					
1. Each department in your organization has sub-goal that support to the main goal of organization.					
2. People in your organization always know the gap between current base line and the goal of department.					
3. People in your organization always know the mission that support to the department goal achievement.					
4. The organization's mission statement can use to identify the performance of employee.					
Leadership Commitment and Empowerment					
1. Senior managers/Directors in this organization open his/her mind for new ideas introducing/sharing from their colleague.					
2. Senior managers/Directors and employees in this organization share a common vision for what our work should accomplish.					
3. Managers in this organization often provide useful feedback that helps to identify potential problems and opportunities.					
4. Managers in this organization frequently involve with employees in important decisions.					
Experimentation					
1. People in your organization often bring new ideas into the organization.					
2. Managers in this organization encourage team members to experiment in order to improve work processes.					
3. Innovative ideas that work are often rewarded by management.					
4. In my experience, management always welcomes for the new idea from employees.					

Transfer of Knowledge

1. Employees often have an opportunity to share about successful programs or work activities to other staff.					
2. Failures are discussed in our organization for improvement.					
3. New work processes that may be useful to the organization are usually shared with all employees.					
4. We have a system that allows us to learn successful practices from other organizations.					

Teamwork and Group-Problem Solving

1. Current organizational practice encourages employees to solve problems in team before discussing them with a manager.					
2. We can usually form informal groups to solve problems in organization.					
3. Members of the problem solving team, are always came from another section or the function of work different.					

Latent variable: Knowledge management cycle

Knowledge management cycle practices	Do you agree? Disagree				Agree
	1	2	3	4	5
Create knowledge					
1. New products/processes are always generated in your organization.					
2. New ideas/solutions are always generated in your organization.					
3. Your organization always has new improvement on quality/productivity.					
Capture knowledge					
1. New products/processes are always presented in your organization by following organization report format.					
2. New idea/solutions are always presented in your organization by following organization report format.					
3. New improvements on quality/productivity are always presented in your organization by following organization report format.					
Refine knowledge					
1. New products/processes are always successfully implemented in your organization.					
2. New ideas/solutions are always applied in your organization.					
3. New improvements on quality/productivity are always implemented in your organization.					

Store knowledge					
1. New products/processes details are always stored in your organization more than one year.					
2. New ideas/solutions details are always stored in your organization more than one year.					
3. New improvements on quality/productivity details are always stored in your organization more than one year.					
Manage knowledge					
1. Your organization has the information/document center section.					
2. Information/documents always up to date.					
3. Information/documents are always reviewed with originator before store in center.					
Disseminate knowledge					
1. Your organization always distributes new information to people in the organization.					
2. People in your organization can access to information/document center anytime that they want in the organization.					
3. People in your organization can access to information/document center anywhere that they want in the organization.					

Latent variable: Customer knowledge management

Customer Knowledge management practices	Do you agree? Disagree				Agree
	1	2	3	4	5
Knowledge from customer					
1. Your organization always has a meeting with customer to received suggestion on your product and/or service.					
2. Your organization always invites customer to share knowledge and/or experience on your product and/or service.					
3. Your organization always discusses with customer to access what they want on your product and/or service.					
4. Your organization always applied the information of customer on your new product and/or service.					
Refine knowledge					
1. Good suggestions of customer are always successfully implemented in your organization.					
2. Knowledge/experience of customer (Benchmark with competitor product) are always considered to apply in your product and/or service.					
3. Customer requests are always considered to apply in your product and/or service.					

Store knowledge

1. Suggestion details of customer are always stored in your organization.					
2. Knowledge/experience details from customer sharing are always stored in your organization.					
3. Customer request topics are always stored in your organization.					

Manage knowledge

1. Your organization has the information/document center section to collects the customer information.					
2. Information/documents from customer always up to date.					
3. Information/documents from customer are always review with customer before store in center.					

Disseminate knowledge

1. Your organization always distribute customer information to people in your organization.					
2. People in your organization can access to customer information/document center anytime that they want in organization.					
3. People in your organization can access to customer information/document center anywhere that they want in organization.					

Latent variable: Innovation generation process

Innovation Generation process practices	Do you agree? Disagree				Agree
	1	2	3	4	5
Idea generation					
1. Concepts of new product are always generated in your organization.					
2. Concepts of new process are always generated in your organization.					
3. New management tools (such as TQM, JIT, Lean manufacturing etc.) are always applied in your organization.					
Innovation support					
1. Concepts of new product are always reviewed with management team before develop to new product.					
2. Concepts of new process are always reviewed with management team before develop to new process.					
3. New management tools always align with organization goal.					
Innovation development					
1. Organization always allocates resource (man, time, machine, material, money etc.) to support New product development.					
2. Organization always allocates resource (man, time, machine, material, money etc.) to support New process development.					

3. New management tools are always promoted by management team.					

Innovation implementation

1. New product of your organization always has high market share.					
2. New process always increases your organization productivity/quality.					
3. Your organization always achieves organization's goal (Cost reduction, good delivery etc.) by applying new management tools..					

Latent variable: Intellectual capital

Intellectual capital key indicator	Do you agree? Disagree				Agree
	1	2	3	4	5
Human capital					
1. Almost employees in your organization have ability to solve customer's problems (Quality improvement).					
2. Amount of talent employee are same or increase if compare to last year.					
3. Your organization has effective system to attract talent employee from outside organization.					
4. Almost employees can use basic computer program such as Microsoft office, outlook etc.					
5. Your organization always has useful training courses.					
6. Almost employees in your organization highly satisfied with the organization and their jobs.					
7. Almost employees in your organization highly dedicated and committed to the organization.					
Innovation capital					
1. Your organization always invest in R&D.					
2. Your organization highly focuses on R&D team.					
3. Your organization always introduces new products into market.					
4. Your organization always generates new intellectual property.					

Process capital

1. Your organization has highly effectiveness documentation management (Like library).					
2. Your organization has highly effectiveness communication system.					
3. Your organization has real-time system to monitor productivity and quality in manufacturing process.					
4. Your organization has highly effectiveness quality control system (Low return rate from customer).					

Customer capital

1. Almost customers are satisfied in your product/service.					
2. Unit of sales always increases every year.					
3. Low customer reporting complaints on your organization product/service.					
4. Market share always increase every year.					
5. Almost customers always repeat order.					

Validity test

Validity test method, distributed three questionnaires to professors (Two are professor of Industrial engineering department of Kasetsart university, and one is professor of Industrial engineering department of Rajamangala University of Technology Thanyaburi) for reviewing a content of each item. This validity method applied Item-Objective Congruence Index (IOC) by ranking score -1, 0 and 1. Then each professor gives a score in each item as instruction below;

- Score equal 1 mean a question of observed variable related on latent variable.
- Score equal -1 mean a question of observed variable is not related on latent variable.
- Score equal 0 is none of above.

Then average score of each item and acceptance criteria is more than 0.5. Result shows all questionnaire items have IOC more than 0.5. Thus a conclusion is the questionnaire items passed content validity test (See details in Appendix C).

Reliability test

Reliability test method, distributed 30 questionnaires to a Japanese electronic manufacturing firm (This firm is not a sample firm) and then calculates Cronbach's alpha by using SPSS 15.0. An acceptance criteria of Cronbach's alpha is more than 0.8 both item and the questionnaire.

Result shows all items have Cronbach's alpha more than 0.8 and the questionnaire has Cronbach's alpha more than 0.8. Thus a conclusion is the questionnaire items and the questionnaire passed reliability test (See details in Appendix C).

Sample procedure

Manufacturing firm sample: There are top ten high value added productivity in Thailand. These firms are national companies and has a manufacturing plant located in Thailand. Value added is a sale revenue minute with a cost of goods sold and depreciation (Riahi-Belkaoui, 2003). Value added productivity is a value added per employee (Masayoshi et.al., 1991). Company details shows in table 11

Table 11 Manufacturing firm sample details

Firm	Type of industry	HQ. Country	Year	Value added (Million $US)	Number employee	Value added productivity ($/employee)
A	Motor Vehicles	Japan	2010	338,664	320,590	10,563,773
			2009	210,134	320,808	6,550,148
			2008	2,877,037	316,121	91,010,626
B	Computer & Other Electronic Products	Japan	2010	1,417,337	359,746	39,398,270
			2009	1,444,926	361,796	39,937,589
			2008	1,640,492	347,810	47,166,326
C	Motor Vehicles	Japan	2010	1,305,769	157,264	83,030,382
			2009	1,240,092	160,422	77,301,866
			2008	2,341,098	163,099	143,538,464
D	Computer & Other Electronic Products	Japan	2010	1,825,082	384,586	47,455,758
			2009	1,772,385	292,250	60,646,193
			2008	2,409,586	305,828	78,788,927
E	Computer & Other Electronic Products	Japan	2010	1,950,431	167,900	116,166,230
			2009	1,664,046	171,300	97,142,207
			2008	2,153,382	180,500	119,300,942
F	Motor Vehicles	Japan	2010	162,112	31,003	52,289,133
			2009	225,866	31,905	70,793,293
			2008	412,272	33,202	124,170,833
G	Motor Vehicles	Japan	2010	79,438	24,440	32,503,273
			2009	114,044	24,257	47,014,882
			2008	216,640	23,712	91,363,023
H	Motor Vehicles	Japan	2010	71,179	10,867	65,500,138
			2009	69,893	10,594	65,974,136
			2008	144,664	10,366	139,556,242
I	Motor Vehicles	Japan	2010	258,972	52,184	49,626,706
			2009	148,591	49,994	29,721,767
			2008	317,500	49,761	63,804,988
J	Computer & Other Electronic Products	Japan	2010	728,441	109,565	66,484,826
			2009	806,125	106,931	75,387,399
			2008	956,350	105,651	90,519,730

- Sample size: Survey research by distributed the questionnaire to the manufacturing firm sample. 30 questionnaires per firm are distributed. Estimated total is 300 samples size. Hair *et al*. (2010) suggest sample size range 200 – 400 is suitable for using structural equation modeling technique. Thus the sample size 300 is in range 200 – 400. Each firm returns the questionnaire more than 25 questionnaires. Finally, this survey has total 270 questionnaires return. By the way the sample size 270 is still in range 200 – 400. Hence, this sample size is suitable for using the structural equation modeling technique. Table 12 shows the number of questionnaire return per firm.

Table 12 Number questionnaire return per firm

Firm	Type of industry	Number of Questionnaire return
A	Motor Vehicles	26
B	Computer & Other Electronic Products	28
C	Motor Vehicles	26
D	Computer & Other Electronic Products	29
E	Computer & Other Electronic Products	25
F	Motor Vehicles	28
G	Motor Vehicles	28
H	Motor Vehicles	26
I	Motor Vehicles	27
J	Computer & Other Electronic Products	27

- Data collection methodology: Survey research applied in this research. Researcher distributes the questionnaires directly to the manufacturing firm and describes a purpose of the research to the participant. Then one week later, researcher goes to manufacturing firm again to receive the completed questionnaire. A respondent required at least engineer or supervisor level up. Their manufacturing firms are located in Samutprakarn, Cholburi, Rayong, and Prajeenburi province. Data collection was completed on October’2011.

- Statistical method: Structural equation modeling (Path and Factor analysis).

- Variable*:* Observed variable data are taken from five Likert scale of the complete survey questionnaire. These observed variables are the representative of each latent variable. There latent variables are KMS, CKM, SDL, LO, KMC, IGP, and IC. Based on the conceptual model, KMS and CKM are exogenous variables. IC is an endogenous variable. SDL, LO, KMC, and IGP serve as both exogenous and endogenous variable.

RESULTS AND DISCUSSION

Results

This section presents the results of this research. The result is divided into two sections. The first section is the development of the IC measurement tool in term of lagging indicator. Moreover this IC measurement tool is validated as a represent of productivity measurement. The second section is the development of the IC roadmap model whereas the IC key indicators are validated as leading indicator (Productivity analysis).

Section 1: IC measurement tool validation.

This section applied a correlation test analysis to study a relationship between IC and value added productivity. Value added productivity is the value added per number of employee. In addition, VAIC is used to define an IC value and then do a correlation test between VAIC and the productivity. This correlation test is used to verify the VAIC as a suitable tool of IC measurement.

VAIC (Value Added Intellectual Coefficient)

Value Added Intellectual Coefficient (VAIC) is widely applied in the Intellectual capital research and it was presented by the Austrian Intellectual Capital Research Center (AICRS) under Pulic (2000).

VAIC Calculation method

Calculation formula: VAIC = VAHU + STVA + VACA

VACA is an indicator of VA efficiency of capital employed = VA ÷ CE

VAHU is an indicator of VA efficiency of human capital = VA ÷ HU

STVA is an indicator of VA efficiency of structural capital = SC ÷ VA

Where

VA = Net sales revenue - Cost of goods sold - Depreciation (Riahi-Belkaoui, 2003)

CE = Total assets - Intangible assets (Pulic, 2000 and Firer and Williams, 2003)

HU = Total expenditure on employees (Pulic, 2000) and Firer and Williams, 2003)

SC = VA – HU (Pulic, 2000 and Firer and Williams, 2003)

- Sample procedure: Top ten high market value manufacturing firm of Thailand stock index.

- Data collection: All data are used from the information of the firm annual report. These annual reports are verified by The Stock Exchange of Thailand.

Calculation result of Value added and a component of VAIC

Table 13 Value added and a component of VAIC

Firm	Year	Value added	Number employee	Capital employed (CE)	VACA	VAHU	STVA
I	2006	3,946,050,000	12,372	33,118,650,000	0.1191	3.1864	0.6862
	2007	4,674,070,000	13,554	44,056,240,000	0.1061	2.3907	0.5817
	2008	3,315,075,589	13,435	58,974,194,933	0.0562	1.4148	0.2932
	2009	1,912,582,717	13,809	46,180,607,584	0.0414	0.8763	-0.1412
II	2006	7,053,289,265	12,613	25,134,339,401	0.2806	1.6111	0.3793
	2007	6,664,434,586	11,677	25,313,207,131	0.2633	1.4609	0.3155
	2008	7,263,314,620	10,049	25,964,755,185	0.2797	1.4945	0.3309
	2009	6,402,846,311	9,693	26,257,213,346	0.2439	1.3564	0.2627

Table 13 (Continued)

Firm	Year	Value added	Number employee	Capital employed (CE)	VACA	VAHU	STVA
III	2006	20,270,000,000	7,155	128,098,000,000	0.1582	4.1571	0.7594
	2007	10,882,580,000	6,409	130,814,000,000	0.0832	1.7817	0.4387
	2008	-16,143,466,254	5,033	102,390,661,795	-0.1577	-3.4943	1.2862
	2009	6,856,010,915	5,325	112,629,319,768	0.0609	1.3134	0.2386
IV	2006	115,014,530,000	5,019	728,856,550,000	0.1578	24.6094	0.9594
	2007	116,577,410,000	7,342	859,825,150,000	0.1356	22.6772	0.9559
	2008	138,825,068,034	3,636	869,135,064,862	0.1597	24.4222	0.9591
	2009	104,560,786,604	3,681	1,083,955,522,839	0.0965	17.8289	0.9439
V	2006	41,013,000,000	23,630	217,495,000,000	0.1886	3.254	0.6927
	2007	39,055,000,000	25,130	244,751,000,000	0.1596	2.9122	0.6566
	2008	32,946,386,000	27,305	282,625,515,000	0.1166	2.1674	0.5386
	2009	41,000,058,000	28,515	312,709,377,000	0.1311	2.3886	0.5813
VI	2006	2,182,224,000	977	44,555,684,000	0.049	6.5973	0.8484
	2007	1,926,606,000	1,001	36,492,880,000	0.0528	5.5754	0.8206
	2008	1,468,512,038	1,015	41,730,326,273	0.0352	4.4007	0.7728
	2009	-3,111,803,570	962	42,725,318,657	-0.0728	-8.9096	1.1122
VII	2006	984,310,000	2,302	5,553,590,000	0.1772	1.4462	0.3086
	2007	924,458,000	2,316	6,483,473,000	0.1426	1.3117	0.2376
	2008	1,273,096,344	2,375	7,277,909,102	0.1749	1.4352	0.3032
	2009	820,220,164	2,548	7,207,758,503	0.1138	0.986	-0.0142
VIII	2006	5,299,000,000	4,511	68,458,000,000	0.0774	3.2409	0.6914
	2007	5,827,000,000	4,691	75,377,000,000	0.0773	2.5452	0.6071
	2008	5,127,470,000	4,369	73,728,886,000	0.0695	2.1594	0.5369
	2009	3,713,221,000	4,314	69,995,007,000	0.053	1.6439	0.3917
IX	2006	1,171,310,000	1,102	20,663,640,000	0.0567	3.4882	0.7133

Table 13 (Continued)

Firm	Year	Value added	Number employee	Capital employed (CE)	VACA	VAHU	STVA
	2007	3,715,410,000	1,196	23,423,350,000	0.1586	10.5693	0.9054
	2008	3,755,065,515	1,196	19,307,018,20	0.1945	10.6821	0.9064
	2009	284,498,704	1,376	20,911,561,072	0.0136	0.6694	-0.4938
X	2006	1,175,837,982	2,161	3,189,617,586	0.3686	3.4737	0.7121
	2007	1,225,527,570	2,222	3,002,253,230	0.4082	3.866	0.413
	2008	1,635,549,242	2,302	3,784,875,204	0.4321	4.1691	0.7601
	2009	2,167,951,954	2,419	3,519,551,160	0.616	4.7068	0.7875

Calculation result of Value added productivity and VAIC

Table 14 Value added productivity and VAIC result

Firm	Year	VAIC	Value added productivity
I	2006	3.99	318,950
	2007	3.08	344,848
	2008	1.76	246,749
	2009	0.78	138,503
	Average	2.4027	262,262.47
II	2006	2.27	559,208
	2007	2.04	570,732
	2008	2.11	722,790
	2009	1.86	660,564
	Average	2.0697	628,323.35
III	2006	5.07	2,832,984
	2007	2.3	1,698,015
	2008	-2.37	-3,207,524

Table 14 (Continued)

Firm	Year	VAIC	Value added productivity
	2009	1.61	1,287,514
	Average	1.6564	652,747.35
IV	2006	25.73	22,915,826
	2007	23.77	15,878,154
	2008	25.54	38,180,712
	2009	18.87	28,405,538
	Average	23.4764	26,345,057.61
V	2006	4.14	1,735,633
	2007	3.73	1,554,119
	2008	2.82	1,206,606
	2009	3.1	1,437,842
	Average	3.4468	1,483,549.84
VI	2006	7.49	2,233,597
	2007	6.45	1,924,681
	2008	5.21	1,446,810
	2009	-7.87	-3,234,723
	Average	2.8205	592,591.22
VII	2006	1.93	427,589
	2007	1.69	399,161
	2008	1.91	536,041
	2009	1.09	321,907
	Average	1.6558	421,174.64
VIII	2006	4.01	1,174,684
	2007	3.23	1,242,166
	2008	2.77	1,173,603
	2009	2.09	860,737
	Average	3.0234	1,112,797.49
IX	2006	4.26	1,062,895
	2007	11.63	3,106,530
	2008	11.78	3,139,687
	2009	0.19	206,758
	Average	6.9659	1,878,967.38
X	2006	4.55	544,118
	2007	5.02	551,543

Table 14 (Continued)

Firm	Year	VAIC	Value added productivity
	2008	5.36	710,491
	2009	6.11	896,218
	Average	5.2604	675,592.22

- Statistical method: Correlation test analysis between Value added productivity and VAIC.

- Result: Pearson correlation result of VAIC and Value added productivity 0.977 (97.7% positive correlation). And P-Value 0.000 means a significant correlate at 95% CI.

Note: P-vale less than 0.05 means a significant correlated at 95% confident interval.

VAIC is high positively correlated with value added productivity. VAIC as ROI technique, firm can applied VAIC to measure the efficiency of investment on IC. Based on statistical result, manufacturing firm should be applied VAIC as a new productivity indicator of the organization. Based on the correlation result, this research concludes IC can be used as a substitute for productivity measurement.

Figure 8 shows the diagram of firm's cash flow and general performance indicator plus VAIC. General performance indicator (ROA, ROE, etc.) are measured base on the tangible asset performance but VAIC is measured base on the intangible asset (IC) performance (Upstream of productivity factor). The performance measurement will completed if they do measurement both tangible and intangible assets of the organization. To fulfillment a manufacturing firm performance measurement, VAIC is recommended as an IC indicator in the manufacturing firm. In addition, VAIC is useful for management to monitor IC as a productivity indicator in the organization.

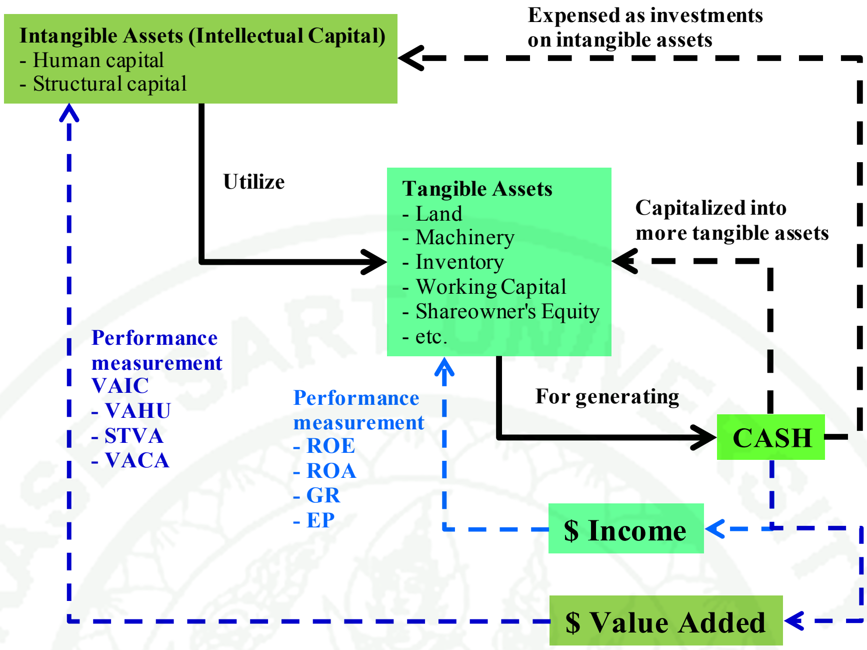

Figure 9 Manufacturing firm cash flow and performance measurement

Based on the research question, can measuring IC be used as a substitute for productivity measurement? The result shows IC measurement can be used as a productivity measurement. Manufacturing firms should be measure IC as a new indicator of productivity. The research result shows IC impacted on the growth of productivity, the next step of research is provided the IC development roadmap. The IC development roadmap is used for the productivity analysis.

Section 2: IC development roadmap model.

This section applied a Structural equation modeling to study a relationship between latent variables. Latent variable and their relationship as following;

Knowledge Management System (KMS)

Customer Knowledge Management (CKM)

Self-Directed Learning (SDL)

Learning Organization (LO)

Knowledge Management Cycle (KMC)

Customer Knowledge Management (CKM)

Intellectual Capital (IC)

Table 15 Relationship hypothesis on latent variable

Relationship hypothesis between latent variable	**Relationship symbol**
KMS positive associated with CKM	KMS ←→ CKM
KMS positively affects SDL	KMS → SDL
KMS positively affects LO	KMS → LO
KMS positively affects KMC	KMS → KMC
CKM positively affects LO	CKM → LO
CKM positively affects KMC	CKM → KMC
CKM positively affects IGP	CKM → IGP
SDL positively affects IC	SDL → IC
LO positively affects IC	LO → IC
KMC positively affects IC	KMC → IC
IGP positively affects IC	IGP → IC

Based on the relationship between latent variables, the IC development model can be constructed as detail in figure 10.

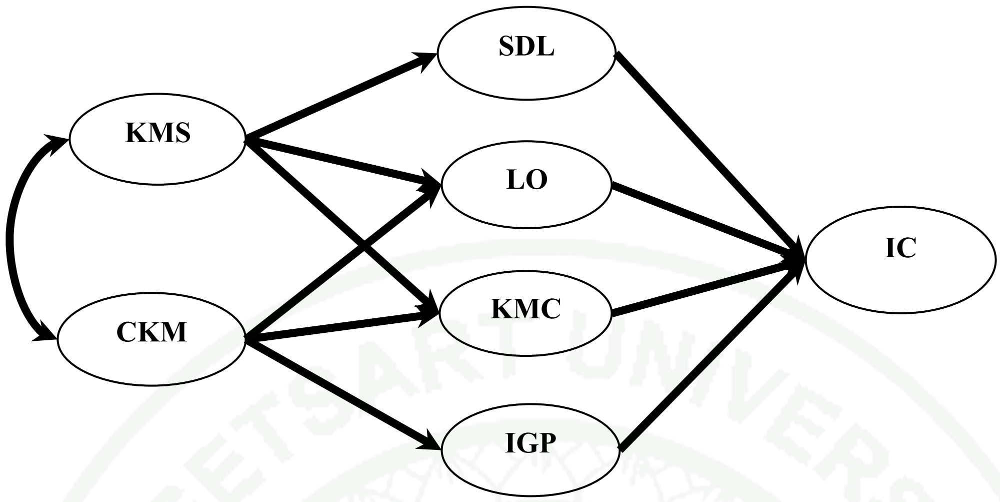

Figure 10 IC development roadmap model: “SMILE” model

The IC development roadmap model starts with KMS and CKM. Then KMS supports SDL, LO and KMC. And CKM supports LO, KMC and IGP. At the final stage, SDL, LO, KMC, and IGP support IC.

Latent variables of the conceptual model are KMS, CKM, SDL, LO, KMC, IGP, and IC. Total seven latent variables are in the conceptual model. Latent variable used the observed variable as a representative. This research has total 96 observed variables and these observed variables are in the questionnaire.

Variable

Observed variable data are taken from five Likert scale of the completed survey questionnaire. These observed variables are the representative of each latent variable. Total 270 questionnaires are return to researcher, and then interpret their data into descriptive statistical result.

The descriptive statistical results of this research are mean and standard deviation (S.D.) of each observed variable and the descriptive statistical results shows as following;

Latent variable: Knowledge management system

Communication and Collaboration Technologies	Mean N = 270	S.D. N = 270
1. People in your organization always send/receive information/data via Information Technology System such as e-mail, intranet, web board etc.	4.2815	0.8057
2. People in your organization always access to organization's information data base system.	3.8741	0.8398
3. Your organization always discuss/meeting information/data via net meeting, E-conference etc.	3.5667	0.9452
4. Your organization's IT system always support group working such as groupware etc.	3.6815	0.8462
Storage and retrieval technologies	**Mean N = 270**	**S.D. N = 270**
1. Your organization has Information technology department to store organization's information/data.	4.1593	0.7716
2. People in your organization always know where they can find the information/data in organization information/data warehousing.	4.0926	0.7919
3. Your organization has document center department to manage information/data warehousing.	3.7667	0.8842

Latent variable: Self-directed learning

Self-directed learning	Mean N = 270	S.D. N = 270
1. People in your organization always increase their knowledge or improve work performance by accessing organization information/data warehousing.	3.4778	0.9857
2. People in your organization always increase their knowledge or improve work performance by working with workgroup.	3.6000	0.8553
3. People in your organization can learn manufacturing process via organization information technology system (Web., Intranet etc.).	3.5296	0.8209
4. Your organization always open new knowledge source for employee searching, finding, adapting new solution on their work.	3.4407	0.9879

Latent variable: Learning organization

Learning organization practices	Mean N = 270	S.D. N = 270
Clarity of Purpose and Mission		
1. Each department in your organization has sub-goal that support to the main goal of organization.	3.8556	0.8390
2. People in your organization always know the gap between current base line and the goal of department.	3.7259	0.8354
3. People in your organization always know the mission that support to the department goal achievement.	3.8444	0.7795
4. The organization's mission statement can use to identify the performance of employee.	3.7444	0.9153
Leadership Commitment and Empowerment		
1. Senior managers/Directors in this organization open his/her mind for new ideas introducing/sharing from their colleague.	3.3222	0.9504
2. Senior managers/Directors and employees in this organization share a common vision for what our work should accomplish.	3.5333	0.9150
3. Managers in this organization often provide useful feedback that helps to identify potential problems and opportunities.	3.4444	0.9220
4. Managers in this organization frequently involve with employees in important decisions.	3.5074	0.9156
Experimentation		
1. People in your organization often bring new ideas into the organization.	3.1852	0.9845
2. Managers in this organization encourage team members to experiment in order to improve work processes.	3.3704	0.9104
3. Innovative ideas that work are often rewarded by management.	3.2741	0.9321
4. In my experience, management always welcomes for the new idea from	3.3185	0.9339
1. Employees often have an opportunity to share about successful programs or work activities to other staff.	3.3667	0.8059
2. Failures are discussed in our organization for improvement.	3.4667	0.8387
3. New work processes that may be useful to the organization are usually shared with all employees.	3.2370	0.9303
4. We have a system that allows us to learn successful practices from other organizations.	3.5000	0.8077

Teamwork and Group-Problem Solving

1. Current organizational practice encourages employees to solve problems in team before discussing them with a manager.	3.5704	0.8274
2. We can usually form informal groups to solve problems in organization.	3.7852	0.7986
3. Members of the problem solving team, are always came from another section or the function of work different.	3.5852	0.89928

Latent variable: Knowledge management cycle

Knowledge management cycle practices	Mean N = 270	S.D. N = 270
Create knowledge		
1. New products/processes are always generated in your organization.	3.6074	0.82341
2. New ideas/solutions are always generated in your organization.	3.5556	0.8012
3. Your organization always has new improvement on quality/productivity.	3.6815	0.7332
Capture knowledge		
1. New products/processes are always presented in your organization by following organization report format.	3.4185	0.7849
2. New idea/solutions are always presented in your organization by following organization report format.	3.5185	0.7842
3. New improvements on quality/productivity are always presented in your organization by following organization report format.	3.4444	0.7728
Refine knowledge		
1. New products/processes are always successfully implemented in your organization.	3.6000	0.7968
2. New ideas/solutions are always applied in your organization.	3.6444	0.7757
3. New improvements on quality/productivity are always implemented in your organization.	3.6741	0.7744
Store knowledge		
1. New products/processes details are always stored in your organization more than one year.	3.7963	0.8266
2. New ideas/solutions details are always stored in your organization more than one year.	3.7333	0.8683
3. New improvements on quality/productivity details are always stored in your organization more than one year.	3.5481	0.7829

Manage knowledge

1. Your organization has the information/document center section.	3.5704	0.7270
2. Information/documents always up to date.	3.5815	0.7460
3. Information/documents are always reviewed with originator before store in center.	3.6852	0.7169

Disseminate knowledge

1. Your organization always distributes new information to people in the organization.	3.4556	0.8292
2. People in your organization can access to information/document center anytime that they want in the organization.	3.5074	0.7891
3. People in your organization can access to information/document center anywhere that they want in the organization.	3.5000	0.8437

Latent variable: Customer knowledge management

Customer Knowledge management practices	Mean N = 270	S.D. N = 270
Knowledge from customer		
1. Your organization always has a meeting with customer to received suggestion on your product and/or service.	3.5778	0.8086
2. Your organization always invites customer to share knowledge and/or experience on your product and/or service.	3.4926	0.8655
3. Your organization always discusses with customer to access what they want on your product and/or service.	3.5259	0.7599
4. Your organization always applied the information of customer on your new product and/or service.	3.6704	0.7308
Refine knowledge		
1. Good suggestions of customer are always successfully implemented in your organization.	3.6259	0.7693
2. Knowledge/experience of customer (Benchmark with competitor product) are always considered to apply in your product and/or service.	3.5593	0.6967
3. Customer requests are always considered to apply in your product and/or service.	3.6259	0.7547
Store knowledge		
1. Suggestion details of customer are always stored in your organization.	3.5185	0.9031
2. Knowledge/experience details from customer sharing are always stored in your organization.	3.5407	0.8900
3. Customer request topics are always stored in your organization.	3.5667	0.8455

Manage knowledge

1. Your organization has the information/document center section to collects the customer information.	3.5741	0.7809
2. Information/documents from customer always up to date.	3.6519	0.7886
3. Information/documents from customer are always review with customer before store in center.	3.5630	0.7428
Disseminate knowledge		
1. Your organization always distribute customer information to people in your organization.	3.4889	0.7843
2. People in your organization can access to customer information/document center anytime that they want in organization.	3.5444	0.8157
3. People in your organization can access to customer information/document center anywhere that they want in organization.	3.3444	0.9022

Latent variable: Innovation generation process

Innovation Generation process practices	Mean N = 270	S.D. N = 270
Idea generation		
1. Concepts of new product are always generated in your organization.	3.5185	0.8391
2. Concepts of new process are always generated in your organization.	3.6148	0.8578
3. New management tools (such as TQM, JIT, Lean manufacturing etc.) are always applied in your organization.	3.5185	0.8302
Innovation support		
1. Concepts of new product are always reviewed with management team before develop to new product.	3.5222	0.8695
2. Concepts of new process are always reviewed with management team before develop to new process.	3.5407	0.8515
3. New management tools always align with organization goal.	3.6000	0.8725
Innovation development		
1. Organization always allocates resource (man, time, machine, material, money etc.) to support New product development.	3.5593	0.8548
2. Organization always allocates resource (man, time, machine, material, money etc.) to support New process development.	3.5667	0.8277
3. New management tools are always promoted by management team.	3.5556	0.8507
Innovation implementation		
1. New product of your organization always has high market share.	3.6556	0.8111
2. New process always increases your organization productivity/quality.	3.6593	0.8330

3. Your organization always achieves organization's goal (Cost reduction, good delivery etc.) by applying new management tools.	3.5852	0.7892

Latent variable: Intellectual capital

Intellectual capital key indicator	Mean N = 270	S.D. N = 270
Human capital		
1. Almost employees in your organization have ability to solve customer's problems (Quality improvement).	3.5778	0.6840
2. Amount of talent employee are same or increase if compare to last year.	3.4852	0.7553
3. Your organization has effective system to attract talent employee from outside organization.	3.4963	0.8867
4. Almost employees can use basic computer program such as Microsoft office, outlook etc.	3.8593	0.7871
5. Your organization always has useful training courses.	3.7667	0.8842
6. Almost employees in your organization highly satisfied with the organization and their jobs.	3.6815	0.7823
7. Almost employees in your organization highly dedicated and committed to the organization.	3.6444	0.7563
Innovation capital		
1. Your organization always invest in R&D.	3.3370	0.8800
2. Your organization highly focuses on R&D team.	3.4889	0.9196
3. Your organization always introduces new products into market.	3.5259	0.8651
4. Your organization always generates new intellectual property.	3.4630	0.9853
Process capital		
1. Your organization has highly effectiveness documentation management (Like library).	3.6111	0.8319
2. Your organization has highly effectiveness communication system.	3.6481	0.8350
3. Your organization has real-time system to monitor productivity and quality in manufacturing process.	3.6556	0.8065
4. Your organization has highly effectiveness quality control system (Low return rate from customer).	3.6778	0.7972
Customer capital		
1. Almost customers are satisfied in your product/service.	3.8444	0.7890
2. Unit of sales always increases every year.	3.8148	0.7182

3. Low customer reporting complaints on your organization product/service.	3.7407	0.6730
4. Market share always increase every year.	3.7667	0.8322
5. Almost customers always repeat order.	3.8333	0.7253

Based on the research question, validate the IC key indicator is required. The next statistical result is the IC index of each manufacturing firm. The next table presents the IC index and the value added productivity of each manufacturing firm. The IC index is averaged from all IC observed variable of each firm (Bozbura, 2004).

Table 16 IC index and value added productivity

Firm	Sample size	IC index	Value added productivity		
			Year 2008	Year 2009	Year 2010
A	26	3.0678	91,010,626	6,550,148	10,563,773
B	28	3.2420	47,166,326	3,9937,589	39,398,270
C	26	3.9711	143,538,464	77,301,866	80,030,382
D	29	3.6107	78,788,927	60,646,193	47,455,758
E	25	3.9569	119,300,942	9,7142,207	116,166,230
F	28	3.8211	124,170,833	70,793,293	52,289,133
G	28	3.6288	91,363,023	47,014,882	32,503,273
H	26	3.8661	139,556,242	65,974,136	65,500,138
I	27	3.4592	63,804,988	29,721,767	49,626,706
J	27	3.8148	90,519,730	75,387,399	66,484,826

To validate the IC index, a correlation test is used to test a relationship between the IC index and value added productivity. The correlation test applied between the IC index and three year of value added productivity. This correlation test used to prove time lagging is not effect to the IC index. Moreover, the correlation test is used to validate a positive relationship of the IC index and the firm productivity.

The result of correlation test as following;

- Pearson correlation of the IC index and Value added productivity year 2010 = 0.821 (82.1% positive correlation). P-Value 0.004 means a significant correlate at 95% CI.

- Pearson correlation of the IC index and Value added productivity year 2009 = 0.928 (92.8% positive correlation). P-Value 0.000 means a significant correlate at 95% CI.

- Pearson correlation of the IC index and Value added productivity year 2008 = 0.745 (74.5% positive correlation). P-Value 0.013 means a significant correlate at 95% CI.

Note: P-vale less than 0.05 means a significant correlated at 95% confident interval.

The conclusion is IC related to a firm productivity and the IC key indicator can be applied to the IC development roadmap model for productivity analysis.

Next result, the IC development roadmap model is validated by using SEM technique. In the same time, the observed variables of IC are also validated in the measurement model. This validate do at one time during software test a fit data of the model, and the statistical results shows in the software result report in Appendix D.

Structural equation modeling result

The structural equation modeling (SEM) is applied in this research to test the conceptual model and hypothesis. SEM is a multivariate statistical technique for confirming the structural theory (Tan, 2001). This research applied LISREL 8.72 as statistical analysis software and selected maximum likelihood as the parameter estimation method (Ho, 2008).

The result of the structural equation modeling is provided in two parts. Part one is a confirmation of measurement model and part two is a confirmation of structural model.

Measurement model result

LISREL software is provided a result of measurement model; this technique is used to confirm the key indicator of IC. The LISREL output shows the parameter estimation and t-value. The t-value is used to conclude a relationship between observed variable and latent variable. The hypothesis of statistical test is;

- Null hypothesis: No relationship between observed variable and latent variable (The parameter estimation equal zero).

- Alternative hypothesis: Significant relationship between observed variable and latent variable (The parameter estimation is not zero).

If the null hypothesis is rejected, a conclusion is “the observed variable has a significant relate to the latent variable”.

Based on t-distribution table at large sample size (> 120 samples), the t-value 1.960 is a minimum value for a rejection of the null hypothesis at 95% CI. In addition, the t-value 2.567 is a minimum value for a rejection of the null hypothesis at 99% CI.

Overall result of observed variables of each latent variable, the parameter estimation value, and the t-value show as following;

Latent variable: Knowledge management system

Communication and Collaboration Technologies	Parameter Estimation	T-value
1. People in your organization always send/receive information/data via Information Technology System such as e-mail, intranet, web board etc.	1	Fix parameter
2. People in your organization always access to organization's information data base system.	0.70	8.44
3. Your organization always discuss/meeting information/data via net meeting, E-conference etc.	0.98	10.35
4. Your organization's IT system always support group working such as groupware etc.	1.12	15.10
Storage and retrieval technologies	**Parameter Estimation**	**T-value**
1. Your organization has Information technology department to store organization's information/data.	1	Fix parameter
2. People in your organization always know where they can find the information/data in organization information/data warehousing.	1.20	14.34
3. Your organization has document center department to manage information/data warehousing.	1.39	13.71

Latent variable: Self-directed learning

Self-directed learning	Parameter Estimation	T-value
1. People in your organization always increase their knowledge or improve work performance by accessing organization information/data warehousing.	1	Fix parameter
2. People in your organization always increase their knowledge or improve work performance by working with workgroup.	1.22	8.90
3. People in your organization can learn manufacturing process via organization information technology system (Web., Intranet etc.).	1.38	8.97
4. Your organization always open new knowledge source for employee searching, finding, adapting new solution on their work.	1.30	9.25

Latent variable: Learning organization

Learning organization practices	Parameter Estimation	T-value
Clarity of Purpose and Mission		
1. Each department in your organization has sub-goal that support to the main goal of organization.	1	Fix parameter
2. People in your organization always know the gap between current base line and the goal of department.	0.97	16.17
3. People in your organization always know the mission that support to the department goal achievement.	1.09	13.09
4. The organization's mission statement can use to identify the performance of employee.	0.87	10.72
Leadership Commitment and Empowerment		
1. Senior managers/Directors in this organization open his/her mind for new ideas introducing/sharing from their colleague.	1	Fix parameter
2. Senior managers/Directors and employees in this organization share a common vision for what our work should accomplish.	0.94	14.45
3. Managers in this organization often provide useful feedback that helps to identify potential problems and opportunities.	0.98	13.84
4. Managers in this organization frequently involve with employees in important decisions.	0.98	13.67
Experimentation		
1. People in your organization often bring new ideas into the organization.	1	Fix parameter
2. Managers in this organization encourage team members to experiment in order to improve work processes.	0.96	12.93
3. Innovative ideas that work are often rewarded by management.	0.95	13.27
4. In my experience, management always welcomes for the new idea from employees.	1.05	15.68
Transfer of Knowledge		
1. Employees often have an opportunity to share about successful programs or work activities to other staff.	1	Fix parameter
2. Failures are discussed in our organization for improvement.	1.09	18.88
3. New work processes that may be useful to the organization are usually shared with all employees.	0.99	14.03
4. We have a system that allows us to learn successful practices from other organizations.	0.89	13.37

Teamwork and Group-Problem Solving

1. Current organizational practice encourages employees to solve problems in team before discussing them with a manager.	1	Fix parameter
2. We can usually form informal groups to solve problems in organization.	0.93	14.59
3. Members of the problem solving team, are always came from another section or the function of work different.	0.86	11.96

Latent variable: Knowledge management cycle

Knowledge management cycle practices	Parameter Estimation	T-value
Create knowledge		
1. New products/processes are always generated in your organization.	1	Fix parameter
2. New ideas/solutions are always generated in your organization.	0.92	13.74
3. Your organization always has new improvement on quality/productivity.	0.98	15.30
Capture knowledge		
1. New products/processes are always presented in your organization by following organization report format.	1	Fix parameter
2. New idea/solutions are always presented in your organization by following organization report format.	0.92	15.28
3. New improvements on quality/productivity are always presented in your organization by following organization report format.	0.81	13.20
Refine knowledge		
1. New products/processes are always successfully implemented in your organization.	1	Fix parameter
2. New ideas/solutions are always applied in your organization.	0.88	16.63
3. New improvements on quality/productivity are always implemented in your organization.	0.96	16.79
Store knowledge		
1. New products/processes details are always stored in your organization more than one year.	1	Fix parameter
2. New ideas/solutions details are always stored in your organization more than one year.	1.11	21.47
3. New improvements on quality/productivity details are always stored in your organization more than one year.	1.07	20.91

Manage knowledge

1. Your organization has the information/document center section.	1	Fix parameter
2. Information/documents always up to date.	1.06	19.00
3. Information/documents are always reviewed with originator before store in center.	0.95	17.94

Disseminate knowledge

1. Your organization always distributes new information to people in the organization.	1	Fix parameter
2. People in your organization can access to information/document center anytime that they want in the organization.	0.99	15.49
3. People in your organization can access to information/document center anywhere that they want in the organization.	1.14	16.71

Latent variable: Customer knowledge management

Customer Knowledge management practices	Parameter Estimation	T-value
Knowledge from customer		
1. Your organization always has a meeting with customer to received suggestion on your product and/or service.	1	Fix parameter
2. Your organization always invites customer to share knowledge and/or experience on your product and/or service.	0.84	11.67
3. Your organization always discusses with customer to access what they want on your product and/or service.	0.54	7.39
4. Your organization always applied the information of customer on your new product and/or service.	0.67	8.58
Refine knowledge		
1. Good suggestions of customer are always successfully implemented in your organization.	1	Fix parameter
2. Knowledge/experience of customer (Benchmark with competitor product) are always considered to apply in your product and/or service.	1.14	16.54
3. Customer requests are always considered to apply in your product and/or service.	1.01	13.31
Store knowledge		
1. Suggestion details of customer are always stored in your organization.	1	Fix parameter
2. Knowledge/experience details from customer sharing are always stored in your organization.	1.09	14.10
3. Customer request topics are always stored in your organization.	1.07	18.23

Manage knowledge

1. Your organization has the information/document center section to collects the customer information.	1	Fix parameter
2. Information/documents from customer always up to date.	1.16	16.23
3. Information/documents from customer are always review with customer before store in center.	0.97	15.35

Disseminate knowledge

1. Your organization always distribute customer information to people in your organization.	1	Fix parameter
2. People in your organization can access to customer information/document center anytime that they want in organization.	1.07	14.38
3. People in your organization can access to customer information/document center anywhere that they want in organization.	0.94	14.50

Latent variable: Innovation generation process

Innovation Generation process practices	Parameter Estimation	T-value
Idea generation		
1. Concepts of new product are always generated in your organization.	1	Fix parameter
2. Concepts of new process are always generated in your organization.	1.01	19.43
3. New management tools (such as TQM, JIT, Lean manufacturing etc.) are always applied in your organization.	0.93	20.37
Innovation support		
1. Concepts of new product are always reviewed with management team before develop to new product.	1	Fix parameter
2. Concepts of new process are always reviewed with management team before develop to new process.	0.98	24.71
3. New management tools always align with organization goal.	1.07	21.28
Innovation development		
1. Organization always allocates resource (man, time, machine, material, money etc.) to support New product development.	1	Fix parameter
2. Organization always allocates resource (man, time, machine, material, money etc.) to support New process development.	0.98	20.16
3. New management tools are always promoted by management team.	1.06	22.94

Innovation implementation

1. New product of your organization always has high market share.	1	Fix parameter
2. New process always increases your organization productivity/quality.	0.86	15.13
3. Your organization always achieves organization's goal (Cost reduction, good delivery etc.) by applying new management tools.	0.87	17.33

Latent variable: Intellectual capital

Intellectual capital key indicator	Parameter Estimation	T-value
Human capital		
1. Almost employees in your organization have ability to solve customer's problems (Quality improvement).	1	Fix parameter
2. Amount of talent employee are same or increase if compare to last year.	0.85	12.60
3. Your organization has effective system to attract talent employee from outside organization.	1.08	14.21
4. Almost employees can use basic computer program such as Microsoft office, outlook etc.	0.84	11.58
5. Your organization always has useful training courses.	1.20	17.23
6. Almost employees in your organization highly satisfied with the organization and their jobs.	1.11	19.01
7. Almost employees in your organization highly dedicated and committed to the organization.	0.98	15.83
Innovation capital		
1. Your organization always invest in R&D.	1	Fix parameter
2. Your organization highly focuses on R&D team.	1.15	18.51
3. Your organization always introduces new products into market.	0.97	14.67
4. Your organization always generates new intellectual property.	1.27	17.34
Process capital		
1. Your organization has highly effectiveness documentation management (Like library).	1	Fix parameter
2. Your organization has highly effectiveness communication system.	1.01	19.21
3. Your organization has real-time system to monitor productivity and quality in manufacturing process.	1.02	15.07
4. Your organization has highly effectiveness quality control system (Low return rate from customer).	0.99	14.74

Customer capital

1. Almost customers are satisfied in your product/service.	1	Fix parameter
2. Unit of sales always increases every year.	0.75	11.18
3. Low customer reporting complaints on your organization product/service.	0.84	14.93
4. Market share always increase every year.	1.02	14.69
5. Almost customers always repeat order.	0.87	13.75

Based on the result, all observed variables have t-value more than 2.567. So the conclusion is "All observed variables of each latent variable have a significant relate to their latent variable at 99% confident interval".

Structural model result

In the "SMILE" model, KMS and CKM are exogenous variables. IC is an endogenous variable. SDL, LO, KMC, and IGP serve as both exogenous and endogenous variable. KMS, CKM, SDL, KMC, LO, IGP, and IC are latent variable.

LISREL software provides a result of the fit model; this technique is used to test a relationship between latent variable (The arrow direction of each path represent a relationship between latent variable). The LISREL output shows the parameter estimation and t-value of each path. The t-value is used to conclude a relationship between latent variable. The hypothesis of statistical test is;

- Null hypothesis: No relationship between latent variable (The parameter estimation equal zero).

- Alternative hypothesis: Significant relationship between latent variable (The parameter estimation is not zero).

If the null hypothesis is rejected, a conclusion is “a latent variable significant relate to another latent variable via a path indicated”. Table 16 shows the model hypothesis, a relationship between latent variables (Path), the parameter estimation value, and the t-value.

Based on t-distribution table at large sample size (> 120 samples), the t-value 1.960 is a minimum value for a rejection of the null hypothesis at 95% CI. In addition, the t-value 2.567 is a minimum value for a rejection of the null hypothesis at 99% CI.

Table 17 Hypothesis, latent relationship, parameter estimation and T-value result

Hypothesis of this research	Relationship	Parameter Estimation	T-value
H1: KMS positive associated with CKM	KMS ↔ CKM	0.22	7.66
H2-1: KMS positively affects SDL	KMS → SDL	0.74	8.89
H2-2: KMS positively affects LO	KMS → LO	0.23	4.36
H2-3: KMS positively affects KMC	KMS → KMC	0.12	2.23
H3-1: CKM positively affects LO	CKM → LO	0.64	12.73
H3-2: CKM positively affects KMC	CKM → KMC	0.78	14.45
H3-3: CKM positively affects IGP	CKM → IGP	0.91	17.07
H4-1: SDL positively affects IC	SDL → IC	0.13	2.34
H4-2: LO positively affects IC	LO → IC	0.21	2.97

Table 17 (Continued)

Hypothesis of this research	Relationship	Parameter Estimation	T-value
H4-3: KMC positively affects IC	KMC ➔ IC	0.24	3.98
H4-4: IGP positively affects IC	IGP ➔ IC	0.36	7.62

"SMILE" Model result

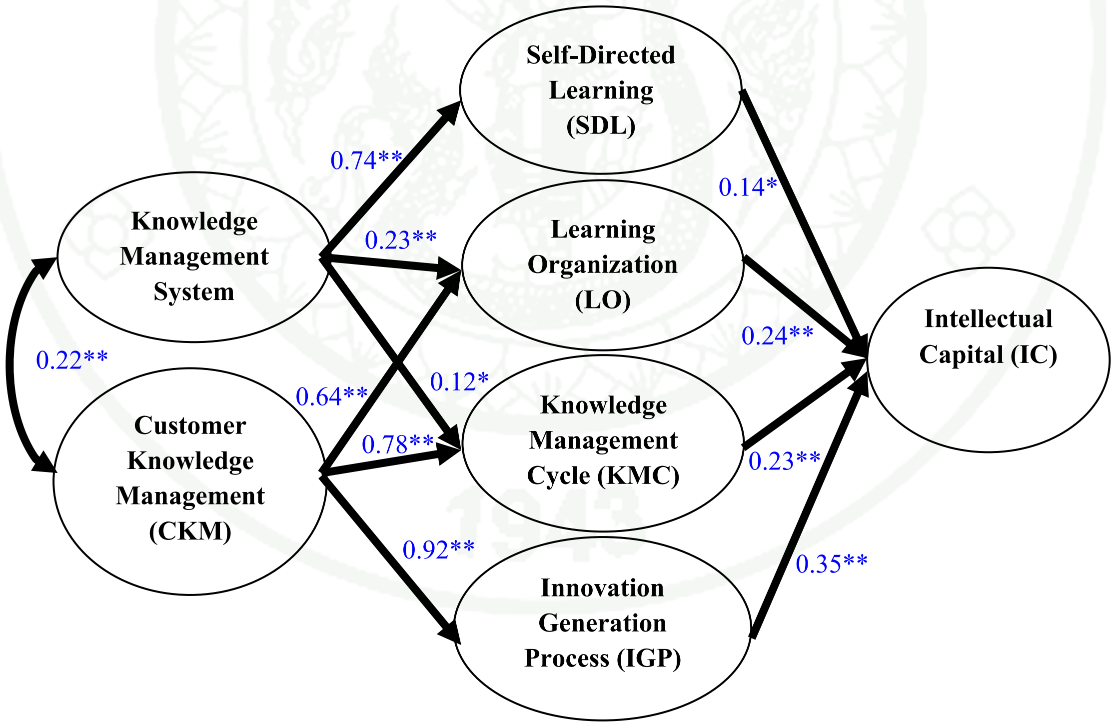

Figure 11 "SMILE" Model Result

Note: * mean significant at 95% CI and ** mean significant at 99% CI.

The final SEM model analysis is shown in Figure 11 (The “SMILE” model). The absolute fit measures (NFI = 0.93, NNFI = 0.95, CFI = 0.95, and RMSEA = 0.099) indicates that the “SMILE” model meets recommended levels, and represents a satisfactory fit for the sample data collected.

The Chi-square statistic divided by the degrees of freedom also indicates a model fit at 3.47. It can be concluded that the “SMILE” model maintains good construct validity. Since the model is valid, next step of the structural equation modeling is a regression predictability validation. The output result of LISREL is structural equations. This equation is a regression analysis. There are simple and multi regression model. Type of regression based on number of independent variables (Latent variables).

Structural Equations

LISREL software is provided the regression equations. The output result of LISREL shows a regression equation, regression coefficient with the t-value, and R-square result.

The criteria of accept the prediction equation as following;

1. The t-value more than 1.96 means parameter is not equal zero at 95% CI.

2. R-square more than 60%. (Venkatesh *et al*., 2003)

SDL regression equation

Simple regression: SDL = 0.74KMS

Regression coefficient = 0.74 with t-value = 8.88

R-square = 70%

Conclusion: SDL regression equation is suitable for predicting the SDL.

LO regression equation

Multi regression: LO = 0.23KMS + 0.64CKM

Regression coefficient = 0.23 with t-value = 4.39

Regression coefficient = 0.64 with t-value = 12.72

R-square = 78%

Conclusion: LO regression equation is suitable for predicting the LO.

KMC regression equation

Multi regression: KMC = 0.12KMS + 0.78CKM

Regression coefficient = 0.12 with t-value = 2.20

Regression coefficient = 0.78 with t-value = 14.59

R-square = 78%

Conclusion: KMC regression equation is suitable for predicting the KMC.

IGP regression equation

Simple regression: IGP = 0.92CKM

Regression coefficient = 0.92 with t-value = 17.19

R-square = 68%

Conclusion: IGP regression equation is suitable for predicting the IGP.

IC regression equation

Multi regression: IC = 0.14SDL + 0.24LO + 0.23KMC + 0.35IGP

Regression coefficient = 0.14 with t-value = 2.35

Regression coefficient = 0.24 with t-value = 3.32

Regression coefficient = 0.23 with t-value = 3.66

Regression coefficient = 0.35 with t-value = 7.30

R-square = 76%

Conclusion: IC regression equation is suitable for predicting the IC.

All structural equations are the good prediction equations. There structural equations are the regression model. All regression coefficients are not equal zero at 95% CI. In addition, all regression models have R-square more than 60% (Almost regression models have R-square more than 70%). Especially for the IC regression equation, it has R-square more than 75%. IC regression equation is a good IC prediction model.

Discussion

Current knowledge economy, the intellectual capital is a main contribute value to the firms (Pulic, 2004). IC is an intangible asset and consists of human and structural capital. IC is the organization's intangible asset, and the intangible asset is difficult to measure and manage in the organization.

The result of the research introduce VAIC is a suitable IC measurement tool. The criteria of selecting IC measurement tool are based on the measurement theory and benchmark ability. The conclusion is "VAIC is a suitable lagging indicator of IC" and "IC key indicator is a suitable leading indicator of IC". Both IC measurement tools can be used as a productivity measurement.

VAIC as IC lagging indicator is used to monitor the efficiency of manufacturing firm investment on IC. In addition, the IC key indicator as the leading indicator is used to establish the IC development roadmap of the manufacturing firm.

To verify an IC measurement tool, the correlation test is applied between VAIC and value added productivity. Moreover the correlation test is also applied between the IC key indicator (The average of IC key indicator is the IC index) and value added productivity.

The result of correlation test present,

1. VAIC has high positive relate to the manufacturing firm value added productivity.

2. The IC index (IC key indicator normalized value) has high positive relate to the manufacturing firm value added productivity.

The VAIC is a suitable IC measurement tool and the manufacturing firm needs to apply VAIC as a new productivity measurement in the organization. VAIC is indicated the efficiency of the firm investment on IC and monitor in a monetary indicator of the productivity measurement.

The IC index is a suitable IC measurement tool for the IC source of the manufacturing firm. The IC index is the average value of the IC key indicator. These IC indicators are suitable for establish the IC development roadmap. The final propose of the research provided the IC development roadmap. The IC development roadmap model of the research named “SMILE” model.

Based on result of model validity, the SMILE model is a good construct (Meet all criteria of structural equation modeling qualification). Thus the SMILE model is suitable for applying in the manufacturing firm for enhancing the IC and productivity.

Manufacturing firm can applied “SMILE” model as strategic tool to develop IC in organization. Concept of “SMILE” model started from KMS and CKM. Organization needs to provide KMS and CKM at the first stage. KMS supported employee for self-directed learning, supported organization for promote a learning organization, and supported knowledge management cycle activity in organization. CKM provided the goal (what customer want/need: Quality) and direction for learning organization. CKM is also provided customer's information to generate new innovation and support knowledge management cycle activity in organization. Then SDL, LO, KMC and IGP drive and enhance IC and productivity of the organization.

Note in predictability, the LISREL shows the indirect effect result. The SMILE model, KMS and CKM have an indirect effect to the IC. The IC regression equation of the indirect effect as following;

Indirect effect path: IC regression equation

Multi regression: IC = 0.18KMS + 0.64CKM

Regression coefficient = 0.18 with t-value = 4.32

Regression coefficient = 0.64 with t-value = 13.73

R-square = 68%

Conclusion: IC regression equation is suitable for predicting the IC.

The indirect effect of this result demonstrates KMS and CKM are effect to the IC through SDL, LO, KMC, and IGP. This evident show the manufacturing firm needs to follow the concept of the SMILE model to enhance the IC and the productivity of the organization. This part concerns on the productivity analysis, the result show the production input factor of this research are KMS, CKM, SDL, LO, KMC, and IGP. In addition, these input factors form as a sequence as a path model.

CONCLUSION AND RECOMMENDATION

Conclusion

The IC is a main driving the productivity of manufacturing firm in current knowledge economy. As described in the section of Literature Review, generally, the IC is intangible assets of the organization and IC contributes value to the organization. The manufacturing firm needs to focus on IC to sustain competitive advantage and enhance their productivity. Therefore IC is very important for the manufacturing firm.

Based on IC is an intangible asset of the organization, so IC is difficult to measure and manage. This research provides the suitable IC measurement tool both lagging and leading indicator measurement. At the final output of the research, the IC development roadmap is introduced. The overall of the output of this research will assist manufacturing firm's management to measure and manage their firm's IC for enhancement the productivity of the firm.

The research has two majorities finding, there are the suitable IC measurement tool (Productivity measurement) and the IC development roadmap (Productivity analysis).

1. Intellectual capital measurement tool

The first output of the research is the suitable IC measurement tool. There is lagging and leading indicator measurement. The result of research shows VAIC is a good lagging of IC measurement. In addition, the IC key indicator is a good leading of IC measurement.

VAIC (Value Added Intellectual Coefficient)

Value Added Intellectual Coefficient (VAIC) is widely applied in the Intellectual capital research and it was presented by the Austrian Intellectual Capital Research Center (AICRS) under Pulic (2000).

VAIC Calculation method

Calculation formula: VAIC = VAHU + STVA + VACA

VACA is indicator of VA efficiency of capital employed = VA ÷ CE

VAHU is indicator of VA efficiency of human capital = VA ÷ HU

STVA is indicator of VA efficiency of structural capital = SC ÷ VA

Where

VA = Net sales revenue - Cost of goods sold - Depreciation (Riahi-Belkaoui, 2003)

CE = Total assets - Intangible assets (Pulic, 2000 and Firer and Williams, 2003)

HU = Total expenditure on employees (Pulic, 2000) and Firer and Williams, 2003)

SC = VA – HU (Pulic, 2000 and Firer and Williams, 2003)

The result of this research shows a high positive relationship between VAIC and value added productivity. VAIC is a monetary measurement and it suitable for measure the efficiency of investment on IC. A manufacturing firm who has high VAIC means has high IC and high productivity. Thus management level of the manufacturing firm must be applied the VAIC as a one key of productivity indicator in the organization.

IC key indicator

The IC key indicator is a non-monetary key indicator which used to measure IC at the direct source. The observed variable of IC is the key indicator. The observed variable data is surveyed in the best practice organizations. Then calculated the IC index by averaged all the IC observed variables. The IC index is non-monetary measurement tool. The result of research show a high positive relationship between the IC index and value added productivity. Likewise, the IC index is suitable for measure the IC at direct source. To prevent the bias from the respondent in the organization, this research interprets their observed variables to the performance IC indicator as following;

IC key indicator converts to the performance IC indicator

A. Human capital

Observed variable/IC key indicator	Performance IC indicator
1. Almost employees in your organization have ability to solve customer's problems (Quality improvement). 2. Almost employees in your organization highly dedicated and committed to the organization.	Percentage of customer problem solving project succeed in period of time (week, month etc.).
3. Amount of talent employees are same or increase if compare to last year.	Percentage of talent employee in period of time (month, year etc.).
4. Your organization has effective system to attract talent employee from outside organization.	Percentage of talent employee in period of time (month, year etc.).
5. Almost employees can use basic computer program such as Microsoft office, outlook etc.	Percentage of employee can perform basic computer program in period of time (week, month etc.).

6. Your organization always has useful training courses.	Number of useful training courses in period of time (week, month etc.). Note; Useful training course should be verify from user and organization.
7. Almost employees in your organization highly satisfied with the organization and their jobs.	Percentage of employee turnover rate in period of time (quarter, year etc.). Note; organization need to interview with employee on the reason of resignation.

B. Innovation capital

Observed variable/IC key indicator	Performance IC indicator
1. Your organization always invests in R&D.	Percentage of R&D spending per total cost in period of time (week, month etc.).
2. Your organization highly focuses on R&D team.	Percentage of talent people in R&D team in period of time (month, year etc.).
3. Your organization always introduces new products into market.	Percentage of sale revenue of new product in period of time (quarter, year etc.).
4. Your organization always generates new intellectual property.	Percentage of sale revenue of new intellectual property in period of time (quarter, year etc.).

C. Process capital

Observed variable/IC key indicator	Performance IC indicator
1. Your organization has highly effectiveness documentation management (Like library).	Time spend for finding information in organization.
2. Your organization has highly effectiveness communication system.	Time spend for sharing information in organization.
3. Your organization has real-time system to monitor productivity and quality in manufacturing process.	Percentage of customer on time delivery in period of time.

4. Your organization has highly effectiveness quality control system manufacturing process.	Percentage of customer return product (quality issue) in period of time.

D. Customer capital

Observed variable/IC key indicator	Performance IC indicator
1. Almost customers are satisfied in your product/service.	Number of customer in period of time.
2. Unit of sales always increases every year.	Growth in sale year per year.
3. Low customer reporting complaints on your organization product/service.	Percentage of customer complaint in period of time.
4. Market share always increase every year.	Percentage of market share in period of time.
5. Almost customers always repeat order.	Percentage of customer repeat order in period of time.

The manufacturing firm can applied the IC index in the organization. In addition, management level can get the IC index by doing a survey on the IC observed variable/IC key indicator of the organization.

To validate the IC observed variable data, management level should be compared the observed variable data to the performance of IC indicator. A relationship of two indicator (IC key indicator and Performance IC indicator) should be go in the same direction, and then calculate the IC index and keep monitor the IC index for managing the IC at the sources.

2. Intellectual capital development roadmap

The second output of the research is the IC development roadmap model. The roadmap is used to enhance the IC and productivity in the manufacturing firm. The name of the IC roadmap is “SMILE” model. SMILE model consist of Knowledge management system, Customer knowledge management, Self-directed learning, Learning organization, Knowledge management cycle, Innovation generation process, and Intellectual capital. SMILE is from;

S	=	**S**elf-directed learning
M	=	**M**anage employee and customer knowledge
I	=	**I**nnovation generation process
L	=	**L**earning organization
E	=	**E**lectronic information data base and communication system

The SMILE model with a productivity relationship as following,

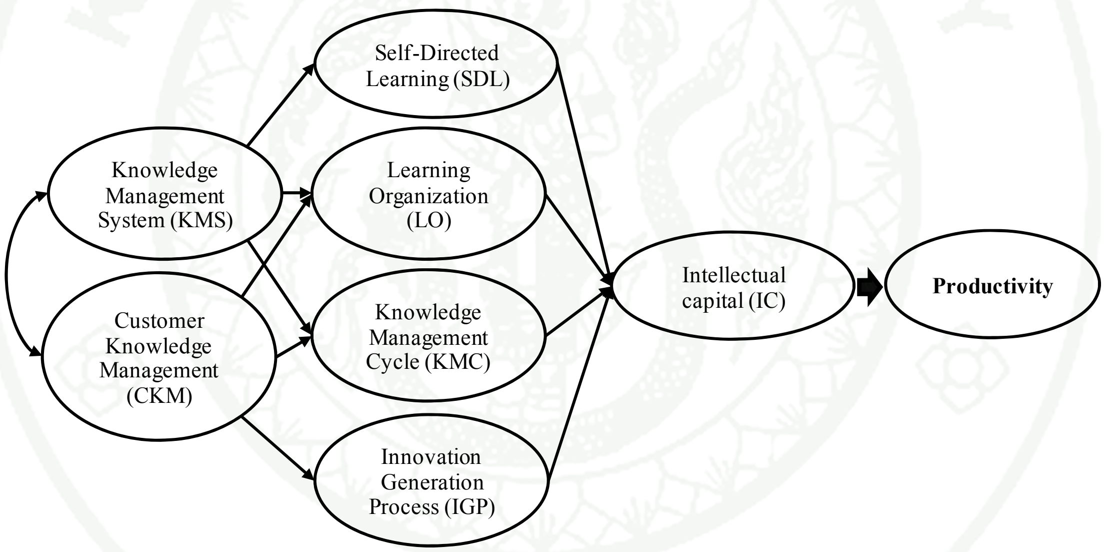

Figure 12 The "SMILE" Model and productivity

Based on the result section, all paths (hypothesis) are accepted. Then the SMILE model can conclude;

- KMS positively correlated with CKM.
- KMS directly supports SDL, LO, KMC, and indirectly support IC and productivity.

- CKM directly supports LO, KMC, IGP, and indirectly support IC and productivity.
- SDL, LO, KMC, and IGP directly support IC and productivity.

For model validation, SMILE model meets all criteria of structural equation modeling validation (See result section). Hence the management level of the manufacturing firm can applied SMILE model in the organization for developing IC and enhance the firm's productivity.

The manufacturing firm needs to implement KMS and CKM in the organization at the first step. Next step management level needs to promote SDL, LO, KMC, and IGP in the organization. Then SDL, LO, KMC, and IGP enhance the IC. In this case, KMS, CKM, SDL, LO, KMC, and IGP are the production factor input of the manufacturing firm. Thus management can enhance productivity through measure and manage the IC of the organization.

Management level should be monitor the effectiveness of the firm's strategic by using VAIC, and monitor the IC at the direct source by using the IC index. The period of time for monitoring should be specific for benchmarking such as quarter by quarter or year by year. In addition, benchmarked with the best practice or competitors should be applied in the organization.

Recommendation

The research has some recommendation as following;

1. The research survey on Thailand. The SMILE model may suitable for applying in manufacturing firm of Thailand.
2. The research focus on private manufacturing firm.
3. The research shows VAIC is an IC benchmark tool but the information on the annual report of each country are different and difficult to calculate VAIC for benchmarking.

Based on the recommendation, so the future research can conclude as following;

1. Apply SMILE model to manufacturing company outside Thailand and monitor the result after implemented the SMILE model.
2. The research should be expanding to service and public firm such as bank, university etc.
3. Develop a new IC measurement tool which has completed benchmark ability (Easy calculate by using general information on annual report).

LITERATURE CITED

Abeysekera I. and J. Guthrie. 2005. An empirical investigation of annual reporting trends of intellectual capital in Sri Lanka. **Journal of Critical Perspectives on Accounting** 16: 151-163.

Alavi, M. and E. Leidner Dorothy. 1999. Knowledge management systems: issues, challenges, and benefit. **Communications of AIS** 1 (7): 1-37.

Allard, S. 2003. **Knowledge Creation, Handbook of Knowledge Management: Knowledge Matters**. Vol.1. Springer-Verlag, Heidelberg.

Andriessen, D. and R. Tiessen. 2000. **Weightless Weight – Find Your Real Value in a Future of Intangible Assets**. Pearson Education, London.

Ash, C. R. 1985. **Applying Principles of Self-Directed Learning in the Health Professions. In Self-Directed Learning: From Theory to Practice**. New Directions for Continuing Education. Jossey-Bass, San Francisco.

Bauer, B. A. 1985. **Self-Directed Learning in a Graduate Adult Education Program. In Self-Directed Learning: From Theory to Practice**. New Directions for Continuing Education. Jossey-Bass, San Francisco.

Bernstein, B. and P.J. Singh. 2006. An integrated innovation process model based on practices of Australian biotechnology firms. **Technovation**. 26: 561–572.

Bernstein, B. and P.J. Singh. 2008. Innovation generation process. **European Journal of Innovation Management**. 11 (3): 366-388.

Boisot, M. 2002. The creation and sharing of knowledge. **The Strategic Managment of Intellectual Capital and Organizational Learning**. Oxford University Press, Oxford.

Bontis, N. 1999. Managing organisational knowledge by diagnosing intellectual capital: framing and advancing the state of the field. **International of Journal of Technology Management**. 18 (5): 433-62.

Bontis, N. 2001. Assessing knowledge assets: a review of the models used to measure intellectual capital. **International Journal of Management Reviews**. 3 (1): 41-60.

Bontis, N. 2002. **World Congress on Intellectual Capital Reading**. Butterworth-Heinemann, Boston, MA.

Bose, R. 2004. Knowledge management metrics. **Industrial Management & Data Systems**. 104: 457-468.

Bozbura F. T. 2004. Measurement and application of intellectual capital in Turkey. **The Learning Organization**. 11 (4/5): 357-367.

Brandenburg. 2002. **Methodik zur Planung technologischer Produktinnovationen**. RWTH Aachen, Aachen.

Brennan, N. and B. Connell. 2000. Intellectual capital: current issues and policy implications. **Journal of Intellectual Capital**. 1 (3): 206-40.

Brockett, R. G., and R. Hiemstra. 1985. Bridging the Theory-Practice Gap in Self-Directed Learning. In Self-Directed Learning: From Theory to Practice. **New Directions for Continuing Education.** Jossey-Bass, San Francisco.

Brookfield, S. 1985. The Continuing Educator and Self-Directed Learning in the Community. In Self-Directed Learning: From Theory to Practice. **New Directions for Continuing Education**. Jossey-Bass, San Francisco.

Brooking, A. 1997. **Intellectual Capital: Core Asset for the Third Millennium Enterprise.** Thomson Business Press, London.

Camp, R. 1989. **The search for industry best practices that lead 2 superior performance**. Productivity Press, London.

Carlucci, D. and G. Schiuma. 2007. Exploring intellectual capital concept in strategic management research. **Strategies for Information Technology and Intellectual Capital: Challenges and Opportunities.** Idea Group, London.

Chan K.H. 2009. Impact of intellectual capital on organizational performance. **The Learning Organization**. 16 (1): 4-21.

Chen J., Zhu Z. and H.Y. Xie. 2004. Measuring intellectual capital: a new model and empirical study. **Journal of Intellectual Capital**. 5 (1): 195-212.

Chen M., S. Cheng and Y. Hwang. 2005. An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. **Journal of Intellectual capital**. 6 (2): 159-176.

Choong, K.K. 2008. Intellectual capital: definitions, categorization and reporting models. **Journal of Intellectual Capital**. 9 (4): 609-638.

Cooper, R.G. and E.J. Kleinschmidt. 1986. An investigation into the new product process: steps, deficiencies and impact. **Journal of Product Innovation Management**. 3 (2): 71-85

Cross, K. P. 1981. **Adult As Learners**. San Francisco, Jossey-Bass.

Cross, K. P. 1978. **The Missing Link: Implications for the Future of Adult Education**. Syracuse University Research Corp, New York.

Damanpour, F. and S. Gopalakrishnan. 2001. The dynamics of the adoption of product and process innovations in organizations. **Journal of Management Studies**. 38 (1): 45-66.

Davenport, T.H., J.G. Harris, and A.K. Kohli. 2001. How do they know their customers so well?. **MIT Sloan Management Review**. Winter: 63–73.

Dimitrova, V., M. Kaneva, and T. Gallucci. 2009. Customer knowledge management in the natural cosmetics industry. **Industrial Management & Data Systems.** 109 (9): 1155-1165.

Drucker, P.F. 1999. Knowledge-worker productivity: the biggest challenge. **California Management Review**. 41 (2): 79-94.

Duffy, J. 2001. The tools and technologies needed for knowledge management. **Information Management Journal**. 35 (1): 64-7.

Dumay, J.C. 2009. Intellectual capital measurement: a critical approach. **Journal of Intellectual Capital**. 10 (2): 190-210.

Edvinsson, L. 1997. **Developing intellectual capital at Skandia**. Long Range Planning. 30 (3): 320-331.

Edvinsson, L. and M.S. Malone. 1997. **Intellectual Capital: Realizing Your Company's True Value by Finding Its Hidden Brainpower.** Harper Business Press, New York.

Edvinsson, L. and P. Sullivan. 1996. Developing a model for managing intellectual capital. **European Management Journal**. 14 (4): 356-364.

Eisenhardt, K.M. and B.N. Tabrizi. 1995. Accelerating adaptive processes: product innovation in the global computer industry. **Administrative Science Quarterly**. 40 (1): 84-107.

Feng, T.X. and J.X. Tian. 2005. Customer knowledge management and condition analysis of successful CKM implementation. **Proceedings of 2005 International Conference on Machine Learning and Cybernetics**. 4: 2239-2244.

Firer, S. and S.M. Williams. 2003. Intellectual capital and traditional measures of corporate performance. **Journal of Intellectual Capital**. 4 (3): 348-360.

Frambach, R.T. and N. Schillewaert. 2002. Organizational innovation adoption: a multi-level framework of determinants and opportunities for future research. **Journal of Business Research**. 55: 163-76.

Garcia-Murillo, M. and H. Annabi . 2002. Customer Knowledge Management. **Journal of the Operational Research Society**. 53: 875-884.

Garvin, D.A. 1993. Building a learning organization. **Harvard Business Review**. 71 (4): 78.

Gilbert, M., M. Leibold, and G. Probst. 2002. Five styles of customer knowledge management and how smart companies use them to create value. **European Management Journal**. 20 (5): 459-69.

Goh, S. and G. Richards. 1997. Benchmarking the Learning Capability of Organizations. **European Management Journal**. 15 (5): 575-583.

Guglielmino, L. 1977. **Development of self-directed learning readiness scale**. Dissertation Abstracts International, University of Georgia. United States.

Gupta, B., L.S. Iyer, and J.E. Aranson. 2000. Knowledge management: practices and challenges. **Industrial Management & Data Systems**. 100 (1): 17-21.

Hair, Jr. J.F., W.C. Black, B.J. Bain, and R.E. Anderson. 2010. **Multivariate Data Analysis**. Seventh edition, Prentice Hall, New Jersey.

Harrison, S. and P.H. Sullivan. 2000. Profiting from intellectual capital – learning from leading companies. **Journal of Intellectual Capital**. 1 (1): 33-46.

Heisig, P., J. Vorbeck, and J. Niebubr. 2001. **Knowledge Management – Best Practices in Europe**. Springer, Berlin.

Ho, L.N. 2008. What affects organizational performance? The linking of learning and knowledge management. **Industrial Management & Data Systems**. 108 (9): 1234-1254.

Huang, C. C., R. Luther, and M. Tayles. 2007. An evidence-based taxonomy of intellectual capital. **Journal of Intellectual Capital**. 8 (3): 386-408.

Intellectual Capital Service. 2005. Intellectual capital Management approach in ICS Ltd. **Journal of Intellectual Capital**. 6 (4): 489-509.

Jacobsen K., P. Hofman-Bang. and Jr.R. Nordby. 2005. The IC Rating model by Intellectual Capital Sweden. **Journal of Intellectual Capital**. 6 (4): 570-587.

Joia L.A. 2007. The impact of government-to-government endeavors on the intellectual capital of public organizations. **Government Information Quarterly**. 25: 256-257.

Kamath G. B. 2007. The intellectual capital performance of Indian banking sector. **Journal of Intellectual Capital**. 8 (1): 96-123.

Kamath G. B. 2008. Intellectual capital and corporate performance in Indian pharmaceutical industry. **Journal of Intellectual Capital**. 9 (4): 684-704.

Kannan G. and W.G. Aulbur. 2004. Intellectual capital Measurement effectiveness. **Journal of Intellectual Capital**. 5 (3): 389-413.

Kaufmann, L. and Y. Schneider. 2004. Intangibles: a synthesis of current research. **Journal of Intellectual Capital**. 5 (3): 366-388.

Knowles, M. 1975. **Self-directed Learning as a Guide for Learners and Teachers**. Adult Education Company. Cambridge, MA.

Koenig, M.E.D. 1997. Intellectual capital and how to leverage it. **The Bottom Line: Managing Library Finances**. 10 (3): 112-118.

Liao, S.-H., Y.-J. Chen, and M.-Y. Deng. 2010. Mining customer knowledge for tourism new product development and customer relationship management. **Expert Systems with Applications**. 37: 4212–4223.

Lin, J. 2007. An object-oriented development method for Customer Knowledge Management Information Systems. **Knowledge-Based Systems**. 20: 17-36.

Lopez-Nicolas, C. and F.J. Molina-Castillo. 2008. Customer knowledge management and e-commerce: the role of customer perceived risk. **International Journal of Information Management**. 28: 102-13.

Lu W., W. Wang, W. Tung. and F. Lin. 2009. Capability and efficiency of intellectual capital: The case of fabless companies in Taiwan. **Journal of Expert Systems with applications**. 37: 546-555.

Marr, B. 2005. **Perspectives on Intellectual Capital**. Elsevier, Amsterdam.

Marr, B. and G. Schiuma. 2001. Measuring and managing intellectual capital and knowledge assets in new economy organizations. **Handbook of Performance Measurement**. Gee Publisher, London.

Marwick, A. D. 2001. Knowledge management technology. **IBM Systems Journal**. 40: 814-830.

Masayoshi, S., W. Kiyoshi, and N. Kazuo. 1991. **Value added productivity. Asian Productivity Organization.** Tokyo.

Morey, D., M. Maybury, and B. Thuraisingham. 2000. **Knowledge Management: Classic and Contemporary Works**. The MIT Press, Cambridge, Massachusett.

Mouritsen, J., P.N. Bukh, and B. Mar. 2004. Reporting on intellectual capital: why, what and how?. **Measuring Business Excellence**. 8 (1): 46-54.

Mouritsen, J., H.T. Larsen, and P.N.D. Bukh. 2001. Intellectual capital and the capable firm: narrating, visualising and numbering for managing knowledge. **Accounting, Organization and Society**. 26 (6/7): 735-62.

Nonaka, I. 1994. A dynamic theory of organizational knowledge creation. **Organization Science**. 5: 14–37.

Pablos, P.O.D. 2003. Knowledge management projects: state of the art in the Spanish manufacturing industry International. **Journal of Manufacturing Technology and Management**. 14 (4): 297-310.

Pablos, P.O.D. 2004. Measuring and reporting structural capital: lessons from European learning firms. **Journal of Intellectual Capital**. 5 (4): 629-647.

Park, J.-H. and T. Wentling. 2007. Factors associated with transfer of training in workplace e-learning. **The Journal of Workplace Learning**. 19 (5): 311-329.

Petty, R. and J. Guthrie. 2000. Intellectual capital literature review: measurement, reporting and management. **Journal of Intellectual Capital**. 1 (2): 155-76.

Phusavat, K., N. Comepa, A. Sitko-Lutek, and K.B. Ooi. 2011. Interrelationships between intellectual capital and performance: Empirical examination. **Industrial Management & Data Systems**. 111: 810-829.

Phusavat, K., P. Jaiwong, S. Sujitwanich, and R. Kanchana. 2009. When to measure productivity: lessons from manufacturing and supplier-selection strategies. **Industrial Management & Data Systems**. 109 (3): 425- 442.

Pike, S. and G. Roos. 2004. Mathematics and modern business management. **Journal of Intellectual Capital**. 5 (2): 243-256.

Pulic, A. 2000. VAICe – an accounting tool for IC management. **International Journal of Technology Management. 20 (5-8): 702-714.**

Pulic A. 2004. Intellectual capital – does it create or destroy value?. **Measuring Business Excellence**. 8 (1): 62 – 68.

Rastogi, P.N. 2003. The nature and role of IC – rethinking the process of value creation and sustained enterprise growth. **Journal of Intellectual Capital**. 4 (2): 227-48.

Reisser, L. J. 1973. **A Facilitation Process for Self-Directed Learning**. Ed. D. dissertation, University of Massachusetts. United States.

Reychav, I. and J. Weisberg. 2009. Going beyond technology: Knowledge sharing as a tool for enhancing customer-oriented attitudes. **International Journal of Information Management**. 29: 353-361.

Riahi-Belkaoui, A. 2002. Intellectual capital and firm performance of US multinational firms: a study of the resource-based and stakeholder views. **Social Science Electronic Publishing Presents Papers**. 2-26.

Rodov, I. and P. Leliaert. 2002. FiMIAM: financial method of intangible assets measurement. **Journal of Intellectual Capital**. 3 (3): 323 – 336.

Roos, G., S. Pike, and L. Fernström. 2005. **Managing Intellectual Capital in Practice**. Elsevier, Oxford.

Roos, J., G. Roos, N. Dragonetti, and L. Edvinsson. 1998. **Intellectual Capital: Navigating in the New Business Landscape**. New York University Press, New York.

Roos, J., G. Roos, L. Edvinsson, and N.C. Dragonetti. 1997. **Intellectual Capital – Navigating in the New Business Landscape**. Macmillan Press, London.

Salomann, H., M. Dous, L. Kolbe, and W. Brenner. 2005. Rejuvenating Customer Management: How to Make knowledge For, From and About Customer Work. **Journal of European Management**. 23 (4): 392- 403.

Schiuma, G. and A. Lerro. 2008. Intellectual capital and company's performance improvement. **Measuring Business Excellence**. 12 (2): 3-9.

Senge, P. 1990. **The Fifth Discipline: the Art and Practice of the Learning Organization**. Doubleday, New York.

Senge, P. 1992. **The Fifth Discipline**. Doubleday, New York.

Shaw, R.B. and D.N.T. Perkins. 1991. Teaching organizations to learn. **Organizational Developmental Journal**. 9 (4): 1-12.

Sink, D. 1985. **Productivity Management: Planning, Measurement and Evaluation, Control and Improvement**. Wiley, New York, NY.

Sinkula, J. M., W.E. Baker, and T. Noordewier. 1997. A framework for market-based organizational learning: Linking values, knowledge and behavior. **Journal of the Academy of Marketing Science**. 25 (4): 305−318.

Skandia Insurance Services. 1997. **Center for Education and Research in Information Assurance and Security – CERIAS.** Skandia Insurance Services, Sweden.

Slocum, J.W. Jr, M. McGill, and D.T. Lei. 1994. The new learning strategy: anytime, anything, anywhere. **Organizational Dynamics**. 23 (2): 33-47.

Stewart B. and J. Stern. 1994. EVA Roundtable. **Journal of applied Corporate Finance**. 7 (2): 46-70.

Stewart, T. 1991. Now capital means brains, not just bucks. **Fortune**. 123: 31-32.

Stewart, T.A. 1997. **Intellectual Capital**. Nicholas Brealey Publishing, London.

Stewart, T.A. 1998. **Intellectual Capital – The New Wealth of Organizations**. Nicolas Brealey Publishing, London.

Sullivan, P.H. 2000. **Value-Driven Intellectual Capital: How to Convert Intangible Corporate Assets into Market Value**. Wiley, New York, NY.

Sveiby, K.E. 1997. **The New Organizational Wealth: Managing and Measuring Knowledge-based Assets.** Barrett-Kohler, San Francisco, CA.

Svensson, L., P.E. Ellström, and C. Åberg. 2004. Integrating formal and informal learning at work. **The Journal of Workplace Learning**. 16 (8): 479-491.

Tan, K.C. 2001. A structure equation model of new product design and development. **Decision Science**. 32 (2): 195-226.

Teng, Y. 1995. **Adult instruction and self-directed learning**. Wu-Nan Publication. Taipei, Taiwan.

Thompson, T.Y. 2011. Work-learning in informal online communities: evolving spaces. **Information Technology & People**. 24 (2): 184-196.

Torres M.R. 2006. A procedure to design a structural and measurement model of Intellectual Capital: An exploratory study. **Journal of Information & management**. 43: 6127-6626.

Tough, A. 1978. Major Learning Efforts: Recent Research and Future Directions. **Adult Education**. 28: 250-263.

Tovstiga, G., and E. Tulugurova. 2009. Intellectual capital practices: a four-region comparative study. **Journal of Intellectual Capital**. 10 (1): 70-80.

Turban, E., J.E. Aronson, T.P. Liang, and R. Sharda. 2007. **Decision Support and Business Intelligence Systems**. PEARSON Prentice Hall, New Jersey.

Tynjälä, P. and P. Häkkinen. 2005. E-learning at work: theoretical underpinnings and pedagogical challenges. **The Journal of Workplace Learning**. 17 (5/6): 318-336.

Ullman. J.B. 1996. **Structural equation modeling (In: Using Multivariate Statistics)**. Third Edition. HarperCollins College Publishers, New York.

Venkatesh, V., M.G. Morris, G.B. Davis, and F.D. Davis. 2003. User acceptance of information technology: Toward a unified view. **MIS Quarterly**. 27 (3): 425-478.

Walsh, J.P. and G.R. Ungson. 1991. Organizational memory. **The Academy of Management Review**. 16 (1): 57-91.

Wang J. 2008. Investigating market value and intellectual capital for S&P500. **Journal of Intellectual Capital**. 9 (4): 546-563.

Yasin, M.M. 2002. The theory and practice of benchmarking: then and now. **Benchmarking: An International Journal**. 9 (3): 217-43.

Youndt, M.A., M. Subramaniamand, and S.A. Snell. 2004. Intellectual capital profiles: an examination of investments and returns. **Journal of Management Studies**. 41: 335-61.

APPENDICES

Appendix A

Percentage of tertiary education work force and GNI per capita

Percentage of tertiary education work force and GNI per capita (US$).

1. Labor force with tertiary education (% of total): Labor force with tertiary education is the proportion of labor force that has a tertiary education, as a percentage of the total labor force (World Bank).

Appendix Table A1 Percentage of tertiary education work force

Year	North America	OECD member
1997	34.6757	25.2666
1998	34.2522	25.6267
1999	34.6740	27.4412
2000	35.2546	27.7223
2001	36.2280	27.4908
2002	57.1441	35.5413
2003	57.6552	36.6426
2004	58.0160	37.7048
2005	58.2748	37.0500
2006	58.8375	36.5077
2007	59.5429	36.7639

Test correlation analysis between “Labor force with tertiary education (% of total)” and “Researchers in R&D (per million people)”. These two variables are from World Bank.org. A result shows these two variables have 78% correlation at 95% CI. So this statistical result indicates “Labor force with tertiary education (% of total) can represent the knowledge worker. World Bank defined Researchers in R&D are professionals engaged in the conception or creation of new knowledge, products, processes, methods, or systems and in the management of the projects concerned. Postgraduate PhD students engaged in R&D are included.

2. GNI per capita is the gross national income, converted to U.S. dollars using the World Bank Atlas method, divided by the midyear population. GNI is the sum of value added by all resident producers plus any product taxes (less subsidies) not included in the valuation of output plus net receipts of primary income (compensation of employees and property income) from abroad (World Bank.org).

Appendix Table A2 GNI per capita

Year	North America	OECD member
1997	29299.3898	22406.7801
1998	29895.4639	21562.1101
1999	31477.3219	21881.1352
2000	33637.5147	22830.7122
2001	34195.2418	22763.3650
2002	34659.8189	22623.1911
2003	36971.3681	24380.2538

Appendix Table A2 (continued)

Year	North America	OECD member
2004	40654.2761	27905.1425
2005	43494.5202	30769.5627
2006	45308.6610	32301.2270
2007	46195.0253	33562.1134

Appendix B

Agriculture, Industrial and Service value added

Agriculture, Industrial and Service value added

Agriculture corresponds to ISIC divisions 1-5 and includes forestry, hunting, and fishing, as well as cultivation of crops and livestock production. (World Bank.org)

Industry corresponds to ISIC divisions 10-45 and includes manufacturing (ISIC divisions 15-37). It comprises value added in mining, manufacturing (also reported as a separate subgroup), construction, electricity, water, and gas. (World Bank.org)

Services correspond to ISIC divisions 50-99. They include value added in wholesale and retail trade (including hotels and restaurants), transport, and government, financial, professional, and personal services such as education, health care, and real estate services. Also included are imputed bank service charges, import duties, and any statistical discrepancies noted by national compilers as well as discrepancies arising from rescaling. (World Bank.org)

Value added is the net output of a sector after adding up all outputs and subtracting intermediate inputs. The industrial origin of value added is determined by ISIC, revision 3. Data are in current U.S. dollars. (World Bank.org)

Appendix Table B1 Agriculture, Industrial and Service value added

Year	Agriculture value added		Industrial value added		Service value added	
	North America	OECD Member	North America	OECD Member	North America	OECD Member
1997	476.6198	479.3436	7039.4431	5760.5742	19819.48391	13594.0084
1998	393.6550	442.5089	6965.7096	5576.6792	21094.37965	13834.0403
1999	390.9208	434.3564	7354.0762	5779.9832	22255.04601	14531.7365
2000	400.4768	421.6790	7632.1283	5805.7469	23637.07842	14834.3376
2001	404.5848	401.4715	7416.4525	5465.2116	24544.42625	14845.4585
2002	358.5944	396.0144	7400.2904	5529.2642	25300.72501	15507.1067
2003	437.0259	453.3393	7699.8370	6163.1824	26455.90447	17250.7968
2004	515.9835	519.5778	8346.2528	6893.1541	27811.84795	18935.2809
2005	491.2398	497.2992	8946.4646	7247.0511	29485.38519	19828.3965
2006	449.9499	484.9633	9467.3906	7623.8538	31131.71052	20723.9379

Appendix C

Questionnaire, reliability and validity test result

Questionnaire

The questionnaire items with IOC index and Cronbach's alpha.

Latent variable: Knowledge management system

Communication and Collaboration Technologies	IOC index N = 3	Cronbach's alpha N = 30
1. People in your organization always send/receive information/data via Information Technology System such as e-mail, intranet, web board etc.	1	0.9770
2. People in your organization always access to organization's information data base system.	1	0.9770
3. Your organization always discuss/meeting information/data via net meeting, E-conference etc.	1	0.9769
4. Your organization's IT system always support group working such as groupware etc.	1	0.9771
Storage and retrieval technologies	IOC index N = 3	Cronbach's alpha N = 30
1. Your organization has Information technology department to store organization's information/data.	1	0.9770
2. People in your organization always know where they can find the information/data in organization information/data warehousing.	1	0.9773
3. Your organization has document center department to manage information/data warehousing.	1	0.9774

Latent variable: Self-directed learning

Self-directed learning	IOC index N = 3	Cronbach's alpha N = 30
1. People in your organization always increase their knowledge or improve work performance by accessing organization information/data warehousing.	1	0.9771
2. People in your organization always increase their knowledge or improve work performance by working with workgroup.	1	0.9768
3. People in your organization can learn manufacturing process via organization information technology system (Web., Intranet etc.).	1	0.9770
4. Your organization always open new knowledge source for employee searching, finding, adapting new solution on their work.	1	0.9769

Latent variable: Learning organization

Learning organization practices	IOC index N = 3	Cronbach's alpha N = 30
Clarity of Purpose and Mission		
1. Each department in your organization has sub-goal that support to the main goal of organization.	1	0.9771
2. People in your organization always know the gap between current base line and the goal of department.	1	0.9767
3. People in your organization always know the mission that support to the department goal achievement.	1	0.9768
4. The organization's mission statement can use to identify the performance of employee.	1	0.9768
Leadership Commitment and Empowerment		
1. Senior managers/Directors in this organization open his/her mind for new ideas introducing/sharing from their colleague.	1	0.9768
2. Senior managers/Directors and employees in this organization share a common vision for what our work should accomplish.	1	0.9767
3. Managers in this organization often provide useful feedback that helps to identify potential problems and opportunities.	1	0.9770
4. Managers in this organization frequently involve with employees in important decisions.	1	0.9768
Experimentation		
1. People in your organization often bring new ideas into the organization.	1	0.9766
2. Managers in this organization encourage team members to experiment in order to improve work processes.	1	0.9767
3. Innovative ideas that work are often rewarded by management.	1	0.9768
4. In my experience, management always welcomes for the new idea from employees.	1	0.9768
Transfer of Knowledge		
1. Employees often have an opportunity to share about successful programs or work activities to other staff.	1	0.9766
2. Failures are discussed in our organization for improvement.	1	0.9769
3. New work processes that may be useful to the organization are usually shared with all employees.	1	0.9768
4. We have a system that allows us to learn successful practices from other organizations.	1	0.9767
Teamwork and Group-Problem Solving		
1. Current organizational practice encourages employees to solve problems in team before discussing them with a manager.	1	0.9768
2. We can usually form informal groups to solve problems in organization.	1	0.9770

3. Members of the problem solving team, are always came from another section or the function of work different.	1	0.9768

Latent variable: Knowledge management cycle

Knowledge management cycle practices	IOC index N = 3	Cronbach's alpha N = 30
Create knowledge		
1. New products/processes are always generated in your organization.	1	0.9767
2. New ideas/solutions are always generated in your organization.	1	0.9766
3. Your organization always has new improvement on quality/productivity.	1	0.9769
Capture knowledge		
1. New products/processes are always presented in your organization by following organization report format.	1	0.9765
2. New idea/solutions are always presented in your organization by following organization report format.	1	0.9766
3. New improvements on quality/productivity are always presented in your organization by following organization report format.	1	0.9767
Refine knowledge		
1. New products/processes are always successfully implemented in your organization.	1	0.9767
2. New ideas/solutions are always applied in your organization.	1	0.9767
3. New improvements on quality/productivity are always implemented in your organization.	1	0.9768
Store knowledge		
1. New products/processes details are always stored in your organization more than one year.	1	0.9768
2. New ideas/solutions details are always stored in your organization more than one year.	1	0.9766
3. New improvements on quality/productivity details are always stored in your organization more than one year.	1	0.9767
Manage knowledge		
1. Your organization has the information/document center section.	1	0.9766
2. Information/documents always up to date.	1	0.9766
3. Information/documents are always reviewed with originator before store in center.	1	0.9767
Disseminate knowledge		
1. Your organization always distributes new information to people in the organization.	1	0.9766

2. People in your organization can access to information/document center anytime that they want in the organization.	1	0.9765
3. People in your organization can access to information/document center anywhere that they want in the organization.	1	0.9766

Latent variable: Customer knowledge management

Customer Knowledge management practices	IOC index N = 3	Cronbach's alpha N = 30
Knowledge from customer		
1. Your organization always has a meeting with customer to received suggestion on your product and/or service.	1	0.9768
2. Your organization always invites customer to share knowledge and/or experience on your product and/or service.	1	0.9769
3. Your organization always discusses with customer to access what they want on your product and/or service.	1	0.9771
4. Your organization always applied the information of customer on your new product and/or service.	1	0.9769
Refine knowledge		
1. Good suggestions of customer are always successfully implemented in your organization.	1	0.9769
2. Knowledge/experience of customer (Benchmark with competitor product) are always considered to apply in your product and/or service.	1	0.9771
3. Customer requests are always considered to apply in your product and/or service.	1	0.977
Store knowledge		
1. Suggestion details of customer are always stored in your organization.	1	0.9772
2. Knowledge/experience details from customer sharing are always stored in your organization.	1	0.977
3. Customer request topics are always stored in your organization.	1	0.9771
Manage knowledge		
1. Your organization has the information/document center section to collects the customer information.	1	0.9767
2. Information/documents from customer always up to date.	1	0.9769
3. Information/documents from customer are always review with customer before store in center.	1	0.9768
Disseminate knowledge		
1. Your organization always distribute customer information to people in your organization.	1	0.9766
2. People in your organization can access to customer information/document center anytime that they want in organization.	1	0.9767

3. People in your organization can access to customer information/document center anywhere that they want in organization.	1	0.9765

Latent variable: Innovation generation process

Innovation Generation process practices	IOC index N = 3	Cronbach's alpha N = 30
Idea generation		
1. Concepts of new product are always generated in your organization.	1	0.9765
2. Concepts of new process are always generated in your organization.	1	0.9765
3. New management tools (such as TQM, JIT, Lean manufacturing etc.) are always applied in your organization.	1	0.9766
Innovation support		
1. Concepts of new product are always reviewed with management team before develop to new product.	1	0.9767
2. Concepts of new process are always reviewed with management team before develop to new process.	1	0.9767
3. New management tools always align with organization goal.	1	0.9768
Innovation development		
1. Organization always allocates resource (man, time, machine, material, money etc.) to support New product development.	1	0.9769
2. Organization always allocates resource (man, time, machine, material, money etc.) to support New process development.	1	0.9769
3. New management tools are always promoted by management team.	1	0.977
Innovation implementation		
1. New product of your organization always has high market share.	1	0.9769
2. New process always increases your organization productivity/quality.	1	0.9769
3. Your organization always achieves organization's goal (Cost reduction, good delivery etc.) by applying new management tools.	1	0.9768

Intellectual capital key indicator	IOC index N = 3	Cronbach's alpha N = 30
Human capital		
1. Almost employees in your organization have ability to solve customer's problems (Quality improvement).	1	0.9769
2. Amount of talent employee are same or increase if compare to last year.	1	0.9774

3. Your organization has effective system to attract talent employee from outside organization.	1	0.9770
4. Almost employees can use basic computer program such as Microsoft office, outlook etc.	1	0.9775
5. Your organization always has useful training courses.	1	0.9771
6. Almost employees in your organization highly satisfied with the organization and their jobs.	1	0.9770
7. Almost employees in your organization highly dedicated and committed to the organization.	1	0.9769
Innovation capital		
1. Your organization always invest in R&D.	1	0.9771
2. Your organization highly focuses on R&D team.	1	0.9772
3. Your organization always introduces new products into market.	1	0.9769
4. Your organization always generates new intellectual property.	1	0.9768
Process capital		
1. Your organization has highly effectiveness documentation management (Like library).	1	0.9773
2. Your organization has highly effectiveness communication system.	1	0.9771
3. Your organization has real-time system to monitor productivity and quality in manufacturing process.	1	0.9773
4. Your organization has highly effectiveness quality control system (Low return rate from customer).	1	0.9772
Customer capital		
1. Almost customers are satisfied in your product/service.	1	0.9769
2. Unit of sales always increases every year.	1	0.9768
3. Low customer reporting complaints on your organization product/service.	1	0.9769
4. Market share always increase every year.	1	0.9770
5. Almost customers always repeat order.	1	0.9770

Note: Cronbach's alpha of the questionnaire is 0.9770.

Appendix D

LISREL Command and Result

LISREL Command

Title: SMILE Model

Observed Variables
SDL1-SDL4 KMSCO1-KMSCO4 KMSIT1-KMSIT3 CKMF1-CKMF4 CKMRE1-CKMRE3 CKMST1-CKMST3 CKMMA1-CKMMA3 CKMDI1-CKMDI3 LOG1-LOG4 LOL1-LOL4 LOE1-LOE4 LOD1-LOD4 LOT1-LOT3 KMCR1-KMCR3 KMCA1-KMCA3 KMCRE1-KMCRE3 KMST1-KMST3 KMMA1-KMMA3 KMDI1-KMDI3 INID1-INID3 INSUP1-INSUP3 INDEV1-INDEV3 INIMP1-INIMP3 HUMAN1-HUMAN7 INNOV1-INNOV4 PROC1-PROC4 CUSTO1-CUSTO5

Covariance Matrix from File:test.cov

Sample size=270

Latent Variables
SDL KMS CKM LO KMC IGP IC

Relationships
SDL1=1*SDL
SDL2-SDL4=SDL
KMSCO1=1*KMS
KMSCO2-KMSCO4=KMS
KMSIT1=1*KMS
KMSIT2-KMSIT3=KMS
CKMF1=1*CKM
CKMF2-CKMF4=CKM
CKMRE1=1*CKM
CKMRE2-CKMRE3=CKM
CKMST1=1*CKM
CKMST2-CKMST3=CKM
CKMMA1=1*CKM
CKMMA2-CKMMA3=CKM
CKMDI1=1*CKM
CKMDI2-CKMDI3=CKM
LOG1=1*LO
LOG2-LOG4=LO
LOL1=1*LO
LOL2-LOL4=LO
LOE1=1*LO
LOE2-LOE4=LO
LOD1=1*LO
LOD2-LOD4=LO
LOT1=1*LO
LOT2-LOT3=LO
KMCR1=1*KMC
KMCR2-KMCR3=KMC
KMCA1=1*KMC
KMCA2-KMCA3=KMC
KMCRE1=1*KMC
KMCRE2-KMCRE3=KMC
KMST1=1*KMC
KMST2-KMST3=KMC
KMMA1=1*KMC
KMMA2-KMMA3=KMC

KMDI1=1*KMC
KMDI2-KMDI3=KMC
INID1=1*IGP
INID2-INID3=IGP
INSUP1=1*IGP
INSUP2-INSUP3=IGP
INDEV1=1*IGP
INDEV2-INDEV3=IGP
INIMP1=1*IGP
INIMP2-INIMP3=IGP
HUMAN1=1*IC
HUMAN2-HUMAN7=IC
INNOV1=1*IC
INNOV2-INNOV4=IC
PROC1=1*IC
PROC2-PROC4=IC
CUSTO1=1*IC
CUSTO2-CUSTO5=IC

Set the Error Covariance between KMCR2 and LOT3 Free
Set the Error Covariance between KMCR2 and LOT3 Free
Set the Error Covariance between CKMF4 and CKMF3 Free
Set the Error Covariance between INNOV2 and INNOV1 Free
Set the Error Covariance between KMSIT1 and KMSCO4 Free
Set the Error Covariance between KMCR2 and LOT3 Free
Set the Error Covariance between PROC2 and PROC1 Free
Set the Error Covariance between INNOV3 and INID3 Free
Set the Error Covariance between LOE4 and LOE2 Free
Set the Error Covariance between CUSTO4 and CUSTO3 Free
Set the Error Covariance between LOL4 and LOL3 Free
Set the Error Covariance between KMCR1 and LOT3 Free
Set the Error Covariance between LOE3 and LOE2 Free
Set the Error Covariance between CKMF4 and KMSCO2 Free
Set the Error Covariance between KMST1 and LOT3 Free
Set the Error Covariance between CKMST3 and CKMST2 Free
Set the Error Covariance between KMST2 and KMST1 Free
Set the Error Covariance between LOD2 and LOD1 Free
Set the Error Covariance between CKMDI3 and CKMDI2 Free
Set the Error Covariance between INNOV1 and LOT1 Free
Set the Error Covariance between INNOV3 and INNOV1 Free
Set the Error Covariance between INNOV4 and INNOV1 Free
Set the Error Covariance between KMSCO4 and INNOV1 Free
Set the Error Covariance between KMCR2 and KMCR2 Free
Set the Error Covariance between INNOV1 and LOG1 Free
Set the Error Covariance between KMSCO4 and INID3 Free
Set the Error Covariance between INNOV1 and KMST1 Free
Set the Error Covariance between KMSCO3 and KMSCO2 Free
Set the Error Covariance between LOE2 and LOE2 Free
Set the Error Covariance between LOE3 and LOE2 Free
Set the Error Covariance between LOE4 and LOE2 Free
Set the Error Covariance between LOE4 and LOE3 Free
Set the Error Covariance between KMST3 and KMST1 Free
Set the Error Covariance between INID3 and INID3 Free
Set the Error Covariance between INNOV1 and INIMP3 Free
Set the Error Covariance between INID3 and INID2 Free
Set the Error Covariance between CKMST2 and INNOV1 Free
Set the Error Covariance between LOG2 and LOG1 Free

Set the Error Covariance between INNOV1 and INDEV1 Free
Set the Error Covariance between CKMMA1 and CKMST3 Free
Set the Error Covariance between INNOV3 and INNOV1 Free
Set the Error Covariance between INNOV4 and INNOV3 Free
Set the Error Covariance between PROC3 and PROC2 Free
Set the Error Covariance between KMST3 and LOT3 Free
Set the Error Covariance between INNOV3 and INDEV3 Free
Set the Error Covariance between KMMA3 and LOT3 Free
Set the Error Covariance between INNOV1 and KMST2 Free
Set the Error Covariance between LOL2 and LOG4 Free
Set the Error Covariance between INNOV1 and INID3 Free
Set the Error Covariance between KMSCO4 and INNOV3 Free
Set the Error Covariance between CUSTO5 and CUSTO4 Free
Set the Error Covariance between INIMP3 and INIMP2 Free
Set the Error Covariance between CKMF4 and CKMF2 Free
Set the Error Covariance between KMSCO4 and INID3 Free
Set the Error Covariance between INNOV3 and INDEV2 Free
Set the Error Covariance between KMCR1 and LOT3 Free

LO=KMS CKM
SDL=KMS
KMC=CKM KMS
IGP=CKM
IC=LO KMC IGP SDL

Path Diagram

End of program

LISREL Result

	SDL1	SDL2	SDL3	SDL4	LOG1	LOG2
	--------	--------	--------	--------	--------	--------
SDL1	0.65					
SDL2	0.41	0.71				
SDL3	0.25	0.38	0.89			
SDL4	0.28	0.33	0.49	0.72		
LOG1	0.17	0.17	0.30	0.29	0.68	
LOG2	0.19	0.15	0.29	0.28	0.49	0.64
LOG3	0.12	0.13	0.39	0.27	0.48	0.48
LOG4	0.10	0.18	0.25	0.16	0.24	0.24
LOL1	0.11	0.13	0.21	0.22	0.29	0.24
LOL2	0.16	0.14	0.19	0.17	0.28	0.30
LOL3	0.17	0.13	0.22	0.23	0.33	0.32
LOL4	0.09	0.08	0.21	0.22	0.35	0.35
LOE1	0.10	0.14	0.17	0.19	0.29	0.25
LOE2	0.13	0.17	0.22	0.17	0.33	0.31
LOE3	0.16	0.17	0.22	0.25	0.31	0.29
LOE4	0.21	0.23	0.31	0.27	0.37	0.35
LOD1	0.19	0.15	0.34	0.28	0.32	0.36

LOD2	0.15	0.14	0.30	0.28	0.32	0.35
LOD3	0.15	0.15	0.26	0.30	0.35	0.34
LOD4	0.10	0.16	0.10	0.21	0.29	0.25
LOT1	0.08	0.12	0.26	0.25	0.34	0.29
LOT2	0.07	0.17	0.19	0.21	0.28	0.24
LOT3	0.16	0.22	0.29	0.28	0.31	0.21
KMCR1	0.08	0.12	0.20	0.25	0.37	0.29
KMCR2	0.11	0.12	0.23	0.26	0.38	0.30
KMCR3	0.09	0.13	0.20	0.24	0.31	0.30
KMCA1	0.10	0.20	0.28	0.25	0.26	0.24
KMCA2	0.10	0.15	0.24	0.16	0.28	0.21
KMCA3	0.10	0.13	0.15	0.18	0.23	0.24
KMCRE1	0.10	0.11	0.20	0.27	0.32	0.33
KMCRE2	0.10	0.12	0.14	0.23	0.30	0.28
KMCRE3	0.09	0.12	0.19	0.21	0.30	0.27
KMST1	0.03	0.13	0.30	0.25	0.40	0.29
KMST2	0.07	0.14	0.35	0.29	0.40	0.30
KMST3	0.06	0.14	0.29	0.26	0.32	0.29
KMMA1	0.15	0.21	0.37	0.28	0.31	0.31
KMMA2	0.09	0.13	0.32	0.28	0.34	0.30
KMMA3	0.10	0.21	0.30	0.22	0.32	0.28
KMDI1	0.15	0.13	0.22	0.25	0.29	0.27
KMDI2	0.16	0.19	0.28	0.24	0.33	0.28
KMDI3	0.10	0.12	0.25	0.30	0.36	0.28
INID1	0.07	0.17	0.24	0.27	0.30	0.27
INID2	0.12	0.14	0.28	0.30	0.33	0.29
INID3	0.11	0.14	0.31	0.26	0.38	0.28
INSUP1	0.05	0.17	0.31	0.27	0.37	0.29
INSUP2	0.05	0.15	0.26	0.24	0.34	0.25
INSUP3	0.13	0.17	0.32	0.27	0.39	0.32
INDEV1	0.07	0.14	0.27	0.24	0.37	0.26
INDEV2	0.05	0.12	0.25	0.25	0.34	0.24
INDEV3	0.06	0.14	0.23	0.26	0.35	0.30
INIMP1	0.15	0.13	0.27	0.31	0.33	0.35
INIMP2	0.15	0.15	0.18	0.24	0.33	0.36
INIMP3	0.13	0.15	0.26	0.29	0.37	0.35
HUMAN1	0.19	0.14	0.17	0.18	0.26	0.31
HUMAN2	0.18	0.06	0.21	0.19	0.25	0.25
HUMAN3	0.18	0.06	0.25	0.23	0.39	0.29
HUMAN4	0.26	0.25	0.15	0.20	0.24	0.29
HUMAN5	0.19	0.18	0.18	0.25	0.32	0.29
HUMAN6	0.19	0.13	0.20	0.28	0.33	0.31
HUMAN7	0.14	0.09	0.21	0.22	0.31	0.25
INNOV1	0.12	0.18	0.31	0.29	0.46	0.35
INNOV2	0.13	0.17	0.28	0.31	0.37	0.28
INNOV3	0.10	0.16	0.30	0.31	0.36	0.28

INNOV4	0.16	0.24	0.40	0.36	0.45	0.36
PROC1	0.16	0.21	0.33	0.34	0.38	0.37
PROC2	0.17	0.19	0.26	0.29	0.36	0.37
PROC3	0.13	0.16	0.26	0.29	0.32	0.33
PROC4	0.15	0.17	0.27	0.28	0.30	0.25
CUSTO1	0.15	0.18	0.26	0.23	0.23	0.25
CUSTO2	0.12	0.15	0.14	0.11	0.15	0.19
CUSTO3	0.12	0.18	0.15	0.15	0.24	0.24
CUSTO4	0.20	0.13	0.19	0.25	0.27	0.30
CUSTO5	0.13	0.15	0.14	0.21	0.25	0.28
KMSCO1	0.29	0.33	0.26	0.27	0.19	0.18
KMSCO2	0.30	0.26	0.18	0.20	0.22	0.24
KMSCO3	0.29	0.33	0.35	0.34	0.20	0.19
KMSCO4	0.18	0.30	0.38	0.41	0.39	0.25
KMSIT1	0.21	0.29	0.38	0.40	0.31	0.21
KMSIT2	0.23	0.30	0.33	0.32	0.31	0.22
KMSIT3	0.27	0.36	0.50	0.37	0.36	0.21
CKMF1	0.22	0.13	0.09	0.12	0.23	0.27
CKMF2	0.24	0.09	0.14	0.19	0.28	0.27
CKMF3	0.23	0.13	0.11	0.10	0.17	0.17
CKMF4	0.30	0.18	0.09	0.15	0.24	0.25
CKMRE1	0.13	0.18	0.30	0.33	0.40	0.27
CKMRE2	0.11	0.13	0.29	0.25	0.37	0.29
CKMRE3	0.16	0.18	0.24	0.33	0.39	0.31
CKMST1	0.20	0.14	0.27	0.33	0.35	0.32
CKMST2	0.17	0.14	0.25	0.29	0.48	0.37
CKMST3	0.12	0.11	0.24	0.24	0.42	0.34
CKMMA1	0.10	0.03	0.18	0.21	0.43	0.3
CKMMA2	0.07	0.13	0.25	0.21	0.42	0.27
CKMMA3	0.04	0.11	0.22	0.19	0.40	0.28
CKMDI1	0.07	0.13	0.20	0.15	0.36	0.31
CKMDI2	0.07	0.11	0.21	0.16	0.44	0.32
CKMDI3	0.09	0.10	0.18	0.18	0.38	0.32

	LOG3	LOG4	LOL1	LOL2	LOL3	LOL4
	--------	--------	--------	--------	--------	--------
LOG3	0.81					
LOG4	0.27	0.68				
LOL1	0.26	0.43	0.64			
LOL2	0.30	0.39	0.36	0.54		
LOL3	0.35	0.28	0.34	0.30	0.62	
LOL4	0.39	0.27	0.31	0.28	0.44	0.61
LOE1	0.31	0.27	0.26	0.26	0.42	0.39
LOE2	0.30	0.27	0.22	0.30	0.25	0.23

LOE3	0.30	0.23	0.24	0.27	0.28	0.25
LOE4	0.34	0.27	0.28	0.27	0.30	0.26
LOD1	0.38	0.25	0.26	0.29	0.23	0.28
LOD2	0.39	0.35	0.28	0.33	0.27	0.30
LOD3	0.29	0.25	0.25	0.27	0.22	0.26
LOD4	0.23	0.24	0.22	0.25	0.18	0.20
LOT1	0.29	0.26	0.28	0.30	0.28	0.30
LOT2	0.29	0.26	0.26	0.26	0.22	0.23
LOT3	0.29	0.20	0.22	0.19	0.30	0.29
KMCR1	0.28	0.19	0.28	0.19	0.30	0.34
KMCR2	0.34	0.24	0.23	0.27	0.33	0.34
KMCR3	0.36	0.23	0.28	0.25	0.30	0.32
KMCA1	0.36	0.22	0.27	0.21	0.35	0.33
KMCA2	0.33	0.17	0.22	0.18	0.28	0.27
KMCA3	0.27	0.20	0.22	0.22	0.22	0.28
KMCRE1	0.26	0.17	0.23	0.23	0.33	0.30
KMCRE2	0.20	0.19	0.24	0.22	0.28	0.27
KMCRE3	0.23	0.16	0.25	0.24	0.33	0.25
KMST1	0.36	0.29	0.40	0.34	0.39	0.39
KMST2	0.37	0.21	0.33	0.28	0.36	0.35
KMST3	0.28	0.22	0.30	0.26	0.33	0.34
KMMA1	0.31	0.24	0.28	0.27	0.29	0.26
KMMA2	0.34	0.20	0.26	0.25	0.31	0.27
KMMA3	0.31	0.23	0.22	0.22	0.27	0.27
KMDI1	0.32	0.29	0.28	0.29	0.31	0.32
KMDI2	0.35	0.31	0.26	0.27	0.34	0.34
KMDI3	0.23	0.21	0.32	0.26	0.30	0.36
INID1	0.22	0.32	0.32	0.28	0.30	0.28
INID2	0.26	0.24	0.32	0.25	0.35	0.35
INID3	0.28	0.27	0.31	0.25	0.30	0.29
INSUP1	0.31	0.32	0.37	0.30	0.33	0.33
INSUP2	0.26	0.27	0.35	0.25	0.30	0.30
INSUP3	0.37	0.26	0.37	0.30	0.33	0.38
INDEV1	0.29	0.26	0.33	0.26	0.28	0.31
INDEV2	0.24	0.28	0.33	0.26	0.29	0.30
INDEV3	0.26	0.25	0.31	0.23	0.27	0.31
INIMP1	0.31	0.21	0.29	0.29	0.25	0.25
INIMP2	0.29	0.21	0.31	0.33	0.28	0.26
INIMP3	0.34	0.26	0.28	0.28	0.24	0.26
HUMAN1	0.30	0.19	0.19	0.26	0.21	0.23
HUMAN2	0.28	0.13	0.15	0.24	0.23	0.20
HUMAN3	0.31	0.14	0.25	0.22	0.30	0.23
HUMAN4	0.23	0.19	0.18	0.25	0.20	0.24
HUMAN5	0.19	0.18	0.22	0.23	0.25	0.21
HUMAN6	0.28	0.18	0.29	0.25	0.26	0.28
HUMAN7	0.26	0.20	0.22	0.20	0.24	0.27

INNOV1	0.35	0.34	0.38	0.35	0.31	0.33
INNOV2	0.25	0.25	0.36	0.27	0.33	0.31
INNOV3	0.24	0.27	0.34	0.26	0.27	0.28
INNOV4	0.32	0.30	0.37	0.35	0.32	0.28
PROC1	0.40	0.27	0.28	0.31	0.23	0.25
PROC2	0.39	0.29	0.30	0.34	0.26	0.25
PROC3	0.34	0.21	0.23	0.30	0.28	0.25
PROC4	0.26	0.23	0.22	0.24	0.23	0.22
CUSTO1	0.24	0.21	0.22	0.27	0.22	0.20
CUSTO2	0.16	0.19	0.18	0.22	0.16	0.22
CUSTO3	0.19	0.20	0.19	0.24	0.21	0.21
CUSTO4	0.23	0.16	0.20	0.26	0.25	0.23
CUSTO5	0.18	0.22	0.23	0.25	0.16	0.19
KMSCO1	0.18	0.15	0.18	0.20	0.17	0.10
KMSCO2	0.22	0.13	0.12	0.23	0.17	0.11
KMSCO3	0.22	0.16	0.13	0.18	0.20	0.14
KMSCO4	0.22	0.17	0.24	0.21	0.25	0.19
KMSIT1	0.25	0.21	0.19	0.22	0.16	0.16
KMSIT2	0.26	0.18	0.18	0.19	0.22	0.23
KMSIT3	0.43	0.27	0.24	0.27	0.26	0.22
CKMF1	0.24	0.16	0.13	0.24	0.24	0.15
CKMF2	0.22	0.17	0.21	0.22	0.35	0.24
CKMF3	0.20	0.13	0.17	0.20	0.21	0.13
CKMF4	0.23	0.17	0.15	0.25	0.27	0.19
CKMRE1	0.33	0.23	0.34	0.26	0.33	0.33
CKMRE2	0.34	0.23	0.33	0.32	0.32	0.32
CKMRE3	0.31	0.21	0.26	0.32	0.32	0.29
CKMST1	0.33	0.16	0.27	0.28	0.34	0.32
CKMST2	0.29	0.22	0.34	0.30	0.34	0.32
CKMST3	0.26	0.18	0.33	0.32	0.28	0.31
CKMMA1	0.30	0.24	0.39	0.31	0.33	0.32
CKMMA2	0.33	0.28	0.36	0.33	0.35	0.33
CKMMA3	0.34	0.26	0.28	0.25	0.33	0.30
CKMDI1	0.30	0.16	0.29	0.24	0.32	0.28
CKMDI2	0.41	0.25	0.29	0.32	0.36	0.39
CKMDI3	0.35	0.20	0.26	0.28	0.30	0.33

	LOE1	LOE2	LOE3	LOE4	LOD1	LOD2
	--------	--------	--------	--------	--------	--------
LOE1	0.60					
LOE2	0.33	0.63				
LOE3	0.31	0.45	0.60			
LOE4	0.30	0.47	0.43	0.60		
LOD1	0.23	0.28	0.28	0.31	0.68	

LOD2	0.31	0.37	0.32	0.35	0.57	0.75
LOD3	0.21	0.31	0.30	0.32	0.39	0.44
LOD4	0.23	0.32	0.27	0.30	0.26	0.28
LOT1	0.24	0.29	0.29	0.32	0.32	0.34
LOT2	0.25	0.29	0.26	0.32	0.30	0.35
LOT3	0.32	0.29	0.27	0.33	0.29	0.33
KMCR1	0.32	0.28	0.27	0.31	0.25	0.28
KMCR2	0.34	0.35	0.33	0.36	0.29	0.35
KMCR3	0.25	0.16	0.21	0.24	0.26	0.29
KMCA1	0.30	0.18	0.24	0.26	0.28	0.29
KMCA2	0.23	0.14	0.18	0.22	0.25	0.25
KMCA3	0.23	0.15	0.17	0.16	0.22	0.22
KMCRE1	0.25	0.18	0.23	0.24	0.21	0.23
KMCRE2	0.22	0.19	0.22	0.25	0.26	0.25
KMCRE3	0.28	0.20	0.21	0.25	0.24	0.19
KMST1	0.34	0.33	0.30	0.36	0.33	0.37
KMST2	0.27	0.27	0.30	0.35	0.33	0.32
KMST3	0.32	0.27	0.25	0.33	0.32	0.34
KMMA1	0.23	0.27	0.28	0.34	0.29	0.28
KMMA2	0.21	0.25	0.27	0.35	0.31	0.27
KMMA3	0.25	0.25	0.23	0.31	0.32	0.34
KMDI1	0.29	0.23	0.25	0.29	0.27	0.33
KMDI2	0.33	0.24	0.28	0.32	0.26	0.31
KMDI3	0.28	0.22	0.27	0.32	0.27	0.23
INID1	0.25	0.29	0.30	0.37	0.24	0.26
INID2	0.28	0.26	0.36	0.35	0.25	0.25
INID3	0.26	0.30	0.30	0.36	0.26	0.31
INSUP1	0.32	0.30	0.31	0.36	0.26	0.27
INSUP2	0.32	0.28	0.29	0.35	0.24	0.26
INSUP3	0.28	0.24	0.30	0.35	0.30	0.25
INDEV1	0.26	0.28	0.29	0.34	0.27	0.31
INDEV2	0.27	0.23	0.29	0.29	0.26	0.30
INDEV3	0.23	0.22	0.24	0.30	0.27	0.27
INIMP1	0.16	0.21	0.27	0.30	0.35	0.32
INIMP2	0.20	0.25	0.29	0.33	0.28	0.28
INIMP3	0.23	0.28	0.31	0.34	0.31	0.32
HUMAN1	0.19	0.22	0.22	0.23	0.25	0.26
HUMAN2	0.22	0.17	0.21	0.24	0.29	0.26
HUMAN3	0.24	0.20	0.26	0.31	0.27	0.23
HUMAN4	0.20	0.25	0.26	0.29	0.22	0.25
HUMAN5	0.18	0.16	0.25	0.24	0.25	0.23
HUMAN6	0.19	0.16	0.21	0.24	0.28	0.24
HUMAN7	0.20	0.17	0.19	0.23	0.20	0.20
INNOV1	0.27	0.31	0.33	0.37	0.32	0.34
INNOV2	0.25	0.21	0.29	0.33	0.24	0.23
INNOV3	0.25	0.27	0.30	0.32	0.29	0.29

INNOV4	0.25	0.26	0.35	0.37	0.34	0.28
PROC1	0.26	0.30	0.29	0.35	0.37	0.37
PROC2	0.25	0.26	0.23	0.30	0.35	0.37
PROC3	0.26	0.23	0.24	0.27	0.31	0.37
PROC4	0.20	0.18	0.22	0.23	0.28	0.30
CUSTO1	0.14	0.19	0.24	0.23	0.30	0.28
CUSTO2	0.16	0.20	0.19	0.19	0.22	0.21
CUSTO3	0.20	0.21	0.23	0.22	0.21	0.21
CUSTO4	0.20	0.16	0.26	0.23	0.22	0.26
CUSTO5	0.15	0.25	0.22	0.25	0.24	0.29
KMSCO1	0.11	0.19	0.21	0.21	0.21	0.17
KMSCO2	0.13	0.20	0.20	0.19	0.31	0.28
KMSCO3	0.16	0.15	0.20	0.22	0.21	0.25
KMSCO4	0.26	0.33	0.34	0.38	0.24	0.22
KMSIT1	0.20	0.27	0.30	0.30	0.29	0.25
KMSIT2	0.25	0.30	0.29	0.31	0.23	0.23
KMSIT3	0.31	0.32	0.29	0.35	0.29	0.28
CKMF1	0.19	0.29	0.28	0.27	0.26	0.29
CKMF2	0.26	0.24	0.28	0.29	0.23	0.27
CKMF3	0.13	0.16	0.19	0.17	0.19	0.18
CKMF4	0.21	0.26	0.24	0.24	0.23	0.27
CKMRE1	0.32	0.26	0.26	0.28	0.26	0.26
CKMRE2	0.28	0.27	0.28	0.28	0.29	0.27
CKMRE3	0.27	0.26	0.28	0.25	0.33	0.31
CKMST1	0.28	0.23	0.23	0.27	0.30	0.30
CKMST2	0.29	0.29	0.32	0.37	0.25	0.26
CKMST3	0.23	0.26	0.26	0.30	0.23	0.20
CKMMA1	0.24	0.21	0.29	0.30	0.23	0.19
CKMMA2	0.30	0.22	0.27	0.29	0.27	0.26
CKMMA3	0.30	0.26	0.26	0.29	0.18	0.20
CKMDI1	0.28	0.29	0.30	0.31	0.18	0.16
CKMDI2	0.32	0.29	0.24	0.31	0.26	0.29
CKMDI3	0.32	0.26	0.22	0.28	0.28	0.33

	LOD3	LOD4	LOT1	LOT2	LOT3	KMCR1
	--------	--------	--------	--------	--------	--------
LOD3	0.61					
LOD4	0.34	0.53				
LOT1	0.38	0.37	0.56			
LOT2	0.23	0.35	0.35	0.51		
LOT3	0.29	0.24	0.30	0.30	0.69	
KMCR1	0.25	0.27	0.28	0.30	0.47	0.62
KMCR2	0.28	0.29	0.34	0.33	0.49	0.50
KMCR3	0.24	0.21	0.28	0.28	0.31	0.30

KMCA1	0.20	0.19	0.28	0.30	0.38	0.30
KMCA2	0.21	0.15	0.24	0.22	0.32	0.26
KMCA3	0.16	0.15	0.20	0.21	0.23	0.23
KMCRE1	0.28	0.21	0.25	0.21	0.26	0.25
KMCRE2	0.26	0.22	0.26	0.19	0.26	0.28
KMCRE3	0.22	0.20	0.24	0.21	0.26	0.28
KMST1	0.32	0.26	0.41	0.35	0.44	0.42
KMST2	0.35	0.23	0.43	0.29	0.43	0.41
KMST3	0.28	0.24	0.36	0.31	0.42	0.42
KMMA1	0.25	0.20	0.31	0.26	0.34	0.28
KMMA2	0.31	0.24	0.34	0.27	0.35	0.32
KMMA3	0.24	0.21	0.32	0.27	0.37	0.32
KMDI1	0.23	0.21	0.30	0.25	0.23	0.25
KMDI2	0.22	0.17	0.30	0.26	0.28	0.29
KMDI3	0.32	0.20	0.36	0.24	0.38	0.38
INID1	0.34	0.30	0.36	0.31	0.35	0.35
INID2	0.32	0.24	0.34	0.28	0.34	0.36
INID3	0.35	0.27	0.37	0.28	0.33	0.35
INSUP1	0.27	0.27	0.34	0.33	0.32	0.34
INSUP2	0.25	0.26	0.33	0.30	0.34	0.38
INSUP3	0.31	0.23	0.36	0.30	0.33	0.33
INDEV1	0.32	0.29	0.39	0.34	0.36	0.35
INDEV2	0.28	0.27	0.39	0.31	0.30	0.31
INDEV3	0.30	0.27	0.36	0.32	0.30	0.33
INIMP1	0.33	0.27	0.31	0.24	0.25	0.27
INIMP2	0.28	0.27	0.30	0.28	0.24	0.28
INIMP3	0.33	0.28	0.34	0.33	0.27	0.32
HUMAN1	0.20	0.22	0.24	0.22	0.19	0.17
HUMAN2	0.16	0.18	0.25	0.24	0.20	0.19
HUMAN3	0.22	0.19	0.33	0.23	0.29	0.32
HUMAN4	0.19	0.26	0.22	0.24	0.25	0.21
HUMAN5	0.25	0.27	0.31	0.25	0.24	0.23
HUMAN6	0.26	0.22	0.30	0.22	0.26	0.26
HUMAN7	0.19	0.21	0.26	0.24	0.24	0.28
INNOV1	0.38	0.33	0.45	0.32	0.37	0.38
INNOV2	0.29	0.24	0.37	0.28	0.40	0.37
INNOV3	0.33	0.28	0.37	0.30	0.34	0.39
INNOV4	0.34	0.29	0.44	0.34	0.38	0.36
PROC1	0.30	0.30	0.33	0.33	0.28	0.31
PROC2	0.28	0.29	0.31	0.34	0.27	0.29
PROC3	0.25	0.26	0.29	0.34	0.27	0.28
PROC4	0.26	0.21	0.25	0.27	0.24	0.21
CUSTO1	0.24	0.20	0.25	0.23	0.22	0.16
CUSTO2	0.16	0.20	0.20	0.20	0.16	0.17
CUSTO3	0.16	0.21	0.24	0.25	0.22	0.22
CUSTO4	0.24	0.20	0.28	0.22	0.24	0.23

CUSTO5	0.25	0.23	0.26	0.23	0.19	0.20
KMSCO1	0.18	0.14	0.13	0.14	0.13	0.12
KMSCO2	0.18	0.17	0.18	0.13	0.10	0.07
KMSCO3	0.12	0.10	0.18	0.16	0.12	0.03
KMSCO4	0.34	0.28	0.35	0.23	0.39	0.39
KMSIT1	0.28	0.26	0.28	0.21	0.32	0.24
KMSIT2	0.23	0.25	0.29	0.23	0.27	0.24
KMSIT3	0.21	0.23	0.29	0.28	0.31	0.24
CKMF1	0.18	0.18	0.18	0.15	0.07	0.07
CKMF2	0.25	0.20	0.27	0.20	0.24	0.19
CKMF3	0.15	0.15	0.14	0.07	0.07	0.03
CKMF4	0.15	0.21	0.19	0.15	0.11	0.10
CKMRE1	0.28	0.26	0.31	0.28	0.40	0.41
CKMRE2	0.23	0.17	0.31	0.22	0.28	0.27
CKMRE3	0.28	0.24	0.25	0.25	0.31	0.30
CKMST1	0.26	0.17	0.22	0.18	0.30	0.25
CKMST2	0.35	0.30	0.35	0.31	0.35	0.41
CKMST3	0.24	0.22	0.34	0.24	0.25	0.35
CKMMA1	0.22	0.19	0.30	0.25	0.29	0.37
CKMMA2	0.24	0.23	0.33	0.25	0.32	0.35
CKMMA3	0.27	0.22	0.30	0.23	0.34	0.37
CKMDI1	0.24	0.25	0.30	0.23	0.31	0.36
CKMDI2	0.23	0.23	0.34	0.25	0.30	0.35
CKMDI3	0.25	0.21	0.28	0.24	0.30	0.32

	KMCR2	KMCR3	KMCA1	KMCA2	KMCA3	KMCRE1
	--------	--------	--------	--------	--------	--------
KMCR2	0.71					
KMCR3	0.36	0.65				
KMCA1	0.34	0.45	0.75			
KMCA2	0.32	0.41	0.47	0.58		
KMCA3	0.25	0.35	0.36	0.33	0.53	
KMCRE1	0.25	0.31	0.33	0.26	0.30	0.59
KMCRE2	0.31	0.28	0.29	0.28	0.29	0.37
KMCRE3	0.27	0.32	0.36	0.29	0.30	0.42
KMST1	0.45	0.42	0.48	0.40	0.31	0.41
KMST2	0.45	0.38	0.44	0.38	0.27	0.37
KMST3	0.43	0.41	0.45	0.38	0.27	0.35
KMMA1	0.31	0.31	0.40	0.30	0.30	0.36
KMMA2	0.36	0.32	0.39	0.32	0.27	0.33
KMMA3	0.32	0.29	0.41	0.30	0.26	0.29
KMDI1	0.28	0.30	0.30	0.28	0.28	0.26
KMDI2	0.34	0.33	0.37	0.34	0.27	0.27
KMDI3	0.39	0.38	0.43	0.36	0.27	0.34

INID1	0.40	0.31	0.33	0.25	0.15	0.30
INID2	0.42	0.33	0.38	0.31	0.19	0.32
INID3	0.38	0.36	0.36	0.34	0.17	0.25
INSUP1	0.36	0.43	0.44	0.35	0.25	0.36
INSUP2	0.35	0.34	0.43	0.34	0.24	0.34
INSUP3	0.35	0.37	0.45	0.38	0.25	0.33
INDEV1	0.36	0.39	0.39	0.37	0.23	0.28
INDEV2	0.34	0.37	0.36	0.35	0.24	0.26
INDEV3	0.34	0.42	0.41	0.38	0.26	0.30
INIMP1	0.29	0.33	0.32	0.30	0.25	0.33
INIMP2	0.31	0.32	0.31	0.28	0.26	0.36
INIMP3	0.34	0.29	0.31	0.27	0.23	0.29
HUMAN1	0.21	0.25	0.21	0.23	0.26	0.26
HUMAN2	0.25	0.24	0.21	0.23	0.26	0.23
HUMAN3	0.36	0.26	0.26	0.28	0.19	0.31
HUMAN4	0.25	0.18	0.21	0.17	0.21	0.23
HUMAN5	0.27	0.33	0.30	0.26	0.27	0.37
HUMAN6	0.31	0.34	0.32	0.28	0.28	0.31
HUMAN7	0.33	0.31	0.25	0.26	0.23	0.25
INNOV1	0.44	0.38	0.33	0.34	0.21	0.27
INNOV2	0.41	0.42	0.38	0.34	0.23	0.32
INNOV3	0.41	0.38	0.39	0.33	0.23	0.25
INNOV4	0.41	0.42	0.43	0.37	0.25	0.34
PROC1	0.35	0.34	0.38	0.31	0.27	0.31
PROC2	0.33	0.35	0.32	0.28	0.27	0.31
PROC3	0.31	0.34	0.30	0.24	0.20	0.29
PROC4	0.25	0.28	0.28	0.24	0.23	0.25
CUSTO1	0.19	0.31	0.31	0.26	0.25	0.3
CUSTO2	0.19	0.24	0.26	0.21	0.27	0.19
CUSTO3	0.25	0.28	0.26	0.25	0.22	0.22
CUSTO4	0.24	0.36	0.33	0.29	0.26	0.33
CUSTO5	0.25	0.30	0.27	0.22	0.25	0.24
KMSCO1	0.14	0.13	0.20	0.13	0.15	0.12
KMSCO2	0.13	0.11	0.11	0.10	0.13	0.14
KMSCO3	0.12	0.14	0.22	0.15	0.12	0.14
KMSCO4	0.46	0.21	0.30	0.24	0.09	0.22
KMSIT1	0.31	0.14	0.26	0.21	0.13	0.23
KMSIT2	0.31	0.17	0.28	0.22	0.15	0.18
KMSIT3	0.31	0.21	0.29	0.27	0.16	0.19
CKMF1	0.22	0.15	0.12	0.12	0.12	0.18
CKMF2	0.28	0.26	0.22	0.23	0.16	0.28
CKMF3	0.12	0.14	0.17	0.18	0.20	0.19
CKMF4	0.24	0.21	0.18	0.19	0.23	0.24
CKMRE1	0.38	0.35	0.36	0.29	0.25	0.31
CKMRE2	0.30	0.32	0.33	0.31	0.28	0.31
CKMRE3	0.34	0.29	0.22	0.23	0.23	0.32

CKMST1	0.33	0.34	0.31	0.32	0.26	0.32
CKMST2	0.44	0.35	0.28	0.22	0.18	0.31
CKMST3	0.38	0.37	0.27	0.26	0.20	0.29
CKMMA1	0.37	0.38	0.27	0.28	0.24	0.3
CKMMA2	0.38	0.36	0.36	0.36	0.25	0.29
CKMMA3	0.35	0.33	0.29	0.28	0.17	0.28
CKMDI1	0.35	0.31	0.32	0.31	0.23	0.28
CKMDI2	0.41	0.37	0.37	0.4	0.27	0.26
CKMDI3	0.38	0.36	0.32	0.34	0.25	0.26

	KMCRE2	KMCRE3	KMST1	KMST2	KMST3	KMMA1
	--------	--------	--------	--------	--------	--------
KMCRE2	0.49					
KMCRE3	0.37	0.57				
KMST1	0.36	0.41	0.82			
KMST2	0.36	0.37	0.64	0.79		
KMST3	0.33	0.39	0.60	0.58	0.71	
KMMA1	0.30	0.36	0.46	0.46	0.42	0.61
KMMA2	0.33	0.34	0.47	0.52	0.45	0.49
KMMA3	0.31	0.32	0.44	0.46	0.43	0.45
KMDI1	0.26	0.28	0.35	0.34	0.34	0.30
KMDI2	0.27	0.29	0.38	0.41	0.37	0.34
KMDI3	0.32	0.36	0.51	0.57	0.49	0.40
INID1	0.30	0.32	0.46	0.43	0.42	0.34
INID2	0.29	0.33	0.48	0.50	0.43	0.39
INID3	0.26	0.28	0.45	0.47	0.43	0.34
INSUP1	0.32	0.39	0.53	0.50	0.47	0.40
INSUP2	0.32	0.35	0.54	0.47	0.47	0.41
INSUP3	0.34	0.36	0.51	0.56	0.48	0.42
INDEV1	0.27	0.28	0.49	0.49	0.47	0.36
INDEV2	0.28	0.29	0.44	0.44	0.45	0.35
INDEV3	0.29	0.31	0.46	0.45	0.45	0.35
INIMP1	0.31	0.34	0.37	0.40	0.36	0.37
INIMP2	0.32	0.33	0.41	0.36	0.37	0.39
INIMP3	0.28	0.27	0.38	0.38	0.35	0.34
HUMAN1	0.21	0.24	0.25	0.23	0.21	0.25
HUMAN2	0.22	0.25	0.25	0.23	0.23	0.24
HUMAN3	0.29	0.31	0.33	0.40	0.30	0.34
HUMAN4	0.22	0.21	0.21	0.19	0.23	0.25
HUMAN5	0.32	0.34	0.28	0.33	0.28	0.32
HUMAN6	0.30	0.30	0.36	0.38	0.33	0.31
HUMAN7	0.22	0.22	0.32	0.30	0.27	0.23
INNOV1	0.31	0.29	0.50	0.52	0.41	0.37
INNOV2	0.31	0.34	0.45	0.50	0.41	0.38

INNOV3	0.28	0.29	0.47	0.48	0.48	0.34
INNOV4	0.33	0.41	0.50	0.60	0.47	0.44
PROC1	0.30	0.35	0.38	0.38	0.37	0.37
PROC2	0.31	0.32	0.34	0.36	0.35	0.35
PROC3	0.23	0.28	0.36	0.34	0.36	0.34
PROC4	0.22	0.24	0.30	0.28	0.26	0.27
CUSTO1	0.21	0.29	0.31	0.31	0.26	0.32
CUSTO2	0.20	0.22	0.26	0.20	0.24	0.21
CUSTO3	0.21	0.22	0.29	0.28	0.28	0.25
CUSTO4	0.24	0.24	0.34	0.35	0.34	0.29
CUSTO5	0.23	0.25	0.35	0.26	0.30	0.26
KMSCO1	0.13	0.18	0.13	0.14	0.11	0.18
KMSCO2	0.17	0.14	0.13	0.11	0.12	0.17
KMSCO3	0.13	0.12	0.17	0.17	0.16	0.23
KMSCO4	0.26	0.29	0.42	0.48	0.40	0.32
KMSIT1	0.21	0.24	0.33	0.32	0.29	0.31
KMSIT2	0.19	0.18	0.31	0.34	0.27	0.30
KMSIT3	0.16	0.24	0.37	0.39	0.29	0.30
CKMF1	0.18	0.17	0.16	0.13	0.11	0.16
CKMF2	0.22	0.27	0.31	0.28	0.32	0.27
CKMF3	0.17	0.22	0.17	0.14	0.11	0.19
CKMF4	0.20	0.24	0.19	0.14	0.22	0.20
CKMRE1	0.24	0.32	0.48	0.48	0.45	0.32
CKMRE2	0.23	0.33	0.43	0.44	0.38	0.35
CKMRE3	0.29	0.35	0.34	0.38	0.30	0.24
CKMST1	0.28	0.30	0.33	0.36	0.35	0.28
CKMST2	0.26	0.25	0.41	0.46	0.36	0.32
CKMST3	0.28	0.30	0.42	0.48	0.39	0.36
CKMMA1	0.28	0.30	0.44	0.44	0.37	0.32
CKMMA2	0.30	0.33	0.46	0.47	0.42	0.33
CKMMA3	0.24	0.30	0.39	0.40	0.35	0.30
CKMDI1	0.27	0.31	0.43	0.42	0.40	0.37
CKMDI2	0.31	0.31	0.48	0.41	0.40	0.35
CKMDI3	0.25	0.26	0.38	0.36	0.33	0.27

	KMMA2	KMMA3	KMDI1	KMDI2	KMDI3	INID1
	--------	--------	--------	--------	--------	--------
KMMA2	0.62					
KMMA3	0.41	0.55				
KMDI1	0.32	0.29	0.62			
KMDI2	0.34	0.34	0.52	0.67		
KMDI3	0.43	0.37	0.42	0.48	0.81	
INID1	0.36	0.32	0.26	0.28	0.43	0.70
INID2	0.41	0.33	0.24	0.33	0.50	0.57

INID3	0.38	0.31	0.25	0.33	0.45	0.51
INSUP1	0.39	0.37	0.35	0.39	0.51	0.50
INSUP2	0.38	0.37	0.31	0.35	0.51	0.48
INSUP3	0.47	0.38	0.35	0.40	0.56	0.46
INDEV1	0.39	0.36	0.34	0.38	0.52	0.46
INDEV2	0.38	0.32	0.36	0.39	0.48	0.39
INDEV3	0.39	0.35	0.31	0.36	0.52	0.46
INIMP1	0.41	0.31	0.27	0.31	0.38	0.38
INIMP2	0.37	0.31	0.27	0.29	0.37	0.41
INIMP3	0.35	0.31	0.32	0.35	0.35	0.42
HUMAN1	0.21	0.23	0.25	0.27	0.23	0.17
HUMAN2	0.25	0.22	0.28	0.28	0.23	0.11
HUMAN3	0.35	0.30	0.35	0.40	0.43	0.24
HUMAN4	0.20	0.24	0.21	0.23	0.22	0.25
HUMAN5	0.28	0.27	0.25	0.28	0.36	0.29
HUMAN6	0.29	0.28	0.26	0.27	0.40	0.31
HUMAN7	0.22	0.22	0.25	0.28	0.32	0.27
INNOV1	0.37	0.37	0.33	0.39	0.50	0.47
INNOV2	0.35	0.35	0.32	0.37	0.53	0.43
INNOV3	0.40	0.32	0.31	0.37	0.51	0.48
INNOV4	0.47	0.39	0.38	0.45	0.58	0.48
PROC1	0.36	0.34	0.32	0.39	0.38	0.33
PROC2	0.34	0.33	0.34	0.38	0.36	0.29
PROC3	0.29	0.31	0.32	0.33	0.31	0.30
PROC4	0.24	0.21	0.30	0.28	0.32	0.25
CUSTO1	0.26	0.27	0.24	0.28	0.29	0.26
CUSTO2	0.18	0.19	0.23	0.29	0.24	0.22
CUSTO3	0.21	0.26	0.23	0.27	0.32	0.26
CUSTO4	0.27	0.25	0.25	0.27	0.37	0.27
CUSTO5	0.22	0.21	0.20	0.23	0.28	0.28
KMSCO1	0.18	0.15	0.13	0.19	0.13	0.14
KMSCO2	0.14	0.18	0.16	0.17	0.06	0.09
KMSCO3	0.17	0.24	0.24	0.27	0.18	0.11
KMSCO4	0.33	0.33	0.21	0.30	0.43	0.47
KMSIT1	0.29	0.28	0.24	0.29	0.29	0.33
KMSIT2	0.25	0.30	0.26	0.29	0.33	0.26
KMSIT3	0.26	0.28	0.34	0.38	0.30	0.25
CKMF1	0.16	0.16	0.19	0.18	0.05	0.15
CKMF2	0.27	0.23	0.29	0.27	0.29	0.27
CKMF3	0.14	0.13	0.25	0.21	0.18	0.12
CKMF4	0.14	0.20	0.31	0.27	0.16	0.12
CKMRE1	0.33	0.30	0.30	0.32	0.42	0.34
CKMRE2	0.35	0.30	0.37	0.33	0.41	0.24
CKMRE3	0.24	0.25	0.26	0.25	0.28	0.27
CKMST1	0.30	0.26	0.32	0.32	0.34	0.22
CKMST2	0.34	0.27	0.27	0.27	0.41	0.38

CKMST3	0.35	0.30	0.33	0.30	0.49	0.32
CKMMA1	0.33	0.27	0.33	0.31	0.46	0.30
CKMMA2	0.33	0.30	0.31	0.29	0.41	0.33
CKMMA3	0.30	0.29	0.23	0.26	0.36	0.35
CKMDI1	0.38	0.31	0.27	0.22	0.38	0.34
CKMDI2	0.39	0.35	0.39	0.39	0.40	0.31
CKMDI3	0.26	0.28	0.31	0.31	0.38	0.26

	INID2	INID3	INSUP1	INSUP2	INSUP3	INDEV1
	--------	--------	--------	--------	--------	--------
INID2	0.74					
INID3	0.54	0.69				
INSUP1	0.48	0.52	0.76			
INSUP2	0.47	0.49	0.63	0.73		
INSUP3	0.53	0.50	0.59	0.57	0.76	
INDEV1	0.49	0.50	0.48	0.49	0.50	0.73
INDEV2	0.42	0.46	0.47	0.47	0.46	0.59
INDEV3	0.49	0.51	0.53	0.51	0.54	0.60
INIMP1	0.44	0.41	0.4	0.35	0.44	0.41
INIMP2	0.44	0.35	0.37	0.39	0.41	0.39
INIMP3	0.40	0.41	0.41	0.38	0.41	0.44
HUMAN1	0.18	0.16	0.25	0.22	0.25	0.26
HUMAN2	0.19	0.17	0.21	0.22	0.25	0.26
HUMAN3	0.33	0.31	0.38	0.36	0.41	0.39
HUMAN4	0.26	0.16	0.20	0.21	0.23	0.28
HUMAN5	0.34	0.31	0.33	0.29	0.33	0.40
HUMAN6	0.36	0.32	0.36	0.34	0.41	0.41
HUMAN7	0.30	0.28	0.34	0.30	0.32	0.38
INNOV1	0.46	0.47	0.47	0.45	0.47	0.53
INNOV2	0.47	0.43	0.51	0.49	0.49	0.50
INNOV3	0.50	0.54	0.47	0.44	0.46	0.50
INNOV4	0.52	0.50	0.56	0.45	0.56	0.56
PROC1	0.35	0.36	0.40	0.37	0.38	0.39
PROC2	0.31	0.33	0.37	0.35	0.40	0.36
PROC3	0.32	0.28	0.32	0.34	0.31	0.35
PROC4	0.32	0.28	0.29	0.29	0.28	0.39
CUSTO1	0.29	0.27	0.32	0.30	0.33	0.34
CUSTO2	0.24	0.20	0.22	0.24	0.25	0.22
CUSTO3	0.28	0.27	0.34	0.30	0.32	0.32
CUSTO4	0.36	0.33	0.32	0.33	0.37	0.39
CUSTO5	0.29	0.29	0.32	0.30	0.30	0.31
KMSCO1	0.14	0.14	0.14	0.08	0.14	0.06
KMSCO2	0.10	0.08	0.08	0.06	0.11	0.09
KMSCO3	0.13	0.13	0.11	0.10	0.14	0.13

KMSCO4	0.42	0.45	0.43	0.39	0.40	0.36
KMSIT1	0.28	0.3	0.31	0.3	0.28	0.25
KMSIT2	0.26	0.29	0.31	0.26	0.29	0.28
KMSIT3	0.23	0.31	0.39	0.3	0.34	0.33
CKMF1	0.12	0.14	0.10	0.06	0.13	0.07
CKMF2	0.31	0.28	0.24	0.23	0.28	0.28
CKMF3	0.15	0.11	0.10	0.09	0.16	0.13
CKMF4	0.14	0.13	0.15	0.09	0.15	0.14
CKMRE1	0.36	0.36	0.43	0.39	0.43	0.41
CKMRE2	0.31	0.31	0.39	0.35	0.43	0.36
CKMRE3	0.25	0.26	0.34	0.24	0.30	0.29
CKMST1	0.28	0.30	0.33	0.26	0.36	0.26
CKMST2	0.40	0.41	0.42	0.39	0.41	0.38
CKMST3	0.36	0.34	0.45	0.41	0.46	0.36
CKMMA1	0.36	0.31	0.44	0.39	0.42	0.39
CKMMA2	0.35	0.36	0.47	0.44	0.44	0.42
CKMMA3	0.39	0.37	0.41	0.38	0.36	0.37
CKMDI1	0.37	0.31	0.39	0.39	0.38	0.34
CKMDI2	0.33	0.39	0.41	0.39	0.40	0.34
CKMDI3	0.3	0.33	0.33	0.32	0.33	0.35

	INDEV2	INDEV3	INIMP1	INIMP2	INIMP3	HUMAN1
	--------	--------	--------	--------	--------	--------
INDEV2	0.69					
INDEV3	0.54	0.72				
INIMP1	0.37	0.44	0.66			
INIMP2	0.38	0.41	0.52	0.69		
INIMP3	0.38	0.41	0.48	0.48	0.62	
HUMAN1	0.23	0.22	0.31	0.28	0.29	0.47
HUMAN2	0.26	0.19	0.28	0.28	0.29	0.36
HUMAN3	0.38	0.33	0.35	0.34	0.36	0.33
HUMAN4	0.21	0.23	0.28	0.31	0.31	0.31
HUMAN5	0.38	0.38	0.41	0.42	0.37	0.34
HUMAN6	0.39	0.37	0.39	0.38	0.35	0.32
HUMAN7	0.32	0.34	0.29	0.26	0.32	0.29
INNOV1	0.49	0.47	0.47	0.46	0.48	0.28
INNOV2	0.48	0.47	0.41	0.43	0.40	0.24
INNOV3	0.49	0.52	0.41	0.43	0.43	0.15
INNOV4	0.55	0.53	0.51	0.46	0.48	0.28
PROC1	0.38	0.40	0.42	0.41	0.40	0.33
PROC2	0.37	0.36	0.40	0.41	0.38	0.32
PROC3	0.34	0.33	0.35	0.38	0.36	0.29
PROC4	0.37	0.30	0.29	0.29	0.32	0.25
CUSTO1	0.31	0.29	0.37	0.33	0.29	0.29

CUSTO2	0.22	0.24	0.30	0.30	0.25	0.23
CUSTO3	0.31	0.31	0.29	0.34	0.28	0.24
CUSTO4	0.34	0.39	0.40	0.42	0.33	0.27
CUSTO5	0.31	0.33	0.35	0.37	0.32	0.23
KMSCO1	0.13	0.10	0.21	0.17	0.19	0.16
KMSCO2	0.13	0.06	0.23	0.24	0.23	0.22
KMSCO3	0.18	0.14	0.18	0.21	0.20	0.17
KMSCO4	0.30	0.36	0.34	0.28	0.38	0.17
KMSIT1	0.23	0.23	0.32	0.26	0.36	0.22
KMSIT2	0.25	0.27	0.20	0.17	0.28	0.22
KMSIT3	0.31	0.26	0.19	0.15	0.29	0.24
CKMF1	0.10	0.10	0.21	0.22	0.20	0.23
CKMF2	0.29	0.31	0.27	0.28	0.23	0.22
CKMF3	0.16	0.11	0.20	0.24	0.14	0.2
CKMF4	0.18	0.14	0.24	0.25	0.21	0.27
CKMRE1	0.39	0.39	0.34	0.29	0.35	0.24
CKMRE2	0.37	0.33	0.30	0.28	0.27	0.27
CKMRE3	0.32	0.25	0.32	0.27	0.32	0.32
CKMST1	0.30	0.29	0.33	0.31	0.27	0.26
CKMST2	0.35	0.37	0.36	0.39	0.40	0.19
CKMST3	0.37	0.37	0.33	0.38	0.31	0.22
CKMMA1	0.37	0.33	0.31	0.34	0.34	0.21
CKMMA2	0.41	0.35	0.31	0.31	0.33	0.19
CKMMA3	0.33	0.34	0.29	0.27	0.32	0.19
CKMDI1	0.33	0.29	0.25	0.30	0.28	0.15
CKMDI2	0.36	0.33	0.29	0.30	0.30	0.20
CKMDI3	0.31	0.28	0.24	0.25	0.27	0.24

	HUMAN2	HUMAN3	HUMAN4	HUMAN5	HUMAN6	HUMAN7
	--------	--------	--------	--------	--------	--------
HUMAN2	0.57					
HUMAN3	0.43	0.79				
HUMAN4	0.25	0.24	0.62			
HUMAN5	0.33	0.48	0.40	0.78		
HUMAN6	0.33	0.44	0.33	0.50	0.61	
HUMAN7	0.34	0.41	0.30	0.41	0.43	0.57
INNOV1	0.25	0.45	0.29	0.45	0.43	0.38
INNOV2	0.25	0.47	0.27	0.53	0.45	0.38
INNOV3	0.18	0.36	0.20	0.36	0.35	0.30
INNOV4	0.31	0.51	0.25	0.54	0.49	0.40
PROC1	0.32	0.38	0.31	0.41	0.38	0.34
PROC2	0.35	0.41	0.29	0.40	0.38	0.33
PROC3	0.31	0.34	0.30	0.40	0.33	0.30
PROC4	0.30	0.34	0.26	0.41	0.36	0.36

CUSTO1	0.25	0.30	0.26	0.41	0.34	0.29
CUSTO2	0.21	0.18	0.24	0.27	0.25	0.21
CUSTO3	0.20	0.26	0.26	0.34	0.29	0.24
CUSTO4	0.26	0.32	0.27	0.43	0.38	0.30
CUSTO5	0.20	0.21	0.23	0.31	0.31	0.25
KMSCO1	0.14	0.14	0.21	0.14	0.14	0.07
KMSCO2	0.23	0.15	0.25	0.19	0.18	0.09
KMSCO3	0.17	0.18	0.23	0.19	0.14	0.08
KMSCO4	0.14	0.35	0.21	0.28	0.29	0.26
KMSIT1	0.19	0.25	0.21	0.21	0.21	0.18
KMSIT2	0.18	0.29	0.23	0.23	0.23	0.24
KMSIT3	0.26	0.35	0.23	0.24	0.26	0.28
CKMF1	0.24	0.19	0.24	0.20	0.19	0.14
CKMF2	0.26	0.33	0.21	0.26	0.30	0.24
CKMF3	0.18	0.23	0.19	0.26	0.25	0.13
CKMF4	0.27	0.24	0.28	0.27	0.29	0.20
CKMRE1	0.19	0.32	0.19	0.29	0.36	0.29
CKMRE2	0.26	0.37	0.20	0.31	0.35	0.28
CKMRE3	0.27	0.34	0.27	0.39	0.40	0.29
CKMST1	0.26	0.39	0.21	0.33	0.37	0.27
CKMST2	0.19	0.37	0.20	0.38	0.36	0.32
CKMST3	0.20	0.41	0.19	0.34	0.37	0.28
CKMMA1	0.23	0.40	0.18	0.30	0.38	0.36
CKMMA2	0.20	0.34	0.19	0.32	0.36	0.34
CKMMA3	0.18	0.30	0.19	0.29	0.29	0.29
CKMDI1	0.16	0.27	0.19	0.25	0.26	0.23
CKMDI2	0.23	0.35	0.20	0.23	0.29	0.31
CKMDI3	0.25	0.33	0.21	0.31	0.33	0.30

	INNOV1	INNOV2	INNOV3	INNOV4	PROC1	PROC2
	--------	--------	--------	--------	--------	--------
INNOV1	0.77					
INNOV2	0.65	0.85				
INNOV3	0.55	0.53	0.75			
INNOV4	0.65	0.64	0.60	0.97		
PROC1	0.43	0.41	0.40	0.52	0.69	
PROC2	0.41	0.37	0.38	0.49	0.57	0.70
PROC3	0.38	0.37	0.34	0.42	0.44	0.48
PROC4	0.36	0.41	0.31	0.41	0.40	0.37
CUSTO1	0.34	0.41	0.29	0.41	0.34	0.32
CUSTO2	0.24	0.25	0.26	0.24	0.27	0.24
CUSTO3	0.33	0.34	0.30	0.35	0.29	0.30
CUSTO4	0.37	0.40	0.37	0.42	0.32	0.35
CUSTO5	0.34	0.33	0.34	0.37	0.33	0.31

KMSCO1	0.17	0.14	0.20	0.25	0.23	0.22
KMSCO2	0.20	0.07	0.10	0.20	0.24	0.26
KMSCO3	0.20	0.12	0.17	0.24	0.22	0.23
KMSCO4	0.49	0.47	0.48	0.47	0.35	0.30
KMSIT1	0.37	0.30	0.33	0.33	0.30	0.26
KMSIT2	0.33	0.25	0.30	0.36	0.33	0.27
KMSIT3	0.37	0.30	0.30	0.46	0.37	0.32
CKMF1	0.16	0.07	0.08	0.15	0.21	0.23
CKMF2	0.27	0.22	0.26	0.31	0.22	0.25
CKMF3	0.17	0.16	0.11	0.20	0.18	0.20
CKMF4	0.21	0.14	0.13	0.17	0.25	0.25
CKMRE1	0.42	0.44	0.34	0.50	0.33	0.30
CKMRE2	0.37	0.39	0.29	0.52	0.31	0.31
CKMRE3	0.38	0.39	0.21	0.43	0.36	0.34
CKMST1	0.32	0.33	0.29	0.39	0.33	0.35
CKMST2	0.55	0.53	0.42	0.51	0.31	0.30
CKMST3	0.49	0.50	0.39	0.55	0.31	0.35
CKMMA1	0.48	0.47	0.38	0.54	0.30	0.32
CKMMA2	0.50	0.50	0.37	0.51	0.28	0.28
CKMMA3	0.42	0.45	0.33	0.44	0.29	0.26
CKMDI1	0.35	0.37	0.34	0.42	0.26	0.24
CKMDI2	0.40	0.33	0.37	0.41	0.30	0.31
CKMDI3	0.38	0.35	0.32	0.38	0.29	0.30

	PROC3	PROC4	CUSTO1	CUSTO2	CUSTO3	CUSTO4
	--------	--------	--------	--------	--------	--------
PROC3	0.65					
PROC4	0.44	0.64				
CUSTO1	0.35	0.36	0.62			
CUSTO2	0.24	0.22	0.34	0.52		
CUSTO3	0.27	0.24	0.33	0.30	0.45	
CUSTO4	0.35	0.33	0.40	0.35	0.41	0.69
CUSTO5	0.27	0.29	0.34	0.32	0.32	0.41
KMSCO1	0.19	0.14	0.21	0.19	0.10	0.12
KMSCO2	0.21	0.13	0.19	0.17	0.13	0.17
KMSCO3	0.26	0.14	0.19	0.15	0.14	0.20
KMSCO4	0.27	0.23	0.22	0.14	0.21	0.22
KMSIT1	0.25	0.20	0.25	0.17	0.18	0.17
KMSIT2	0.26	0.21	0.19	0.18	0.21	0.19
KMSIT3	0.31	0.28	0.26	0.17	0.22	0.18
CKMF1	0.20	0.09	0.19	0.15	0.13	0.15
CKMF2	0.28	0.22	0.21	0.16	0.18	0.29
CKMF3	0.19	0.19	0.24	0.23	0.14	0.19
CKMF4	0.26	0.21	0.23	0.25	0.18	0.24

CKMRE1	0.32	0.30	0.31	0.25	0.28	0.34
CKMRE2	0.28	0.29	0.36	0.21	0.24	0.30
CKMRE3	0.32	0.33	0.39	0.18	0.27	0.26
CKMST1	0.32	0.30	0.29	0.21	0.24	0.31
CKMST2	0.34	0.30	0.28	0.18	0.26	0.34
CKMST3	0.30	0.22	0.27	0.18	0.26	0.32
CKMMA1	0.30	0.30	0.27	0.17	0.26	0.30
CKMMA2	0.27	0.30	0.31	0.19	0.25	0.29
CKMMA3	0.29	0.27	0.27	0.18	0.24	0.29
CKMDI1	0.27	0.21	0.21	0.18	0.22	0.26
CKMDI2	0.26	0.21	0.23	0.24	0.25	0.27
CKMDI3	0.30	0.26	0.27	0.21	0.26	0.34

	CUSTO5	KMSCO1	KMSCO2	KMSCO3	KMSCO4	KMSIT1
	--------	--------	--------	--------	--------	--------
CUSTO5	0.53					
KMSCO1	0.15	0.60				
KMSCO2	0.18	0.35	0.63			
KMSCO3	0.15	0.32	0.44	0.78		
KMSCO4	0.21	0.27	0.15	0.24	0.97	
KMSIT1	0.19	0.29	0.24	0.32	0.64	0.73
KMSIT2	0.17	0.24	0.23	0.37	0.54	0.45
KMSIT3	0.14	0.28	0.28	0.41	0.54	0.52
CKMF1	0.16	0.27	0.38	0.34	0.17	0.21
CKMF2	0.23	0.19	0.23	0.27	0.28	0.21
CKMF3	0.16	0.22	0.26	0.28	0.08	0.14
CKMF4	0.23	0.26	0.43	0.38	0.16	0.22
CKMRE1	0.27	0.20	0.15	0.19	0.43	0.30
CKMRE2	0.25	0.20	0.21	0.26	0.30	0.27
CKMRE3	0.23	0.26	0.25	0.18	0.35	0.32
CKMST1	0.24	0.23	0.22	0.26	0.33	0.30
CKMST2	0.28	0.16	0.16	0.18	0.50	0.31
CKMST3	0.27	0.17	0.19	0.21	0.39	0.23
CKMMA1	0.28	0.12	0.13	0.12	0.33	0.19
CKMMA2	0.26	0.12	0.15	0.11	0.35	0.25
CKMMA3	0.24	0.10	0.06	0.07	0.33	0.21
CKMDI1	0.21	0.13	0.10	0.06	0.33	0.18
CKMDI2	0.26	0.15	0.19	0.25	0.30	0.29
CKMDI3	0.27	0.14	0.17	0.18	0.25	0.20

	KMSIT2	KMSIT3	CKMF1	CKMF2	CKMF3	CKMF4
	--------	--------	--------	--------	--------	--------

KMSIT2	0.67					
KMSIT3	0.56	0.98				
CKMF1	0.18	0.22	0.70			
CKMF2	0.26	0.25	0.44	0.70		
CKMF3	0.14	0.18	0.35	0.33	0.61	
CKMF4	0.23	0.29	0.51	0.42	0.46	0.84
CKMRE1	0.32	0.44	0.21	0.39	0.21	0.29
CKMRE2	0.32	0.44	0.26	0.38	0.31	0.34
CKMRE3	0.26	0.41	0.32	0.32	0.27	0.38
CKMST1	0.29	0.40	0.30	0.41	0.27	0.43
CKMST2	0.31	0.36	0.18	0.37	0.13	0.26
CKMST3	0.30	0.32	0.20	0.32	0.19	0.24
CKMMA1	0.26	0.31	0.15	0.34	0.15	0.25
CKMMA2	0.23	0.38	0.14	0.23	0.18	0.21
CKMMA3	0.24	0.28	0.09	0.24	0.09	0.11
CKMDI1	0.25	0.21	0.14	0.28	0.20	0.18
CKMDI2	0.34	0.35	0.21	0.31	0.22	0.29
CKMDI3	0.27	0.33	0.22	0.28	0.22	0.28

	CKMRE1	CKMRE2	CKMRE3	CKMST1	CKMST2	CKMST3
CKMRE1	0.90					
CKMRE2	0.63	0.84				
CKMRE3	0.6	0.55	0.85			
CKMST1	0.61	0.57	0.59	0.84		
CKMST2	0.53	0.41	0.44	0.41	0.97	
CKMST3	0.48	0.53	0.40	0.40	0.68	0.83
CKMMA1	0.50	0.50	0.38	0.38	0.64	0.66
CKMMA2	0.50	0.53	0.43	0.38	0.58	0.59
CKMMA3	0.46	0.37	0.34	0.29	0.44	0.37
CKMDI1	0.39	0.39	0.24	0.25	0.42	0.43
CKMDI2	0.38	0.48	0.28	0.38	0.44	0.47
CKMDI3	0.33	0.40	0.33	0.35	0.37	0.41

	CKMMA1	CKMMA2	CKMMA3	CKMDI1	CKMDI2	CKMDI3
CKMMA1	0.87					
CKMMA2	0.66	0.87				
CKMMA3	0.45	0.50	0.65			
CKMDI1	0.44	0.46	0.46	0.70		
CKMDI2	0.48	0.52	0.42	0.48	0.87	
CKMDI3	0.39	0.43	0.36	0.37	0.55	0.65

LISREL Estimates (Maximum Likelihood)

LAMBDA-Y

	SDL	LO	KMC	IGP	IC
	--------	--------	--------	--------	--------
SDL1	1	- -	- -	- -	- -
SDL2	1.22 (0.14) 8.89	- -	- -	- -	- -
SDL3	1.39 (0.15) 8.97	- -	- -	- -	- -
SDL4	1.3 (0.14) 9.25	- -	- -	- -	- -
LOG1	- -	1	- -	- -	- -
LOG2	- -	0.97 (0.06) 16.18	- -	- -	- -
LOG3	- -	1.09 (0.08) 13.09	- -	- -	- -
LOG4	- -	0.87 (0.08) 10.72	- -	- -	- -
LOL1	- -	1	- -	- -	- -
LOL2	- -	0.94 (0.07) 14.46	- -	- -	- -
LOL3	- -	0.98 (0.07) 13.82	- -	- -	- -

LOL4	- -	0.98 (0.07) 13.66	- -	- -	- -
LOE1	- -	1	- -	- -	- -
LOE2	- -	0.96 (0.07) 12.92	- -	- -	- -
LOE3	- -	0.95 (0.07) 13.27	- -	- -	- -
LOE4	- -	1.05 (0.07) 15.69	- -	- -	- -
LOD1	- -	1	- -	- -	- -
LOD2	- -	1.08 (0.06) 18.87	- -	- -	- -
LOD3	- -	0.99 (0.07) 14.03	- -	- -	- -
LOD4	- -	0.89 (0.07) 13.37	- -	- -	- -
LOT1	- -	1	- -	- -	- -
LOT2	- -	0.93 (0.06) 14.59	- -	- -	- -
LOT3	- -	0.86 (0.07) 11.98	- -	- -	- -
KMCR1	- -	- -	1	- -	- -
KMCR2	- -	- -	0.93	- -	- -

			(0.07)		
			13.82		
KMCR3	- -	- -	0.97	- -	- -
			(0.06)		
			15.23		
KMCA1	- -	- -	1	- -	- -
KMCA2	- -	- -	0.91	- -	- -
			(0.06)		
			15.21		
KMCA3	- -	- -	0.79	- -	- -
			(0.06)		
			12.88		
KMCRE1	- -	- -	1	- -	- -
KMCRE2	- -	- -	0.87	- -	- -
			(0.05)		
			16.46		
KMCRE3	- -	- -	0.95	- -	- -
			(0.06)		
			16.73		
KMST1	- -	- -	1	- -	- -
KMST2	- -	- -	1.16	- -	- -
			(0.05)		
			21.57		
KMST3	- -	- -	1.1	- -	- -
			(0.05)		
			20.85		
KMMA1	- -	- -	1	- -	- -
KMMA2	- -	- -	1.07	- -	- -
			(0.06)		
			19.31		
KMMA3	- -	- -	0.95	- -	- -
			(0.05)		
			18.12		

KMDI1	- -	- -	1	- -	- -
KMDI2	- -	- -	0.99	- -	- -
			(0.06)		
			15.41		
KMDI3	- -	- -	1.15	- -	- -
			(0.07)		
			16.95		
INID1	- -	- -	- -	1	- -
INID2	- -	- -	- -	1	- -
			(0.05)		
			19.39		
INID3	- -	- -	- -	0.93	- -
			(0.05)		
			20.47		
INSUP1	- -	- -	- -	1	- -
INSUP2	- -	- -	- -	1.03	- -
				(0.05)	
				21.11	
INSUP3	- -	- -	- -	1.08	- -
				(0.05)	
				22.07	
INDEV1	- -	- -	- -	1	- -
INDEV2	- -	- -	- -	0.97	- -
				(0.05)	
				19.99	
INDEV3	- -	- -	- -	1.05	- -
				(0.05)	
				22.8	
INIMP1	- -	- -	- -	1	- -
INIMP2	- -	- -	- -	0.85	- -
				(0.06)	
				14.86	

INIMP3	- -	- -	- -	0.85 (0.05) 17.04	- -
HUMAN1	- -	- -	- -	- -	1
HUMAN2	- -	- -	- -	- -	0.85 (0.07) 12.6
HUMAN3	- -	- -	- -	- -	1.08 (0.08) 14.21
HUMAN4	- -	- -	- -	- -	0.84 (0.07) 11.58
HUMAN5	- -	- -	- -	- -	1.2 (0.07) 17.23
HUMAN6	- -	- -	- -	- -	1.11 (0.06) 19.01
HUMAN7	- -	- -	- -	- -	0.98 (0.06) 15.83
INNOV1	- -	- -	- -	- -	1
INNOV2	- -	- -	- -	- -	1.15 (0.06) 18.51
INNOV3	- -	- -	- -	- -	0.97 (0.07) 14.67
INNOV4	- -	- -	- -	- -	1.27 (0.07) 17.34
PROC1	- -	- -	- -	- -	1

PROC2	- -	- -	- -	- -	1.01 (0.05) 19.21
PROC3	- -	- -	- -	- -	1.02 (0.07) 15.07
PROC4	- -	- -	- -	- -	0.99 (0.07) 14.74
CUSTO1	- -	- -	- -	- -	1
CUSTO2	- -	- -	- -	- -	0.75 (0.07) 11.18
CUSTO3	- -	- -	- -	- -	0.84 (0.06) 14.93
CUSTO4	- -	- -	- -	- -	1.02 (0.07) 14.69
CUSTO5	- -	- -	- -	- -	0.87 (0.06) 13.75

LAMBDAX

	KMS	CKM
	--------	--------
KMSCO1	1	- -
KMSCO2	0.7 (0.08) 8.43	- -
KMSCO3	0.98 (0.1) 10.34	- -
KMSCO4	1.12	- -

	(0.07)	
	15.11	
KMSIT1	1	- -
KMSIT2	1.2	- -
	(0.08)	
	14.34	
KMSIT3	1.39	- -
	(0.1)	
	13.71	
CKMF1	- -	1
CKMF2	- -	0.83
		(0.07)
		11.62
CKMF3	- -	0.54
		(0.07)
		7.31
CKMF4	- -	0.66
		(0.08)
		8.51
CKMRE1	- -	1
CKMRE2	- -	1.14
		(0.07)
		16.55
CKMRE3	- -	1.01
		(0.08)
		13.27
CKMST1	- -	1
CKMST2	- -	1.09
		(0.08)
		14.13
CKMST3	- -	1.07
		(0.06)
		18.29

CKMMA1	- -	1
CKMMA2	- -	1.16 (0.07) 16.3
CKMMA3	- -	0.97 (0.06) 15.39
CKMDI1	- -	1
CKMDI2	- -	1.07 (0.07) 14.39
CKMDI3	- -	0.93 (0.06) 14.48

BETA

	SDL	LO	KMC	IGP	IC
SDL	- -	- -	- -	- -	- -
LO	- -	- -	- -	- -	- -
KMC	- -	- -	- -	- -	- -
IGP	- -	- -	- -	- -	- -
IC	0.14 (0.06) 2.35	0.24 (0.07) 3.32	0.23 (0.06) 3.66	0.35 (0.05) 7.3	- -

GAMMA

	KMS	CKM
SDL	0.74 (0.08) 8.88	- -

LO	0.23	0.64
	(0.05)	(0.05)
	4.39	12.72
KMC	0.12	0.78
	(0.05)	(0.05)
	2.2	14.59
IGP	- -	0.92
		(0.05)
		17.19
IC	- -	- -

Covariance Matrix of ETA and KSI

	SDL	LO	KMC	IGP	IC	KMS
SDL	0.24					
LO	0.16	0.3				
KMC	0.15	0.25	0.35			
IGP	0.15	0.27	0.29	0.47		
IC	0.16	0.24	0.26	0.31	0.32	
KMS	0.23	0.21	0.21	0.2	0.2	0.31
CKM	0.16	0.29	0.32	0.35	0.28	0.22

Covariance Matrix of ETA and KSI

	CKM
CKM	0.38

PHI

	KMS	CKM
KMS	0.31	
	(0.04)	
	7.6	
CKM	0.22	0.38

PHI

PSI
Note: This matrix is diagonal.

SDL LO KMC IGP IC

0.07	0.07	0.08	0.15	0.08
(0.02)	(0.01)	(0.01)	(0.02)	(0.01)
3.96	7.24	7.95	8.76	8.25

Squared Multiple Correlations for Structural Equations

SDL	LO	KMC	IGP	IC
0.70	0.78	0.78	0.68	0.76

Squared Multiple Correlations for Reduced Form

SDL	LO	KMC	IGP	IC
0.70	0.78	0.78	0.68	0.68

Reduced Form

	KMS	CKM
SDL	0.74	- -
	(0.08)	
	8.88	
LO	0.23	0.64
	(0.05)	-0.05
	4.39	12.72
KMC	0.12	0.78
	(0.05)	-0.05
	2.2	14.59
IGP	- -	0.92
	(0.05)	
	17.19	
IC	0.18	0.64
	(0.04)	-0.05
	4.32	13.73

THETA-EPS

	SDL1	SDL2	SDL3	SDL4	LOG1	LOG2
	---------	---------	---------	---------	---------	---------
SDL1	0.41 (0.04) 10.37					
SDL2	- - (0.04) 9.47	0.35				
SDL3	- - (0.05) 9.35	- -	0.44			
SDL4	- - (0.04) 8.81	- -	- -	0.31		
LOG1	- - (0.03) 10.96	- -	- -	- -	0.3	
LOG2	- -	- -	- -	- -	0.14 (0.02) 6.37	0.33 (0.03) 10.98
LOG3	- -	- -	- -	- -	- -	- -
LOG4	- -	- -	- -	- -	- -	- -
LOL1	- -	- -	- -	- -	- -	- -
LOL2	- -	- -	- -	- -	- -	- -
LOL3	- -	- -	- -	- -	- -	- -
LOL4	- -	- -	- -	- -	- -	- -
LOE1	- -	- -	- -	- -	- -	- -
LOE2	- -	- -	- -	- -	- -	- -

LOE3	--	--	--	--	--	--
LOE4	--	--	--	--	--	--
LOD1	--	--	--	--	--	--
LOD2	--	--	--	--	--	--
LOD3	--	--	--	--	--	--
LOD4	--	--	--	--	--	--
LOT1	--	--	--	--	--	--
LOT2	--	--	--	--	--	--
LOT3	--	--	--	--	--	--
KMCR1	--	--	--	--	--	--
KMCR2	--	--	--	--	--	--
KMCR3	--	--	--	--	--	--
KMCA1	--	--	--	--	--	--
KMCA2	--	--	--	--	--	--
KMCA3	--	--	--	--	--	--
KMCRE1	--	--	--	--	--	--
KMCRE2	--	--	--	--	--	--
KMCRE3	--	--	--	--	--	--
KMST1	--	--	--	--	--	--
KMST2	--	--	--	--	--	--
KMST3	--	--	--	--	--	--
KMMA1	--	--	--	--	--	--
KMMA2	--	--	--	--	--	--

KMMA3	--	--	--	--	--	--
KMDI1	--	--	--	--	--	--
KMDI2	--	--	--	--	--	--
KMDI3	--	--	--	--	--	--
INID1	--	--	--	--	--	--
INID2	--	--	--	--	--	--
INID3	--	--	--	--	--	--
INSUP1	--	--	--	--	--	--
INSUP2	--	--	--	--	--	--
INSUP3	--	--	--	--	--	--
INDEV1	--	--	--	--	--	--
INDEV2	--	--	--	--	--	--
INDEV3	--	--	--	--	--	--
INIMP1	--	--	--	--	--	--
INIMP2	--	--	--	--	--	--
INIMP3	--	--	--	--	--	--
HUMAN1	--	--	--	--	--	--
HUMAN2	--	--	--	--	--	--
HUMAN3	--	--	--	--	--	--
HUMAN4	--	--	--	--	--	--
HUMAN5	--	--	--	--	--	--
HUMAN6	--	--	--	--	--	--
HUMAN7	--	--	--	--	--	--

INNOV1	- -	- -	- -	- -	0.03 (0.01) 2.5	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	- -	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	LOG3	LOG4	LOL1	LOL2	LOL3	LOL4
	--------	--------	--------	--------	--------	--------
LOG3	0.45 (0.04) 11.05					
LOG4	- -	0.45 (0.04) 11.23				
LOL1	- -	- -	0.38 (0.03) 11.07			
LOL2	- -	0.14 (0.02)	- -	0.27 (0.02)		

		5.94		10.89		
LOL3	- -	- -	- -	- -	0.32 (0.03) 10.96	
LOL4	- -	- -	- -	- -	0.15 (0.02) 6.44	0.33 (0.03) 10.97
LOE1	- -	- -	- -	- -	- -	- -
LOE2	- -	- -	- -	- -	- -	- -
LOE3	- -	- -	- -	- -	- -	- -
LOE4	- -	- -	- -	- -	- -	- -
LOD1	- -	- -	- -	- -	- -	- -
LOD2	- -	- -	- -	- -	- -	- -
LOD3	- -	- -	- -	- -	- -	- -
LOD4	- -	- -	- -	- -	- -	- -
LOT1	- -	- -	- -	- -	- -	- -
LOT2	- -	- -	- -	- -	- -	- -
LOT3	- -	- -	- -	- -	- -	- -
KMCR1	- -	- -	- -	- -	- -	- -
KMCR2	- -	- -	- -	- -	- -	- -
KMCR3	- -	- -	- -	- -	- -	- -
KMCA1	- -	- -	- -	- -	- -	- -
KMCA2	- -	- -	- -	- -	- -	- -
KMCA3	- -	- -	- -	- -	- -	- -
KMCRE1	- -	- -	- -	- -	- -	- -

KMCRE2	--	--	--	--	--	--
KMCRE3	--	--	--	--	--	--
KMST1	--	--	--	--	--	--
KMST2	--	--	--	--	--	--
KMST3	--	--	--	--	--	--
KMMA1	--	--	--	--	--	--
KMMA2	--	--	--	--	--	--
KMMA3	--	--	--	--	--	--
KMDI1	--	--	--	--	--	--
KMDI2	--	--	--	--	--	--
KMDI3	--	--	--	--	--	--
INID1	--	--	--	--	--	--
INID2	--	--	--	--	--	--
INID3	--	--	--	--	--	--
INSUP1	--	--	--	--	--	--
INSUP2	--	--	--	--	--	--
INSUP3	--	--	--	--	--	--
INDEV1	--	--	--	--	--	--
INDEV2	--	--	--	--	--	--
INDEV3	--	--	--	--	--	--
INIMP1	--	--	--	--	--	--
INIMP2	--	--	--	--	--	--
INIMP3	--	--	--	--	--	--

HUMAN1	- -	- -	- -	- -	- -	- -
HUMAN2	- -	- -	- -	- -	- -	- -
HUMAN3	- -	- -	- -	- -	- -	- -
HUMAN4	- -	- -	- -	- -	- -	- -
HUMAN5	- -	- -	- -	- -	- -	- -
HUMAN6	- -	- -	- -	- -	- -	- -
HUMAN7	- -	- -	- -	- -	- -	- -
INNOV1	- -	- -	- -	- -	- -	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	- -	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	LOE1	LOE2	LOE3	LOE4	LOD1	LOD2
LOE1	0.34 (0.03) 11					

LOE2	- -	0.36 (0.03) 11.04				
LOE3	- -	0.18 (0.03) 6.99	0.33 (0.03) 11			
LOE4	- -	0.17 (0.02) 7.16	0.13 (0.02) 5.95	0.27 (0.03) 10.73		
LOD1	- -	- -	- -	- -	0.38 (0.03) 11.07	
LOD2	- -	- -	- -	- -	0.25 (0.03) 8.27	0.4 (0.04) 10.99
LOD3	- -	- -	- -	- -	- -	- -
LOD4	- -	- -	- -	- -	- -	- -
LOT1	- -	- -	- -	- -	- -	- -
LOT2	- -	- -	- -	- -	- -	- -
LOT3	- -	- -	- -	- -	- -	- -
KMCR1	- -	- -	- -	- -	- -	- -
KMCR2	- -	- -	- -	- -	- -	- -
KMCR3	- -	- -	- -	- -	- -	- -
KMCA1	- -	- -	- -	- -	- -	- -
KMCA2	- -	- -	- -	- -	- -	- -
KMCA3	- -	- -	- -	- -	- -	- -
KMCRE1	- -	- -	- -	- -	- -	- -
KMCRE2	- -	- -	- -	- -	- -	- -

KMCRE3	--	--	--	--	--	--
KMST1	--	--	--	--	--	--
KMST2	--	--	--	--	--	--
KMST3	--	--	--	--	--	--
KMMA1	--	--	--	--	--	--
KMMA2	--	--	--	--	--	--
KMMA3	--	--	--	--	--	--
KMDI1	--	--	--	--	--	--
KMDI2	--	--	--	--	--	--
KMDI3	--	--	--	--	--	--
INID1	--	--	--	--	--	--
INID2	--	--	--	--	--	--
INID3	--	--	--	--	--	--
INSUP1	--	--	--	--	--	--
INSUP2	--	--	--	--	--	--
INSUP3	--	--	--	--	--	--
INDEV1	--	--	--	--	--	--
INDEV2	--	--	--	--	--	--
INDEV3	--	--	--	--	--	--
INIMP1	--	--	--	--	--	--
INIMP2	--	--	--	--	--	--
INIMP3	--	--	--	--	--	--
HUMAN1	--	--	--	--	--	--

HUMAN2	- -	- -	- -	- -	- -	- -
HUMAN3	- -	- -	- -	- -	- -	- -
HUMAN4	- -	- -	- -	- -	- -	- -
HUMAN5	- -	- -	- -	- -	- -	- -
HUMAN6	- -	- -	- -	- -	- -	- -
HUMAN7	- -	- -	- -	- -	- -	- -
INNOV1	- -	- -	- -	- -	- -	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	- -	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	LOD3	LOD4	LOT1	LOT2	LOT3	KMCR1
	---------	---------	---------	---------	---------	--------
LOD3	0.32 (0.03) 10.95					

LOD4	- -	0.29 (0.03) 11.02				
LOT1	- -	- -	0.23 (0.02) 10.71			
LOT2	- -	- -	- -	0.25 (0.02) 10.88		
LOT3	- -	- -	- -	- -	0.38 (0.03) 11.35	
KMCR1	- -	- -	- -	- -	0.09 (0.02) 4.3	0.34 (0.03) 11.12
KMCR2	- -	- -	- -	- -	0.1 (0.02) 4.24	- -
KMCR3	- -	- -	- -	- -	- -	- -
KMCA1	- -	- -	- -	- -	- -	- -
KMCA2	- -	- -	- -	- -	- -	- -
KMCA3	- -	- -	- -	- -	- -	- -
KMCRE1	- -	- -	- -	- -	- -	- -
KMCRE2	- -	- -	- -	- -	- -	- -
KMCRE3	- -	- -	- -	- -	- -	- -
KMST1	- -	- -	- -	- -	0.04 (0.02) 2.3	- -
KMST2	- -	- -	- -	- -	- -	- -
KMST3	- -	- -	- -	- -	0.04	- -

					(0.02)	
					2.52	
KMMA1	--	--	--	--	--	--
KMMA2	--	--	--	--	--	--
KMMA3	--	--	--	--	0.07	--
					(0.02)	
					4.1	
KMDI1	--	--	--	--	--	--
KMDI2	--	--	--	--	--	--
KMDI3	--	--	--	--	--	--
INID1	--	--	--	--	--	--
INID2	--	--	--	--	--	--
INID3	--	--	--	--	--	--
INSUP1	--	--	--	--	--	--
INSUP2	--	--	--	--	--	--
INSUP3	--	--	--	--	--	--
INDEV1	--	--	--	--	--	--
INDEV2	--	--	--	--	--	--
INDEV3	--	--	--	--	--	--
INIMP1	--	--	--	--	--	--
INIMP2	--	--	--	--	--	--
INIMP3	--	--	--	--	--	--
HUMAN1	--	--	--	--	--	--
HUMAN2	--	--	--	--	--	--
HUMAN3	--	--	--	--	--	--

HUMAN4	- -	- -	- -	- -	- -	- -
HUMAN5	- -	- -	- -	- -	- -	- -
HUMAN6	- -	- -	- -	- -	- -	- -
HUMAN7	- -	- -	- -	- -	- -	- -
INNOV1	- -	- -	0.04 (0.01) 3.11	- -	- -	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	- -	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	KMCR2	KMCR3	KMCA1	KMCA2	KMCA3	KMCRE1
	--------	--------	--------	--------	--------	--------
KMCR2	0.37 (0.03) 11.21					
KMCR3	- -	0.32				

		(0.03) 11.14				
KMCA1	--	--	0.35 (0.03) 11.16			
KMCA2	--	--	--	0.29 (0.03) 11.14		
KMCA3	--	--	--	--	0.31 (0.03) 11.28	
KMCRE1	--	--	--	--	--	0.3 (0.03) 11.09
KMCRE2	--	--	--	--	--	--
KMCRE3	--	--	--	--	--	--
KMST1	--	--	--	--	--	--
KMST2	--	--	--	--	--	--
KMST3	--	--	--	--	--	--
KMMA1	--	--	--	--	--	--
KMMA2	--	--	--	--	--	--
KMMA3	--	--	--	--	--	--
KMDI1	--	--	--	--	--	--
KMDI2	--	--	--	--	--	--
KMDI3	--	--	--	--	--	--
INID1	--	--	--	--	--	--
INID2	--	--	--	--	--	--
INID3	--	--	--	--	--	--

INSUP1	- -	- -	- -	- -	- -	- -
INSUP2	- -	- -	- -	- -	- -	- -
INSUP3	- -	- -	- -	- -	- -	- -
INDEV1	- -	- -	- -	- -	- -	- -
INDEV2	- -	- -	- -	- -	- -	- -
INDEV3	- -	- -	- -	- -	- -	- -
INIMP1	- -	- -	- -	- -	- -	- -
INIMP2	- -	- -	- -	- -	- -	- -
INIMP3	- -	- -	- -	- -	- -	- -
HUMAN1	- -	- -	- -	- -	- -	- -
HUMAN2	- -	- -	- -	- -	- -	- -
HUMAN3	- -	- -	- -	- -	- -	- -
HUMAN4	- -	- -	- -	- -	- -	- -
HUMAN5	- -	- -	- -	- -	- -	- -
HUMAN6	- -	- -	- -	- -	- -	- -
HUMAN7	- -	- -	- -	- -	- -	- -
INNOV1	- -	- -	- -	- -	- -	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	- -	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -

PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	KMCRE2	KMCRE3	KMST1	KMST2	KMST3	KMMA1
	--------	--------	--------	--------	--------	--------
KMCRE2	0.22 (0.02) 11.04					
KMCRE3	- -	0.25 (0.02) 11.02				
KMST1	- -	- -	0.29 (0.03) 11.2			
KMST2	- -	- -	0.09 (0.02) 5.1	0.26 (0.02) 10.76		
KMST3	- -	- -	0.07 (0.02) 4.44	- -	0.23 (0.02) 10.74	
KMMA1	- -	- -	- -	- -	- -	0.23 (0.02) 10.92
KMMA2	- -	- -	- -	- -	- -	- -
KMMA3	- -	- -	- -	- -	- -	- -
KMDI1	- -	- -	- -	- -	- -	- -

KMDI2	--	--	--	--	--	--
KMDI3	--	--	--	--	--	--
INID1	--	--	--	--	--	--
INID2	--	--	--	--	--	--
INID3	--	--	--	--	--	--
INSUP1	--	--	--	--	--	--
INSUP2	--	--	--	--	--	--
INSUP3	--	--	--	--	--	--
INDEV1	--	--	--	--	--	--
INDEV2	--	--	--	--	--	--
INDEV3	--	--	--	--	--	--
INIMP1	--	--	--	--	--	--
INIMP2	--	--	--	--	--	--
INIMP3	--	--	--	--	--	--
HUMAN1	--	--	--	--	--	--
HUMAN2	--	--	--	--	--	--
HUMAN3	--	--	--	--	--	--
HUMAN4	--	--	--	--	--	--
HUMAN5	--	--	--	--	--	--
HUMAN6	--	--	--	--	--	--
HUMAN7	--	--	--	--	--	--
INNOV1	--	--	0.06 (0.01) 4.28	0.03 (0.01) 1.93	--	--
INNOV2	--	--	--	--	--	--

INNOV3	- -	- -	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	KMMA2	KMMA3	KMDI1	KMDI2	KMDI3	INID1
	--------	--------	--------	--------	--------	--------
KMMA2	0.22 (0.02) 10.78					
KMMA3	- -	0.21 (0.02) 10.87				
KMDI1	- -	- -	0.33 (0.03) 11.14			
KMDI2	- -	- -	- -	0.32 (0.03) 11.12		
KMDI3	- -	- -	- -	- -	0.35 (0.03) 11	

INID1	- -	- -	- -	- -	- -	0.28 (0.03) 10.84
INID2	- -	- -	- -	- -	- -	- -
INID3	- -	- -	- -	- -	- -	- -
INSUP1	- -	- -	- -	- -	- -	- -
INSUP2	- -	- -	- -	- -	- -	- -
INSUP3	- -	- -	- -	- -	- -	- -
INDEV1	- -	- -	- -	- -	- -	- -
INDEV2	- -	- -	- -	- -	- -	- -
INDEV3	- -	- -	- -	- -	- -	- -
INIMP1	- -	- -	- -	- -	- -	- -
INIMP2	- -	- -	- -	- -	- -	- -
INIMP3	- -	- -	- -	- -	- -	- -
HUMAN1	- -	- -	- -	- -	- -	- -
HUMAN2	- -	- -	- -	- -	- -	- -
HUMAN3	- -	- -	- -	- -	- -	- -
HUMAN4	- -	- -	- -	- -	- -	- -
HUMAN5	- -	- -	- -	- -	- -	- -
HUMAN6	- -	- -	- -	- -	- -	- -
HUMAN7	- -	- -	- -	- -	- -	- -
INNOV1	- -	- -	- -	- -	- -	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	- -	- -	- -	- -	- -

INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	INID2	INID3	INSUP1	INSUP2	INSUP3	INDEV1
INID2	0.26 (0.02) 10.69					
INID3	0.04 (0.01) 2.93	0.21 (0.02) 10.73				
INSUP1	- -	- -	0.22 (0.02) 10.64			
INSUP2	- -	- -	- -	0.22 (0.02) 10.57		
INSUP3	- -	- -	- -	- -	0.22 (0.02) 10.44	
INDEV1	- -	- -	- -	- -	- -	0.2

						(0.02) 10.56
INDEV2	- -	- -	- -	- -	- -	- -
INDEV3	- -	- -	- -	- -	- -	- -
INIMP1	- -	- -	- -	- -	- -	- -
INIMP2	- -	- -	- -	- -	- -	- -
INIMP3	- -	- -	- -	- -	- -	- -
HUMAN1	- -	- -	- -	- -	- -	- -
HUMAN2	- -	- -	- -	- -	- -	- -
HUMAN3	- -	- -	- -	- -	- -	- -
HUMAN4	- -	- -	- -	- -	- -	- -
HUMAN5	- -	- -	- -	- -	- -	- -
HUMAN6	- -	- -	- -	- -	- -	- -
HUMAN7	- -	- -	- -	- -	- -	- -
INNOV1	- -	0.02 (0.01) 1.56	- -	- -	- -	0.02 (0.01) 1.88
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	0.11 (0.02) 6.27	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -

CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	INDEV2	INDEV3	INIMP1	INIMP2	INIMP3	HUMAN1
	--------	--------	--------	--------	--------	--------
INDEV2	0.23 (0.02) 10.68					
INDEV3	- -	0.19 (0.02) 10.31				
INIMP1	- -	- -	0.3 (0.03) 10.9			
INIMP2	- -	- -	- -	0.35 (0.03) 11.14		
INIMP3	- -	- -	- -	0.12 (0.02) 5.9	0.26 (0.02) 11.04	
HUMAN1	- -	- -	- -	- -	- -	0.24 (0.02) 10.89
HUMAN2	- -	- -	- -	- -	- -	- -
HUMAN3	- -	- -	- -	- -	- -	- -
HUMAN4	- -	- -	- -	- -	- -	- -
HUMAN5	- -	- -	- -	- -	- -	- -

HUMAN6	- -	- -	- -	- -	- -	- -
HUMAN7	- -	- -	- -	- -	- -	- -
INNOV1	- -	- -	- -	- -	0.04 (0.01) 3.06	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	0.02 (0.02) 1.51	0.05 (0.01) 3.2	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	HUMAN2	HUMAN3	HUMAN4	HUMAN5	HUMAN6	HUMAN7
	--------	--------	--------	--------	--------	--------
HUMAN2	0.33 (0.03) 11.21					
HUMAN3	- -	0.4				

		(0.04) 11.08				
HUMAN4	- -	- -	0.38 (0.03) 11.28			
HUMAN5	- -	- -	- -	0.3 (0.03) 10.76		
HUMAN6	- -	- -	- -	- -	0.2 (0.02) 10.49	
HUMAN7	- -	- -	- -	- -	- -	0.25 (0.02) 10.92
INNOV1	- -	- -	- -	- -	- -	- -
INNOV2	- -	- -	- -	- -	- -	- -
INNOV3	- -	- -	- -	- -	- -	- -
INNOV4	- -	- -	- -	- -	- -	- -
PROC1	- -	- -	- -	- -	- -	- -
PROC2	- -	- -	- -	- -	- -	- -
PROC3	- -	- -	- -	- -	- -	- -
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	INNOV1	INNOV2	INNOV3	INNOV4	PROC1	PROC2
	--------	--------	--------	--------	--------	--------
INNOV1	0.27					
	(0.02)					
	11.85					
INNOV2	0.13	0.37				
	(0.02)	(0.03)				
	6.87	10.96				
INNOV3	0.07	- -	0.38			
	(0.02)		(0.03)			
	4.37		11.53			
INNOV4	0.08	- -	0.13	0.41		
	(0.02)		(0.02)	(0.04)		
	4.59		5.2	10.9		
PROC1	- -	- -	- -	- -	0.29	
					(0.03)	
					11.01	
PROC2	- -	- -	- -	- -	0.16	0.3
					(0.02)	(0.03)
					7.52	11.27
PROC3	- -	- -	- -	- -	- -	0.08
						(0.02)
						4.55
PROC4	- -	- -	- -	- -	- -	- -
CUSTO1	- -	- -	- -	- -	- -	- -
CUSTO2	- -	- -	- -	- -	- -	- -
CUSTO3	- -	- -	- -	- -	- -	- -
CUSTO4	- -	- -	- -	- -	- -	- -
CUSTO5	- -	- -	- -	- -	- -	- -

THETA-EPS

	PROC3	PROC4	CUSTO1	CUSTO2	CUSTO3	CUSTO4
PROC3	0.3 (0.03) 11					
PROC4	- -	0.31 (0.03) 11.03				
CUSTO1	- -	- -	0.29 (0.03) 11.02			
CUSTO2	- -	- -	- -	0.33 (0.03) 11.3		
CUSTO3	- -	- -	- -	- -	0.21 (0.02) 11.01	
CUSTO4	- -	- -	- -	- -	0.1 (0.02) 5.6	0.33 (0.03) 11.16
CUSTO5	- -	- -	- -	- -	- -	0.08 (0.02) 4.2

THETA-EPS

	CUSTO5
CUSTO5	0.28 (0.02) 11.11

Squared Multiple Correlations for Y - Variables

SDL1	SDL2	SDL3	SDL4	LOG1	LOG2
0.37	0.5	0.51	0.56	0.5	0.46

Squared Multiple Correlations for Y - Variables

LOG3	LOG4	LOL1	LOL2	LOL3	LOL4
0.44	0.33	0.44	0.5	0.47	0.47

Squared Multiple Correlations for Y - Variables

LOE1	LOE2	LOE3	LOE4	LOD1	LOD2
0.47	0.43	0.45	0.55	0.44	0.47

Squared Multiple Correlations for Y - Variables

LOD3	LOD4	LOT1	LOT2	LOT3	KMCR1
0.48	0.45	0.57	0.51	0.37	0.51

Squared Multiple Correlations for Y - Variables

KMCR2	KMCR3	KMCA1	KMCA2	KMCA3	KMCRE1
0.45	0.51	0.5	0.51	0.41	0.54

Squared Multiple Correlations for Y - Variables

KMCRE2	KMCRE3	KMST1	KMST2	KMST3	KMMA1
0.55	0.56	0.55	0.65	0.64	0.61

Squared Multiple Correlations for Y - Variables

KMMA2	KMMA3	KMDI1	KMDI2	KMDI3	INID1
0.64	0.61	0.51	0.51	0.57	0.63

Squared Multiple Correlations for Y - Variables

INID2	INID3	INSUP1	INSUP2	INSUP3	INDEV1
0.64	0.66	0.68	0.69	0.72	0.7

Squared Multiple Correlations for Y - Variables

INDEV2	INDEV3	INIMP1	INIMP2	INIMP3	HUMAN1
0.66	0.73	0.61	0.49	0.57	0.57

Squared Multiple Correlations for Y - Variables

HUMAN2	HUMAN3	HUMAN4	HUMAN5	HUMAN6	HUMAN7
0.42	0.49	0.37	0.61	0.67	0.55

Squared Multiple Correlations for Y - Variables

INNOV1	INNOV2	INNOV3	INNOV4	PROC1	PROC2
0.54	0.54	0.44	0.56	0.53	0.53

Squared Multiple Correlations for Y - Variables

PROC3	PROC4	CUSTO1	CUSTO2	CUSTO3	CUSTO4
0.52	0.51	0.52	0.35	0.52	0.51

Squared Multiple Correlations for Y - Variables

CUSTO5
0.47

THETA-DELTA-EPS

	SDL1	SDL2	SDL3	SDL4	LOG1	LOG2
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -

CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	LOG3	LOG4	LOL1	LOL2	LOL3	LOL4
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -

CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	LOE1	LOE2	LOE3	LOE4	LOD1	LOD2
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -

KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	LOD3	LOD4	LOT1	LOT2	LOT3	KMCR1
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -

KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	KMCR2	KMCR3	KMCA1	KMCA2	KMCA3	KMCRE1
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -

KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	KMCRE2	KMCRE3	KMST1	KMST2	KMST3	KMMA1

	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	KMMA2	KMMA3	KMDI1	KMDI2	KMDI3	INID1
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -

CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	INID2	INID3	INSUP1	INSUP2	INSUP3	INDEV1
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	0.06 (0.02) 3.58	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -

CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	INDEV2	INDEV3	INIMP1	INIMP2	INIMP3	HUMAN1
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -
CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -

CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

THETA-DELTA-EPS

	HUMAN2	HUMAN3	HUMAN4	HUMAN5	HUMAN6	HUMAN7
	--------	--------	--------	--------	--------	--------
KMSCO1	- -	- -	- -	- -	- -	- -
KMSCO2	- -	- -	- -	- -	- -	- -
KMSCO3	- -	- -	- -	- -	- -	- -
KMSCO4	- -	- -	- -	- -	- -	- -
KMSIT1	- -	- -	- -	- -	- -	- -
KMSIT2	- -	- -	- -	- -	- -	- -
KMSIT3	- -	- -	- -	- -	- -	- -
CKMF1	- -	- -	- -	- -	- -	- -
CKMF2	- -	- -	- -	- -	- -	- -
CKMF3	- -	- -	- -	- -	- -	- -
CKMF4	- -	- -	- -	- -	- -	- -

CKMRE1	- -	- -	- -	- -	- -	- -
CKMRE2	- -	- -	- -	- -	- -	- -
CKMRE3	- -	- -	- -	- -	- -	- -
CKMST1	- -	- -	- -	- -	- -	- -
CKMST2	- -	- -	- -	- -	- -	- -
CKMST3	- -	- -	- -	- -	- -	- -
CKMMA1	- -	- -	- -	- -	- -	- -
CKMMA2	- -	- -	- -	- -	- -	- -
CKMMA3	- -	- -	- -	- -	- -	- -
CKMDI1	- -	- -	- -	- -	- -	- -
CKMDI2	- -	- -	- -	- -	- -	- -
CKMDI3	- -	- -	- -	- -	- -	- -

Squared Multiple Correlations for X - Variables

KMSCO1	KMSCO2	KMSCO3	KMSCO4	KMSIT1	KMSIT2
0.44	0.26	0.38	0.45	0.48	0.66

Squared Multiple Correlations for X - Variables

KMSIT3	CKMF1	CKMF2	CKMF3	CKMF4	CKMRE1
0.61	0.36	0.38	0.18	0.22	0.49

Squared Multiple Correlations for X - Variables

CKMRE2	CKMRE3	CKMST1	CKMST2	CKMST3	CKMMA1
0.59	0.45	0.46	0.48	0.56	0.48

Squared Multiple Correlations for X - Variables

CKMMA2	CKMMA3	CKMDI1	CKMDI2	CKMDI3
0.58	0.54	0.52	0.5	0.5

Goodness of Fit Statistics

Degrees of Freedom = 4427
Minimum Fit Function Chi-Square = 15387.31 (P = 0.0)
Normal Theory Weighted Least Squares Chi-Square = 16062.99 (P = 0.0)
Estimated Non-centrality Parameter (NCP) = 11635.99
90 Percent Confidence Interval for NCP = (11252.09 ; 12026.90)
Minimum Fit Function Value = 57.20
Population Discrepancy Function Value (F0) = 43.26
90 Percent Confidence Interval for F0 = (41.83 ; 44.71)
Root Mean Square Error of Approximation (RMSEA) = 0.099
90 Percent Confidence Interval for RMSEA = (0.097 ; 0.10)
P-Value for Test of Close Fit (RMSEA < 0.05) = 0.00

Expected Cross-Validation Index (ECVI) = 61.42
90 Percent Confidence Interval for ECVI = (59.99 ; 62.87)
ECVI for Saturated Model = 34.62
ECVI for Independence Model = 861.81

Chi-Square for Independence Model with 4560 Degrees of Freedom = 231635.26
Independence AIC = 231827.26
Model AIC = 16520.99
Saturated AIC = 9312.00
Independence CAIC = 232268.71
Model CAIC = 17574.02
Saturated CAIC = 30722.25

Normed Fit Index (NFI) = 0.93
Non-Normed Fit Index (NNFI) = 0.95
Parsimony Normed Fit Index (PNFI) = 0.91
Comparative Fit Index (CFI) = 0.95
Incremental Fit Index (IFI) = 0.95
Relative Fit Index (RFI) = 0.93

Critical N (CN) = 82.27

Root Mean Square Residual (RMR) = 0.068
Standardized RMR = 0.097
Goodness of Fit Index (GFI) = 0.45
Adjusted Goodness of Fit Index (AGFI) = 0.42
Parsimony Goodness of Fit Index (PGFI) = 0.42

Regression Matrix ETA on KSI (Standardized)

	KMS	CKM
	--------	--------
SDL	0.84	- -
LO	0.23	0.71
KMC	0.11	0.81
IGP	- -	0.82
IC	0.18	0.7

Total and Indirect Effects

Total Effects of KSI on ETA

	KMS	CKM
	--------	--------
SDL	0.74	- -
	(0.08)	
	8.88	
LO	0.23	0.64
	(0.05)	(0.05)
	4.39	12.72
KMC	0.12	0.78
	(0.05)	(0.05)
	2.2	14.59
IGP	- -	0.92
		(0.05)
		17.19
IC	0.18	0.64
	(0.04)	(0.05)
	4.32	13.73

Indirect Effects of KSI on ETA

	KMS	CKM
	--------	--------
SDL	- -	- -
LO	- -	- -
KMC	- -	- -

IGP	- -	- -
IC	0.18	0.64
	(0.04)	(0.05)
	4.32	13.73

Total Effects of ETA on ETA

	SDL	LO	KMC	IGP	IC
SDL	- -	- -	- -	- -	- -
LO	- -	- -	- -	- -	- -
KMC	- -	- -	- -	- -	- -
IGP	- -	- -	- -	- -	- -
IC	0.14	0.24	0.23	0.35	- -
	(0.06)	(0.07)	(0.06)	(0.05)	
	2.35	3.32	3.66	7.3	

CURRICULUM VITAE

NAME : Mr. Narongsak Comepa

BIRTH DATE : May 1, 1978

BIRTH PLACE : Mahasarakham, Thailand

EDUCATION :

YEAR	INSTITUTION	DEGREE/DIPLOMA
2000	Mahidol Univ.	B.Eng. (Chemical Eng.)
2006	Kasetsart Univ.	M.Eng. (Engineering Management)

POSITION/TITLE : Senior Engineer

WORK PLACE : Western Digital, Thailand

SCHOLARSHIP / AWARDS : Graduate Study Scholarship from the International Graduate Program in Industrial Engineering at the Kasetsart University