

SWIS: Web-based Intelligent System of Intellectual Capital for SME in Thailand

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Abstract: In the knowledge economy, Intellectual Capital (IC) has been reported as the new measure for enterprise values, intangible assets and economic performances. Customer Relationship Management (CRM) has also been recognized as a new paradigm of business services. However, the knowledge about IC and customer services in Thailand is very limited according to the very few studies reported up to now. In order to overcome these difficulties, the Web based Intelligent System for SME has been developed to provide knowledge and serve as an intelligent system for measuring the Intellectual Capital and CRM for SMEs in Thailand. The performance of this Web-based system has been evaluated by 10 Thai SMEs. Results revealed that participants in the evaluation are satisfied with the system and they are willing to use it in the near future.

Keywords: Web Intelligence, Web Based Information Technology, Intelligent Systems, Intellectual Capital, CRM, SME.

I. Introduction

Intellectual Capital (IC) plays an important role for the innovation and competitive advantage in the new era of knowledge society. IC is a driver or catalyst of organisational growth. This catalyst is a significant resource for any company as it has a major and considerable impact on its performance. Due to the limited number of research on IC in Southeast Asia, the understanding of IC measurement and management is a substantial problem for many enterprises in this region. Our preliminary analysis of CRM readiness in SME [9] shows that this is also true for most of Thai SME.

In order to compete successfully in the highly competitive local and global market, CRM is a significant factor for all companies including small, medium and large enterprises. It is commonly accepted that companies spend five times more money to acquire a new customer than to keep an old one for purchasing a new product [8]. CRM is a proven approach for increasing the competitiveness. It is a business strategy providing complete combination of business functions for contacting the customers such as marketing, sales, customer service and field support via assembling of people, process, and technology. CRM is based on coordination of all business processes that deal

with customers. Further, it involves the collection, collation, and interpretation of customer data to attract and keep customers through business process in order to create long-lasting, customer centric and mutually beneficial relationships [5], [7].

To provide more knowledge and understanding of IC, its management, and measuring the effect of CRM, a systematic study on the necessity of building information system for Thai SME has been conducted by a joint team from Kasetsart University and Asian Institute of Technology in Bangkok. The basic result of that study was the created framework for development and deployment of a prototype of SME Web-based Intelligent System (SWIS).

This paper is divided into four sections. Section two describes the most recent studies on IC and the proposed IC measurement model. Section three justifies the methodology used for developing the system. Section four summarizes the results from the prototype system evaluation. The last section includes some discussions and draws the conclusions.

II. Literature Review

In Bontis (1999) four performance measurement systems including human resource accounting (HRA), economic value added (EVA), Balanced Score Card (BSC), and Intellectual Capital (IC) are proposed. The HRA aims to quantify the economic value of people to the organizations and also provide input to managerial and financial decisions. There are three types of HRA models: cost models, HR value models and monetary emphasis models. HRA models estimate human capital in financial terms and are applied in organizations where human capital plays important role in organizational value. However, all models are subjective and suffer of lack of reliability. EVA is an overall performance measurement which bundles capital budgeting, financial planning, goal setting, performance measuring, shareholder communication and incentive compensation. This model emphasizes on measuring financial indicators while none of intangible resources are evaluated. Balanced Score Card (BSC) is a multi-dimensional measurement system proposed by Kaplan and Norton (1996). This system assesses both financial and non-financial factors including customer perspectives, internal process, and these factors are linked in a logical system. BSC is different from traditional measurement systems since it adds non-financial factors. Therefore BSC neglects the hidden values of employees and pays attention to the importance of knowledge management as significant drive

of the economic success and sustainability of the organization [2].

Intellectual Capital (IC) is introduced in the beginning of 90s and became well known by Skandia - the largest insurance company in Sweden. Recently, a significant amount of studies have been oriented to and focused on intangibles, knowledge management, and IC measurement by both researchers and practitioners. There are some substantial IC measurement models proposed in those studies. The most famous IC definition has been suggested by Edvinsson (1997) which states that “The Intellectual Capital of a firm is its possession of the knowledge, applied experience, organizational technology, customer relationships and professional skill that provides it with a competitive edge in the market”. The Skandia Model extensively refers to IC measurement and includes both financial and non-financial factors just like BSC. In this model IC is comprised of human capital and structural capital. Human capital includes knowledge, know-how, skills and personnel expertise. Structural Capital is a composite element that includes organizational capital and customer capital. Organizational capital consists of innovation capital (intellectual property and intangible assets) and process capital (databases and information systems). Customer capital is the external capital which includes the organizational relationships with external actors including customers, suppliers, partners and/or other stakeholders. Skandia model measures the company intangible assets and extends the traditional financial model measuring the real value of the company. More specifically, Skandia model includes customer capital, which plays an important role in creating company’s value. Furthermore, this model consists of organizational and process factors, which have not been included in traditional models. However, this model lacks of some indicators for customer relationship management.

Engstrom et al. (2003) conducted a case study of the intellectual capital evaluation for a hotel chain in Scandinavia. The ICAP methodology and multiple source data were used to investigate the knowledge and data produced by an intellectual capital evaluation, and explored the potential relationship between intellectual capital and business performance. The ICAP methodology was analysed together with financial indicators including (a) ability to generate sales and control expenses; (b) revenue per available room; (c) occupancy percent; (d) room profit; (e) food sold profit; and (f) personnel cost. However this measurement model is specific for the hotel industry. Moreover, there are still unanswered questions about the proposed model including (1) reflection on the operationalized constructs; (2) the model represents the essential of intellectual capital; and (3) the truthfulness of the model.

Srivihok and Intrapairote (2004) have proposed the IC measurement model specifically for SME which includes three clusters: human capital, structural capital and relational capital. This model is originated from Skandia model. Relational capital in this model consists of customer capital

and actors including partners, government actors and suppliers. Customer relationship indicators are added to make the model more practical for SME.

II. 2 The IC Measurement Model

The IC measurement model used in our development is derived from Srivihok and Intrapairote (2004). The model includes three clusters: human capital, structural capital and relational capital. The new IC model is adjusted for the Thai SME and presented in Figure 1.

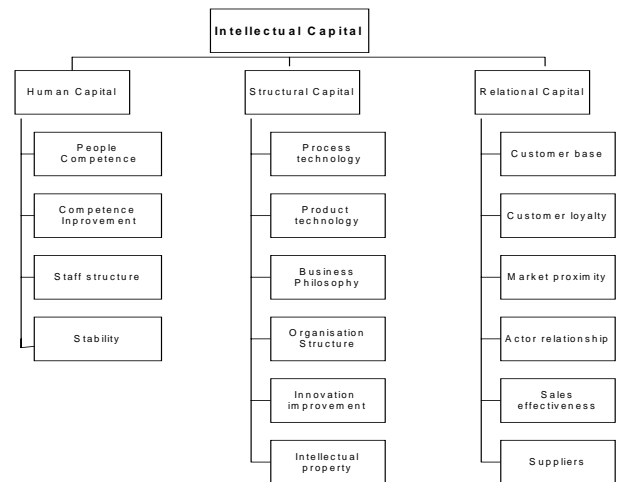


Figure 1. Intellectual Capital measurement model

Human capital refers to the employee knowledge of a firm and capacity to generate this knowledge. The value has been created by employees through using their skills, applying their knowledge and initiating innovative ideas. The utilization of employee knowledge and skills are performed if the employees are willing to do so. Thus, the human capital management should be concerned about knowledge management of employees including maintenance of knowledge base, encouragement, innovation and motivation of employees to transform their tacit knowledge to explicit knowledge [11]. There is also a direct cause effect relationship between knowledge *reuse* and *invention* of new knowledge. Then knowledge is turned into value by commercialization which is called *exploitation*. The summary of the above two factors (knowledge *reuse* and *invention*) multiply by exploitation is *innovation* [4]. In addition, human capital is the fundamental knowledge to generate the other two Intellectual Capital components. The human capital does not belong to a company but it is “hired” by the company for a period of time. This capital will be removed when staff resigns or is retired from the company. Human capital includes people competence, competence improvement, staff structure, and stability (as shown in Table 1 in Appendix 1).

Structural capital is a composite item which is mainly organizational capital. It comprises information and communication systems, management systems, patents and everything that systemizes knowledge of the company and makes it internal and explicit. This capital consists of seven

main indicators: business philosophy, organization structure, intellectual property, research and development (R&D), process technology, product technology and IT penetration per total investment [e.g. key word and directory search engine, EDI (Electronic Data Interchange), and database]. The structural capital belongs to and still remains within an organization even though employees have resigned. Structural capital includes process technology/ IT penetration, product technology, business philosophy, organization structure, improvement of innovation, and intellectual property (as shown in Table 2 in Appendix 1).

Relational capital refers to external relations with customers, suppliers, partners, networks, and regulators. Customer relationship is the value resided in the marketing networks and relationships that a company develops by doing their business. The quality of the relationships, the ability to keep present customers and creating new customers are key factors for the success of a company. The relational capital is classified into customer base, customer loyalty, market proximity, actor relationship, sales effectiveness, and supplier base (as shown in Table 3 in Appendix 1).

III. Conceptual Design of SME Web-based Intelligent System (SWIS)

SWIS is designed for Thai SMEs and consists of four main modules: (1) Navigation, (2) Library, (3) Intelligent System, and (4) Support System. In Navigation, new user starts with registering its personal information to the system, logging in to and out from the system. Library module consists of the following sub-modules: Intellectual Capital, Knowledge Management, Customer Relationship Management, SME and generals. Both Thai and English-translated documents in the library are selected from text books, academic magazines, journals and knowledge portals. The Intelligent System module includes Intellectual Capital and CRM questionnaires for SME to evaluate. Then, the systems will give advice related to the data which have been put in and may suggest documents to be read respectively. The Support System module provides information for SMEs about using facilities in the system such as web board, Help and FAQ and also more specific information such as SME Laws and Regulations, Strategic Planning, Management and Software. The design of SWIS is depicted in Figure 2.

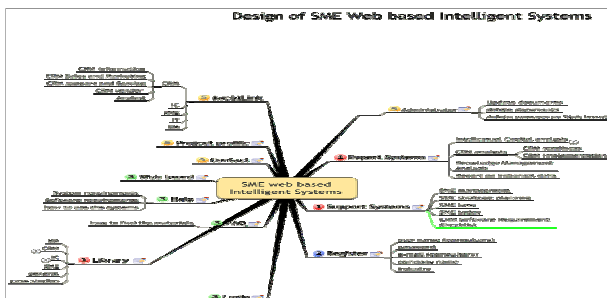


Figure 2. Design of SME Web-based Intelligent System (SWIS).

III. 1 Architecture of SWIS

The system consists of user interface, access control, analyzer agent, and knowledge base (Figure 3). Users get access to the system via the web based interface. The analyzer agent is responsible for analysing and extracting the users' information for each category such as Intellectual Capital or CRM by using provided input data, and it is referenced with the provided knowledge base. Advice messages, documents, activities and support actions are prepared. Authoring interface is updated by administrator. Knowledge base includes documents for SME, guides for SMEs in doing business, rules, Intellectual Capital management and information technology management in organisations, principles and procedures in CRM. The advised message and answers are sent back to users by passing access control and user interface.

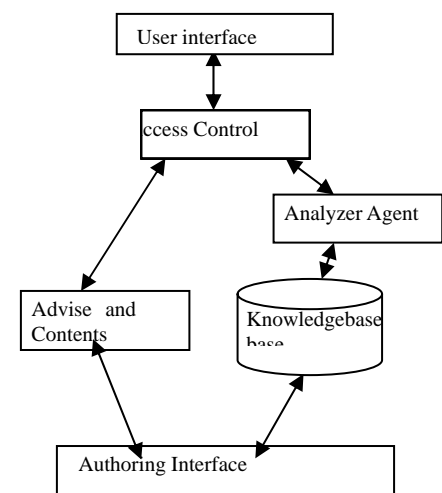


Figure 3. SWIS architecture

III. 2 Prototyping of SWIS

The front page of the system is depicted in Figure 4. In the system, SME can evaluate the company Intellectual Capital (IC) by putting company information in the model (as shown in Figure 5). The system analyses and compares data with benchmark values for IC. The items are reported if their values are higher, or lower than benchmarks. If they are lower, the system suggests related IC materials for SME to be read. These materials can be retrieved from SWIS. Results from IC model measurement are depicted in Figure 6.



Figure 4. SWIS home page (<http://smexpert.kasetsart.org/>)

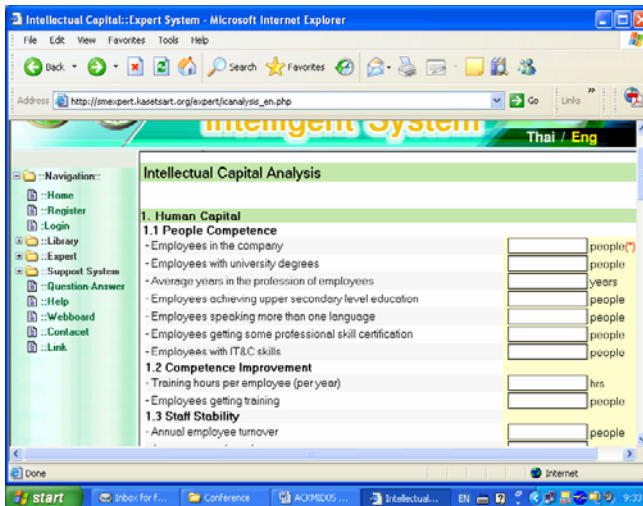


Figure 5. Intellectual Capital Analysis model

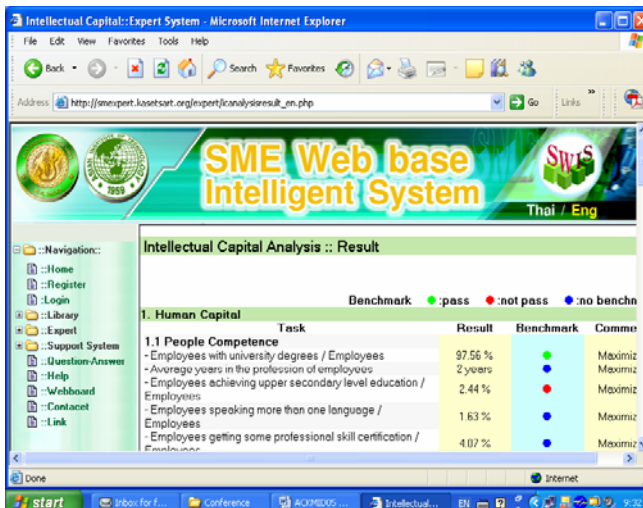


Figure 6. Results of Intellectual Capital Measurement.

III. 4 CRM Evaluation

SMEs can evaluate their organisation readiness for CRM implementation by using CRM readiness module (Figure 7). Then the system will give advice or suggest activities to be performed according to organisational characteristics (Figure 8).

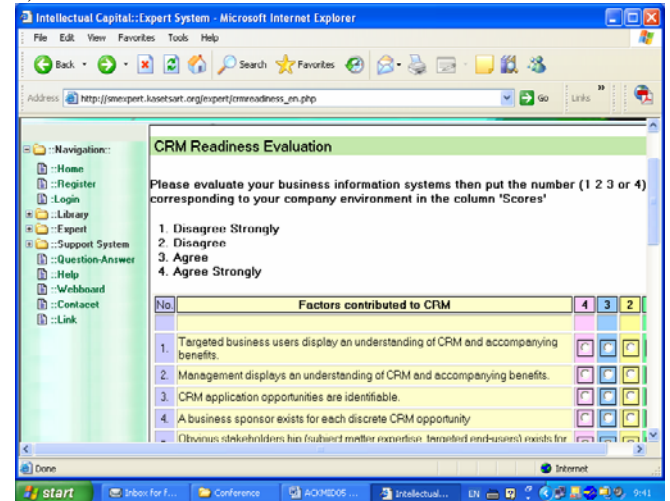


Figure 7. CRM readiness module for SME evaluation.

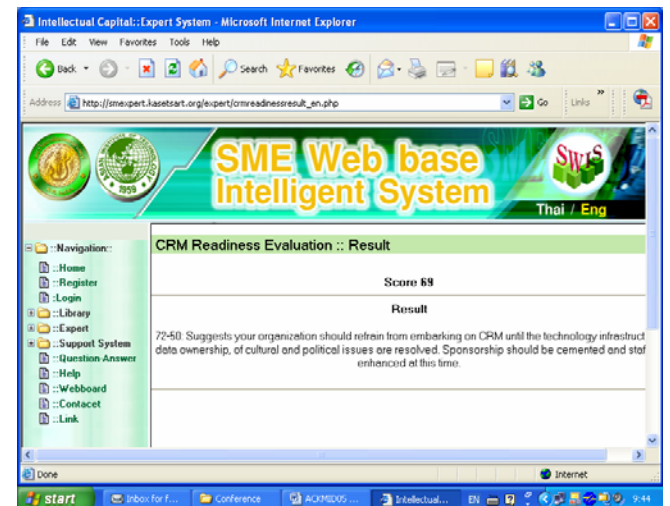


Figure 8. Results from CRM readiness evaluation.

IV. System Evaluation

The system evaluation was designed to be an exploratory, cross sectional, statistical, and based on survey. For the purpose of evaluation we investigated ten Thai SMEs from various industry types. Participants were provided with survey questionnaires. Each questionnaire is divided in two parts: Section 1 is on organisational characteristic (presented in Appendix 2) and Section 2 is system performance evaluation.

IV. 1 Organisational Characteristics

Participants from ten Thai SMEs have been selected to evaluate the systems. Their profiles are illustrated in Table 1.

Three SMEs are in IT services, two are software houses, and the rest are in printing, media production, education, construction and import. Majority of them have 10-100 employees. The registered capitals are between 5 and 300 million Baht. Most companies are relatively young with 5-10 years of services. There are two companies approved for applying ISO9000 for quality assurance. Majority of the respondents are managers who do the administrative work in the organisations.

IV. 2 System Performance Evaluation

The model has been evaluated using the evaluation questionnaires (Appendix 2). Participants evaluate the four main criteria: system performance, user interface, design and presentation, and perceive usefulness. The evaluation score ranges from 1 to 5 on Likert scale. If participants are very satisfied with the model, they will give the score of 5. On the other hand, they will give the score of 1 if it requires some improvements. The feedback information from the ten cases is illustrated in Table 2.

The evaluation scores range from 72% to 90.4%, which implies that the participants are satisfied with this system. All participants accept the system and are willing to access the system in the future. However, some revealed that the model should be simplified to match better with SMEs in various fields.

V. Conclusions

Competing in the knowledgebase society requires that organizations get the maximum benefits from their human capital (employees), structural capital (organizational structure and information systems) and relational capital (relationship with customers and actors). It is difficult to manage these capitals since the measurement tools are not widely introduced and understood. The literature review shows that a very little work has been carried out on the study of IC measurements in Thailand. To overcome this deficiency, the paper introduced a measurement tool for evaluating intangible assets in the company. This measurement model includes three clusters: human capital, structural capital and relational capital. The qualitative measuring indicators are developed to the respective content. SME Web-based Intelligent System (SWIS) has been developed and described in this paper. It provides various measurement modules including IC, CRM implementation

and KM implementation. It also includes knowledge base of IC, CRM, KM and SME management. The system itself contains valuable information that gives each organisation an opportunity to effectively work with and improve the intellectual capital and CRM. Working with this system is useful for strategic planning and for improving business performance.

Acknowledgement

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Table 1: Participant Profile

Characteristics		Case									
URL:		1	2	3	4	5	6	7	8	9	10
Types of business	Software house						✓				✓
	IT services		✓	✓		✓					
	Tourism										
	Manufacturing										
	Finance & Banking										
	Printing	✓									
	Media production									✓	
Other please specify				Education				Construction		Import	
Number of staff	1<10			✓							
	10-50	✓	✓		✓						✓
	51-100					✓		✓			
	100-200						✓			✓	
	>200								✓		
Registered Capital (Million Baht)		10	10		5		150	300			
Years in service.....		20	10	2	5		13	15	10	5	
Awards received											
Your company have procedures for quality control such as....	TQM										
	CMM										
	ISO9000, ISO.....		✓				✓				
	Other..Please specify				5S				Q S H E		
Do you agree to reveal your company name for this project?	Yes										
	No	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Does your company is a subsidiary of an overseas company?	Yes				✓						
	No	✓	✓	✓		✓	✓	✓	✓	✓	✓
Does your company is a subsidiary of a Thai company?	Yes								✓	✓	
	No	✓	✓	✓	✓	✓	✓	✓			✓
Position		*	**	**	**	**	**	**	**	**	**

* assistant manager

** manager

***customer support

Table2: Score of prototype testing

List of Criteria		Evaluation Score (Level of satisfaction =1-5)									
Main Criteria	Sub Criteria	1	2	3	4	5	6	7	8	9	10
System performance	Results are accurate	5	5	5	4	4	4	4	4	4	4
	Results are complete	5	4	5	5	4	4	4	3	3	4
	Convenience of use	4	5	4	5	4	5	5	4	3	4
	Rapid processing time	5	5	5	5	4	5	5	4	3	4
User interface	Content matches your requirements	3	4	4	4	3	4	3	4	3	3
	Understandability	4	4	4	4	4	4	3	4	4	4
	Required time for processing is compatible with participant attention	5	4	5	4	4	4	3	4	4	4
	Ease of use, simplicity	4	4	4	4	4	5	4	4	3	4
	Appropriate alternative command	3	4	4	4	-	3	4	3	3	4
	Clarity of error message	4	4	4	5	4	3	4	3	4	4
	Fault tolerance	4	4	4	4	4	3	3	3	2	4
	Re-accessibility	5	5	5	5	3	5	5	3	3	3
Design and presentation	Suitable font type	5	5	4	5	4	4	4	5	5	4
	Text is printed in suitable size	5	5	4	5	4	4	4	5	5	4
	Suitable font color	5	4	4	5	4	4	4	5	5	4
	Clear and appropriate graphic design	4	3	4	4	4	4	4	5	4	4
	Simple and attractive web pages	3	4	4	4	3	4	4	4	4	3
	Appropriate web links	3	4	4	5	4	4	4	5	4	4
	Contact address/ person is available	1	1	4	4	4	3	2	5	5	4
	Understandable user guide is included	1	1	4	5	3	3	2	5	3	3
	Online help is comprehensive and readily available	1	1	4	4	4	3	2	5	3	3
Perceived usefulness	Useful content for work	4	3	5	5	4	4	3	4	4	4
	Results can be used to improve your organization	4	3	5	5	3	4	3	4	3	4
	Comparability of present to prior results	NA	4	5	4	3	4	3	4	3	3
	Willing to access the system next time	3	4	5	5	4	4	5	4	3	4
Total scores (125)		90	94	109	113	90	98	91	103	90	94
%		75	75	87	90	72	78	73	82	72	75

Appendix 1

Table 1. Human Capital indicators

Characteristics	Indicators
People Competence	Number of employees
	% employees with university degrees
	Average years in professional
Competence improvement	Training expenses
	% internal training
Staff structure	Number of new employees
	Supportive staff/ line staff
	Average age of employees
	Ratio of Male/female
	% part time employees/total employees
Stability	% employees leave company
	Employees feel they are professionally recognised
	Number of full time employees

Table 2. Structural Capital indicators

Characteristics	Indicators
Process technology/IT penetration	Number of Personal Computer/employee
	% employees with internet access
	Number of standard certifications
Product technology	Number of services
Business philosophy	Investment for planning
	No. of channel for transferring business philosophy
Organisation structure	Number of hierarchies level
Improvement of innovation	Number of innovation projects
	Number of new products or services
Intellectual property	Number of patents
	Number of brands or trademarks
	Research and Development expenses

Table 3. Relational Capital indicators

Characteristics	Indicators
Customer base	Number of customers
	Investment in customer information
	% customers pay on time
	% customers perform 60% of sales
	% sales performed by new customers
Customer loyalty	% customer lost
	Average year customer remaining in company
Market proximity	Number of participation in exhibitions
	Number of channels customers access to company
	% marketing investment/ revenue
Actor relationship	Invest in marketing information
	Number of strategic alliances
Sales-effectiveness	Investment for partner information
	Sales growth
Supplier base	Investment for sales system
	Number of suppliers
	Number of lost suppliers / total number of suppliers

Appendix 2

Evaluation Questionnaire FOR IC Model

Section 1: Organization Profile

1. Website of your company (URL:)
2. Types of business
 - Software house
 - IT services
 - Tourism
 - Manufacturing
 - Finance & Banking
 - Printing
 - Media production
 - Other please specify _____
3. Number of staff
 - <10
 - 10-50
 - 51-100
 - 100-200
 - >200
4. Registered Capital.....Baht
5. Years in service.....
6. Awards received.....
7. Procedures for quality control of the company.....
 - TQM
 - CMM
 - ISO9000 ,ISO.....
 - Other please specify.....
8. Are you willing to reveal your company name for this project?
 - Yes
 - No
9. Does your company is a subsidiary of an overseas company?
 - Yes
 - No
10. Does your company is a subsidiary of a Thai company?
 - Yes
 - No
11. Your position
 - MD
 - Manager.....

Section 2:

Please evaluate the system performance in order to bring your feedbacks to improve the model.

List of Criteria		Evaluation Scores (Level of satisfaction):				
		Very good	Good	Fair	Poor	Must Improve
		5	4	3	2	1
System performance	Results are accurate					
	Results are complete					
	Convenience of use					
	Rapid processing time					
User interface	Content matches your requirements					
	Understandability					
	Required time for processing is compatible with participant attention					
	Ease of use, simplicity					
	Appropriate alternative command					
	Clarity of error message					
	Fault tolerance					
	Re-accessibility					
Design and presentation	Suitable font type					
	Text is printed in suitable size					
	Suitable font color					
	Clear and appropriate graphic design					
	Simple and attractive web pages					
	Appropriate web links					
	Contact address/ person is available					
	Understandable user guide is included					
Perceived usefulness	Online help is comprehensive and readily available					
	Useful content for work					
	Results can be used to improve your organization					
	Comparability of present to prior results					
	Willing to access the system next time					