CHAPTER III
RESEARCH STRATEGY AND METHODOLOGY

After reviewing the literature in chapter two, the conceptual model of service quality measurement is explained. In addition, the prospect technologies are discussed. The research design and methodology are described in this chapter by beginning with a review of the methodology employed in the research. Section 3.1 presents the research design and 3.2 explains the systematic literature review method. Section 3.3 shows the process of Delphi study. Section 3.4 presents the method of confirmatory factor analysis and multiple regressions. Section 3.5 provides the background of new product development process. The chapter ends with section 3.6 providing a summary of the methodology.

3.1 RESEARCH DESIGN

The development of the service quality measurement for mobile service encounter (SQM-ME) system requires four main outputs, which are conceptual background of SQM-ME model, a proposed SQM model for service encounter, a developed SQM-ME model by using factor analysis and multiple regression, and SQM-ME system developed by using new product development process.

Table 3.1 Research objectives and the research process

Research Objectives	Research Process	Research Method	Output
(1) To investigate the existing models of service quality measurement, and trends of SQM.	Phase1	Systematic Literature Review	Conceptual background of SQM
(2) To examine the SQ dimensions and develop new SQ measurement instrument for service encounter	Phase 2	Delphi Study	Proposed SQM-ME model for service encounter

Research Objectives	Research Process	Research Method	Output
(3) To validate the Service quality model and the measurement metric for mobile service encounter.	Phase 3	Factor Analysis & Multiple regression	Developed SQM-ME Model
(4) To develop service quality management system for Thai mobile service encounter.	Phase 4	New Product Development	SQM-ME System

Table 3.1 outlines the research objectives and the research process. In the first phase, the systematic literature review provides the conceptual background of SQ measurement, which could be found in chapter two. A number of publications are analyzed with comprehensive comparison of the SQ attributes. In phase 2, SQ dimensions from previous study are examined by Delphi study method and new SQ measurement model for Thai telecom service encounter is proposed. In phase 3, the single comprehensive metric of SQ measurement is developed by conducting the empirical study. In phase 4, the developed framework and comprehensive metric are the fundamental of SQM-ME devices and system.

As shown in figure 3.1, the research is conducted in several stages. This research is started by reviewing literature in four main areas which are service quality measurement, research methods, cloud computing and service encounter in Thai mobile industry. These initial studies can be considered as the fundamental works that are utilized for constructing a conceptual model. The conceptual model is then developed by Delphi study in the second phase. Next, the SQM model is verified by using factor analysis and multiple regressions. Finally, SQM-ME system is developed by using cloud computing technology.
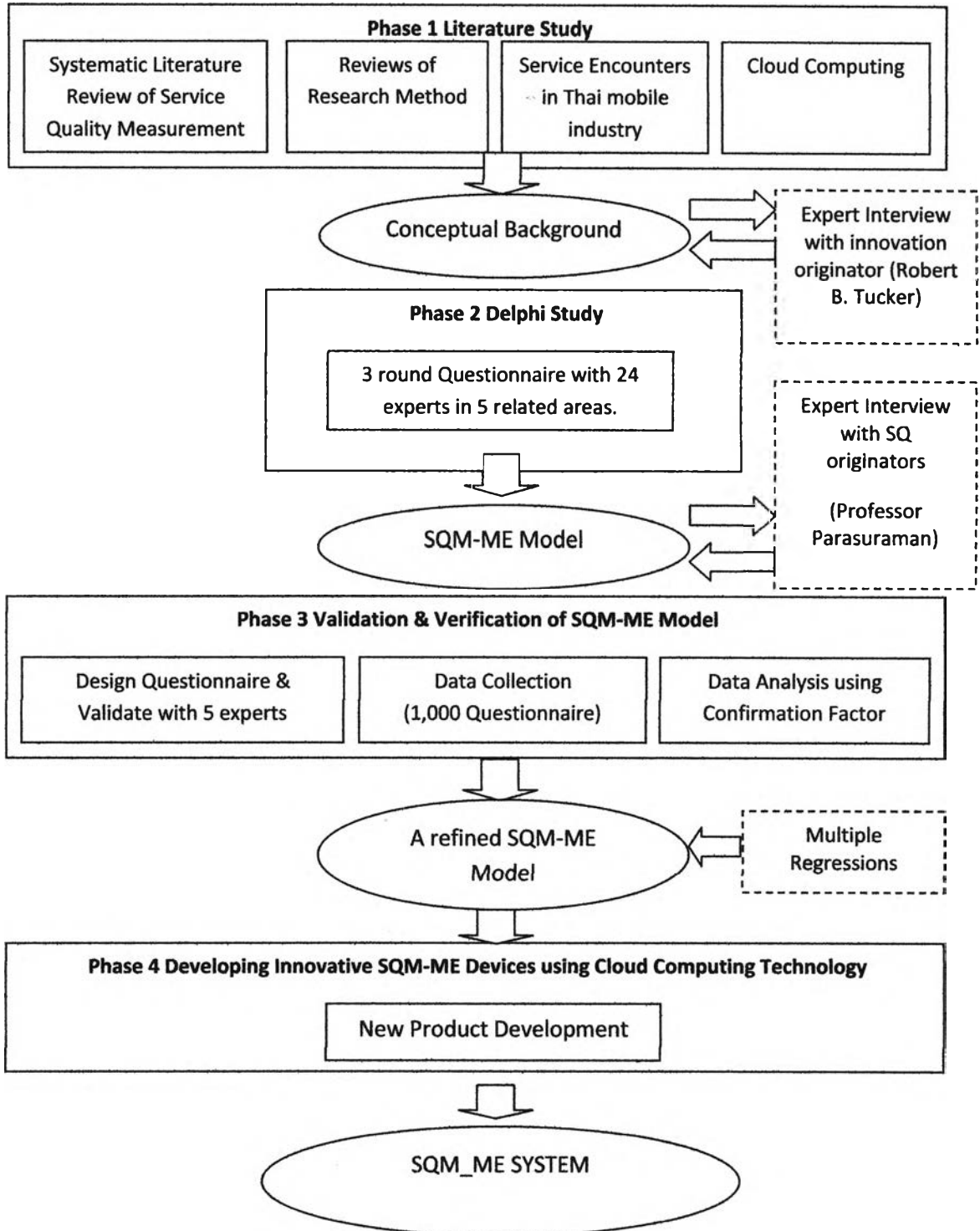
Figure 3.1 Research Framework

3.2   PHASE1: SYSTEMATIC LITERATURE REVIEW METHOD

3.2.1 Objective and Inclusion Criteria

The main objectives of the review are (1) to explore the research themes and trends arising in the reviewed literature. (2) to compare the determinants of SQ perception (3) to explore the existing SQ measurement models (4) to explore the SQ measurement method related to service encounter (5) to propose new SQ measurement model for service encounter by applying contribution from the reviews (6) to identify area for future research for SQ measurement. The inclusion criteria for this research are:

1. Journal articles are peer reviewed only. Book chapter, non-peer reviewed publication, and newspaper article are not included in this study.

2. Select publication from the start of the electronic record to 1 July 2009.

3. Focus on SQ measurement methods, determinants of SQ perception and SQ measurement model.

4. Focus on the SQ related to service encounter.

5. Qualitative and quantitative empirical studies are included in order to capture all evidence of previous studies.

6. Double record papers will be eliminated

3.2.2   Systematic Literature Review Method

Although the large number of studies have been conducted in SQ area, little attempt has been made to translate these findings systematically (Robinson, 1999). Consequently, the complexity of the issues involved requires a systematic review exploring all aspects of the existing literature. According to the study of Mulrow (1994), systematic review (systematic overview) is a review of the articles that clearly formulate a searching strategy and method of screening. The large quantities of information must be reduced into pieces of important information. The result will limit bias and, will improve reliability and accuracy of conclusions.
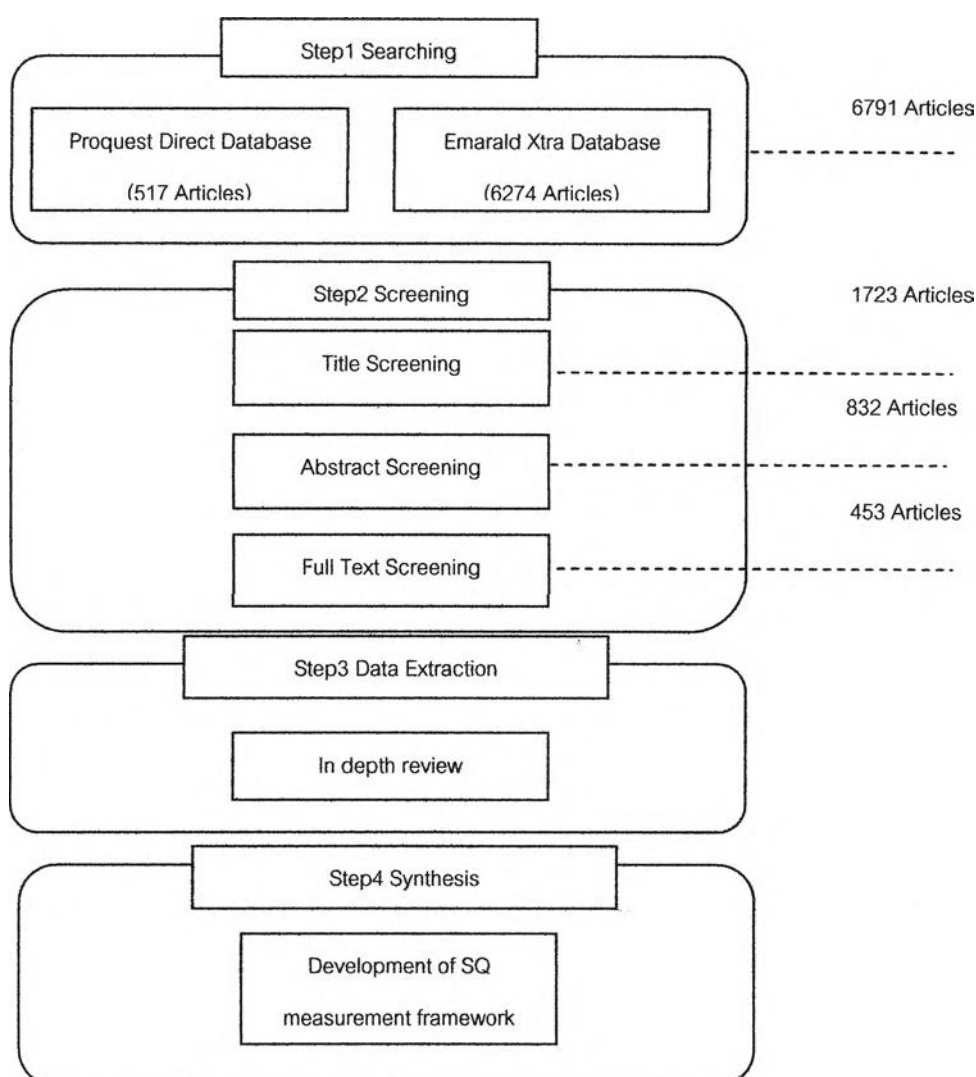
Figure 3.2 Systematic Literature Review Diagram

The main objective of this method is to identify contribution of publication (Transfield et al., 2003) and the analysis of SQ in various dimensions. The systematic literature review of articles published from the start of the electronic record to 1 July 2009 is employed. The selected sources are two electronic databases, which are Emerald Management Xtra and Proquest Direct Database. Figure 3.2 shows the literature review process. Step1: potentially relevant studies are extracted by using search strategy based on Boolean keyword. Secondly, a literature is screened by inclusion criteria in two steps, which are title/abstract screening and full text screening. Next, the contribution of selected articles is extracted by in-depth review. Finally, the development of new framework from reviewed research contribution is proposed.

For the first step, appropriate electronic databases are identified. Two Internet literature searches are conducted on 3 July 2009. The first search is performed in Proquest direct database, resulted in 517 articles and second search is conducted in Emerald management Xtra, resulted in 6274 articles. Keywords and phrases are derived from the research question. Boolean logic of searching strategy is used to allow more efficient search which ensures that the databases are searched properly. The search terms are:

- (Measuring OR Assessing) AND (Service Quality)

- (Measurement OR Assessment) AND (Service Quality)

- (Service encounter OR Service Touch point) AND (Service Quality)

The result from searching phase can be summarized as below:

Table 3.2 Screening Result in each stage of review

Source	Search Terms	Searching Result	Total (exclude double record)	Screen by title	Screen by abstract	Full text screening
Emerald Management Xtra	(Measuring) or (Assessing) and (Service quality)	2713	6274	1483	650	372
	(Measurement) or (Assessment) and (Service quality)	5164				
	(Service Encounter) and (Service Quality)	1694				
Proquest Direct	(Measuring) or (Assessing) and (Service quality)	272	517	240	182	81
	(Measurement) or (Assessment) and (Service quality)	434				
	(Encounter) and (Service Quality)	104				
Total			6791	1723	832	453

After searching the literature, the researcher examines the resulting list of 6,791 references and abstracts and eliminates 5,068 publications that clearly do not match the above-mentioned criteria, using the remaining list of 453.

These retained articles will be analyzed and collected by using excel database. The columns of the database are designed by types of QM initiatives, countries, authors, year, topics related to management innovation and contribution summary. Requests for database can be directed email to the authors.

3.3   PHASE 2: DEVELOP SQM-ME MODEL BY DELPHI STUDY

This research is designed to develop a new SQM framework that contains the key quality dimensions in Thai mobile service industry. The design of the methodology is formulated based upon a conceptual framework from the review of SQM literature in previous study. The research objective is intended to develop a comprehensive SQM model for service encounter in mobile service shop in Thailand. In order to develop the effective SQM model, it is necessary to define three subsidiary objectives:

(1) To identify common SQM indicators and criteria, according to the contribution by expert panels.

(2) To develop new SQM model for mobile service encounter.

(3) To demonstrate the relationship of proposed SQM indicators and describe the detail of key quality indicators.

The methodology of the study is a Delphi survey on SQM issues which is conducted in three rounds. Delphi study is conducted to gain a further consensus. There are several reasons why Delphi is an especially applicable research and evaluation tool for SQM. Firstly, it is a good research method for deriving consensus among a group of expert in complex and subjective topics (Linstone and Turoff, 1975). Secondly, participants are separated by physical distance, so the information can be derived from various companies without any political barrier. Finally, Delphi research is well known and accepted practice in a number of

areas. May (2008) supported that only a search of academic search Premier alone could be found 476 articles in many research area such as information management, banking and quality management, so the Delphi is applicable for this case. However, Delphi study is a time consuming process. Consequently, this study selects the computer based approach. Price (1975) revealed that the computer capability took a shorter turn-around time, allowing for more immediate feedback and on-going interaction.

3.3.1 Delphi Method

The Delphi study was originally developed by the RAND Corporation in California in the 1950s and 1960s to elicit expert opinions (Woudenberg, 1991). The Delphi is a tool for discovering agreement and consensus by sharing the criticism (Buckley, 1995). Delbecq et al. (1975) provided a description of the Delphi process as the approach contained a survey conducted in two or more rounds and provided the experts in the second round with the feedback of the previous round then adjusted the original assessments. The same experts assess the specific topic in two or more round and the result of the next round is influenced by the opinions of the other experts (Häder and Häder, 1995). Linstone and Turoff (1975) stated that the method required expert contributors submitted separately responding to questions to a central coordinator. Delphi method is suitable for expert in different location and if there are the political issues among group (Eto 2003). The benefits of Delphi technique are the potential for anonymity, ability to equalize participants, and ability to remove personality factors from the process (Howze, 2004). The sample size of Delphi study should be a sufficient number of experts. In addition, they should be willing to complete the entire study and provide enough information.

The selected experts in the Delphi panel are the perceived subject expertise, not for demographic representativeness. Scheele (1975) recommended the panel must be chosen from stakeholders who would be directly affected, experts with relevant background and experience, and facilitators in the field under study. Linstone (1978) suggested that large panels had more difficulty achieving agreement and were more difficult to manage the contribution. In addition, the accuracy of developed conclusion is very low with large

numbers. The time consumption for the Delphi process can take around for 30 to 45 days (Barnes, 1987). Normally, the response rates for the second round are decreased, particularly in a paper-base method (Jillson, 1975). Computer-based techniques are far better than paper base approach. The utilization of email or internet-based methods has speeded up the process (Colton and Hatcher, 2004). Yong (1988) stated that a Delphi study involved a multistage procedure, including: the selection of panelists; the design of the questionnaire and the provision of feedback. McKenna (1994) stated that the Delphi technique combined opinion into group consensus. Table 3.3 explains the organization of Delphi process and result in eleven steps.

Table 3.3 Delphi Study Process

Step	Procedure	Result
Step 1	Reviewed literature to develop the conceptual background and referred to previous study of the SQM model.	Conceptual Model
Step 2	Create a list of potential panel members based on the area of expert.	Panel Category and Potential expert list
Step 3	Prepare open end questionnaire based on the knowledge from literature review.	1st round open end questionnaire
Step 4	Distribute 1st round questionnaire to experts	questionnaire via email
Step 5	Analyze 1st round respond	Using affinity diagram
Step 6	Prepare 2nd round Questionnaire and Feedback	2nd round questionnaire with feedback summary and 1st round model
Step 7	Distribute 2nd round questionnaire to experts	questionnaire via email
Step 8	Summarize the feedback and develop new SQM model	Proposed SQM-ME model
Step 9	Prepare 3rd round questionnaire based on new SQM model and supporting information from previous round	3rd round questionnaire and feedback summary
Step 10	Distribute 3rd round questionnaire	questionnaire via email
Step 11	Gain a consensus of new SQM-ME model	a SQM-ME model

3.3.2 Selection of experts

Expert selection is an important process for Delphi study. Barbara (1997) stated that the experts criteria should based on the experience in related aspects. According to the purpose of this research, an expert in a Delphi panel needs to be a person who has practical experience in service quality area. The detail of the expert of the panel is given as below.

Table 3.4 Expert Category and Participants

Expert Categories	Required Qualification	No. of Participants			Overall % Response
		1st Round	2nd Round	3rd Round	
Academic experts,	More than 5 years of experience in academic area with PhD degree.	5	5	4	80%
Service consultants	More than 5 years of experiences as a service consultants	5	4	4	80%
Experience service providers	More than 5 years of experiences in the position of service providers in mobile service shops.	9	9	9	100%
Managements in mobile company	Managements who responsible for mobile service shop.	3	3	3	100%
Quality and innovation consultants	More than 5 years of experiences as a quality/innovation consultants	5	4	4	80%
Total		27	25	24	88%

The Delphi panel in this study consists of 5 expert areas, which are academic experts, service consultants, experience service providers, managements in mobile company, and quality and innovation consultants. The panel consists of 27 experts, who agree to participate and complete all rounds. However, there are 24 experts in the final round.

3.3.3 Questionnaire

1ˢᵗ Round questionnaire:

The designed questionnaire is tested with a number of colleagues to check clarity and consistency. The pilot study respondents make valuable contributions to the development and improvement of the questionnaire. The developed questionnaire consists of two parts. The specific questions addressed in Part A indicate the area of expertise and experiences. The questions in Part B are open-ended and allow participants to provide and express their opinions or add information freely about SQM. The result from the questionnaire will be analyzed by using affinity diagram method, which provides a graphical representation of service quality dimensions and the result of the first round is returned to all participants.

2ⁿᵈ Round questionnaire:

The 2ⁿᵈ round questionnaire focuses on the relative important of the major dimensions and sub-dimensions of SQM. Based on the answers of the first round survey, the questions are rephrased and presented. In part A, the developed model from 1ˢᵗ round questionnaire is proposed. The open-ended questions allow experts to comment on the model and provide the suggestions. In part B, the feedback and comment from the first round are attached and the open-ended question for additional comment is provided.

3ʳᵈ Round questionnaire:

In the third survey, the main aim was to achieve consensus regarding the remaining statements. A few topics still caused substantial controversy after round two. In addition, the importance levels of service quality indicators are ranked by experts. All feedback and

comment from the second round are restructured to the opinion survey. The measurement methods are also recommended by expert panel to specify measurement process. The third round survey also allows the expert panel to provide the final feedback on the result of the previous study.

3.4 PHASE 3: A CONFIRMATION FACTOR ANALYSIS OF SQM-ME MODEL

Confirmatory factory analysis, CFA, is one of the structural equation modeling (SEM) techniques, related to the measuring of both independent and dependent variables. It has been widely used in econometrics, marketing, psychology, sociology and education (Bollen, 1989). The primary objective of a CFA is to determine the ability of a predefined factor model to fit an observed set of data. The SQM-ME model that is precisely defined will be tested. This involves selecting the number of factors, and defining the nature of the loadings between the factors and the measures. This test is highly sensitive to the size of your sample, such that tests involving large samples will generally lead to a rejection of the null hypothesis, even when the factor model is appropriate.

In order to validate and confirm the SQM-ME dimensions, the researcher utilizes CFA method. In CFA, the structural relationship between the items (observed measures) and dimensions (latent variables or factors) are postulated a priori and then statistically tested. In particular, CFA will test the hypothesis that service quality is a multi-dimensional construct composed of the five factors: facility, speed, reliability, professional competence, agent utilization and responsiveness.

The 28-item scale consists of six items for facility, five items for speed, three items for accuracy, five items for professional competence, four items for availability and five items for responsiveness. The sample data is collected through a survey. The survey is conducted through an anonymous self-completed structured questionnaire. The questionnaire consists of five parts. The first part contains questions pertaining to current usage of mobile service shops. The second part contains 29 statements representing the six SQM-ME dimensions. Respondents are requested, on a seven-point Likert scale (from strongly disagree to

strongly agree), to indicate their opinion on statements relating to service quality in mobile service encounter. The third part is related to net promoter scores that lead to possibility of customer to recommend friends to visit mobile service shop. Next, the fourth part is the general information of respondents. And finally, the last part provides the space for additional comment.

According to Paul-Peter (1981: 134) construct validity is "inferred if the measured scores (variance) perform as substantive theory postulates they should perform". Supportive evidence of construct validity in this case is if the CFA is supported by the theory that the SQM-ME service quality construct produces six meaningful factors. A popular diagnostic measure of reliability - Cronbach's alpha coefficient - is used to test the consistency of the construct. For the service quality constructs to be reliable, Hair et al (2006) affirmed that the generally agreed lower limit for Cronbach's alpha coefficient was .70. For the service quality construct as a whole, the Cronbach's alpha was .90, exhibiting high reliability.

3.4.1 Hypotheses

CFA is identified as an appropriate statistical test particularly for the number of SQM factors that are required to explain the inter-correlations among the variables. The beginning of this analysis is to define the factor model that is needed to test. Thus the SQM-ME model from Delphi study is employed and variables in each factor will be tested to find out the correlations. The hypotheses of CFA analysis explain that:

1. Responses to SQM-ME model could be explained by six first-order factors (facility, speed, reliability, professional competence, agent utilization and responsiveness.), and one second-order factor (service quality).

2. Each item would have a non-zero loading on the first-order factor that it is designed to measure, and zero loadings on the other two first-order factors.

3. Error terms associated with each item would be uncorrelated.

4. Co variation among the six first-order factors would be explained fully by their regression on the second-order factor.

3.4.2 Sample

The population chosen for the study is mobile telecom customers in Bangkok. The reason for choosing Bangkok area is that the market share of mobile usage in Bangkok occupies over 70%. Over a three-week period, the questionnaire is administered to customers who are leaving or entering the three case studies, which are AIS, DTAC and TRUE. Overall, about three out of four customers who are approached is willing to fill in the questionnaire. Johns and Tyas (1996) also encountered the problem of respondents not being willing to participate in a survey. In the present study, each respondent is given a pen for participating in the survey. The questionnaire is administered to a convenience sample of 1,500 mobile service shop customers in Bangkok metropolitan area. Comrey and Lee (1992) provided the following guidance in determining the adequacy of sample size: 100= poor, 200 = fair, 300 = good, 500 = very good, 1,000 or more = excellent. Fifteen-thousand questionnaires are distributed to mobile service shop customers in Bangkok metropolitan area. A total of 1,121 questionnaires are returned (74.73 % response rate). 1,000 usable questionnaires (66.67%) are used for data analysis. Because this study focuses on mobile customers who experience mobile service shops, thus customers who never access to mobile service shop are not included in this study.

The questionnaire is pilot tested by five experts in a small sample of mobile customers (n=20) in order to determine clarity of the items and directions. A second pilot test is conducted with a small group of academic researchers (n=5) who are recognized in research area as the experts in professional role evaluation to establish some levels of face validity.

3.4.3 Data Analysis

The data is entered into the statistical software package SPSS and checked for incorrect entries and missing data. Confirmatory Factor Analysis (CFA) is chosen to refine and validate the measurement scales (Hawari, 2005). Given the fact that the proposed model is based on logic, previous empirical research and theoretical findings, the CFA approach is considered the most appropriate method to statistically confirm the proposed

factors of SQM-ME model. The analysis consists of two important parts. The first part contains the descriptive information and represents the result in graph format. In second part, the result of factor analysis will be explained. The conceptual model of SQM-ME contains the 29 variables, which are necessary to be grouped and irrelevant variables are eliminated.

3.4.4 Variable Analysis

Due to the Delphi study which proposes 29 variables for measuring service quality, this section, the author needs to validate the SQM model by using confirmatory factory analysis. Thus, some variables will be grouped and some variables, which are not related to others, will be deleted out. This research uses Factor Analysis Method because it is one of the statistic ways which can group the same variables in same area and enable to decrease the number of factors. Additionally this section is aimed to provide weighting mechanism in each variable including the dominant characteristics of a variable and the variable group. As a result, it occurs to the relations between each variable and enables to recognize the information structure and co-relate factor of variable including weight of each component calculated from variable value as well.

3.4.5 Factor Analysis technique procedures

At the first step, we need to determine the relation of all couple variable by using a correlation co-efficient and building the co-efficient of Correlation matrix of all couple variables, adapted from the Likelihood- Ratio Chi-square. Abbott (1999) explained the degree of linear association between two variables.

- If the co-efficient of any couple variable valued close to +1 or -1, it was verified that the couple of variable had strong relations which should be set in the same factor.

- If the co-efficient of any couple variable valued close to zero, it was indicated that the couple of variable had no relations to each other at all or scarcely related then it supposed to be in the same factor.

- If the variables had not related to any other variable or had a diminish relation of the rest of other factor, we should eliminate that variable.

Secondly, the factor extraction is employed. The objective of factor extraction is to find out the amount of factors which are able to substitute all variables. There are several methods to extract factors. In this case, the author also uses "Principal Component Analysis Method" that can be called PCA method. The "PCA" is the technique aim to use detail of a large amount variables setting in some of small number of factors (Reise, 2000). Determination of the result of each factor in PCA Analysis will create Linear Combination of variable. In addition, the first factor is the first Linear Combination of variables or it could be mentioned that it has the highest standard deviation value. The second factor is the linear combination value of variable as well, it provides the detail of remaining data as it is supposed to set the angle orthogonally on first factor or it has not related to the first factor. This is an option to solve Multi-co linearity of third factor that also the linear combination of variables. (No relation between factors and the left information from variables can be collected as much as possible.

In the same way, to establish the fourth and the fifth factor, this section uses the same technique as mentioned above. At the second level, the result of the analysis provides the evaluation of the factor loading value and uses it to determine which variable should be in the same factor. In each factor, each variable will be determined by factor loading value method. If the factor loading of each variable has numerous amounts close to +1 or -1, we should set that variable in that factor. In some cases, the factor loading value exhibits its medium value which causes uncertain variable to set in a factor. Therefore, this study supposes to rotate the factor axis at the next step.

The third step is factor axis rotation. As mentioned at the second step, in case the factor loading value has medium value which could not be set in any factor so that we do axis rotation. Consequently, the purpose of axis rotation factor is to increase factor loading

value of variable or mitigate their value until the experimenters acknowledge the exact position of variable in each factor.

- **Rotation axis Method**

The goal of rotation is to simplify and clarify the data structure. Orthogonal rotations produce factors that are uncorrelated; oblique methods allow the factors to correlate. Costello (2005) stated that conventional wisdom advised researchers to use orthogonal rotation because it produced more easily interpretable results. The detail of each rotation is described below:

1. Orthogonal Rotation

   The rotation occurs when the factor axis angles orthogonally or lays on independently which causes factor loading increasing or decreasing.

2. Oblique Rotation

   The rotation occurs when the factor axis *is not* angled orthogonally or still depends on each factors.

After the numerous amounts of variables in a group are set, the factor score in each case is calculated. For instances, if there are2 factors, they are calculated by using the factor score value and then 2 new factors are put to analyze continuously. The data will be analyzed by using Varimax of orthogonal method, which is the most common choice for researchers.

3.4.6   Factor Analysis Conditions

This topic gives necessary and sufficient conditions for variables' characteristic. Krijnen (1998) revealed that

1. Factor (F) and error (e) in an equation would be independently.
2. The variable should be the quantitative variable and in the case of grouped variable was set within the equation it required to change the grouped variable in "**Dummy variable form**".
3. The relation between both factor and variable was set only in the "**Linear form**".

4. Principal component analysis technique of each variable or data is unnecessary to do the normal distribution .However, some variables also had rather much skewed distribution and outline value which causes the result might not correct.

5. A number of cases should be more than the amount of variable as it frequently asked how many times of cases suppose to have more than variables. In some cases, it was specified that a number of cases should be at least 10 times more than the amount of variable.

3.4.7 Multiple Regression Analysis

Multiple regressions method is a statistical method used to examine the relationship between one dependent variable Y and independent variables Xi and reveal the regression parameters or coefficients bi in the regression equation. According to Armitage (2002), the factor analysis result turned out the group of variable which was affected to the customer satisfaction in service quality. Therefore, the variable from the factor analysis can be adjusted to diagnose in "Multiple Regression Analysis" steps in order to find out the equation to forecast the Customer satisfaction in service value by using the Dependent variable (Y) and Independent value or called the Forecast Variable in the research analysis. The multiple regression analysis procedures are:

1. Determine which variable related to dependent variable
2. Build the equation or Model of Analysis. In general, it is supposed to be as the following:

$$Y = B_0 + B_1 X_1 + B_2 X_2 + \ldots + B_k X_k + e$$

3. Using One-Way ANOVA to verify the relations between variable by designating an assumption as follow

H_0 = Dependent variable was set independently on all Independent variable

H_1 = Dependent variable depend on at least a Independent variable

4. Regulate the relationship between dependent variable and independent variable only one variable each time.

Setting an assumption as the followings:

i. $H_o : B_i = 0$

ii. $H_1 : B_i \neq 0$

The researcher uses R^2 or adjusted R^2 in the study of the relationship level between the independent variable which is related to dependent variable. If the R^2 or adjusted R^2 value is close to 1, it means that the independent variable relate to dependent variable considerably. On the other hand, if R^2 or adjusted R^2 value is close to zero, it means that it is not related to dependent variable at all or has exiguous relationship with the dependent variables.

3.4.8 The variable selection in regression equation

If two variables are correlated, then identifying the score on one variable will allow researchers to predict the score on the other variables. According to Brace (2006), there are several techniques to select a variable into the regression equation. The researcher should test an assumption before beginning the process so as to check which independent variable relates to dependent variable as the regression equation analysis by using SPSS program and stepwise technique.

-   Select variables which relate to dependent variable and testing. If it is tested and the outcomes show that the assumption H_1: $B_i \neq 0$ is accepted consequently, the analysis can verify that whether it relates to the dependent variable, then this variable is put in the equation.

-   The second variable is selected into equation by use backward technique to choose which variables should be cut off from main equation. As mentioned before, the relationship between variable in the regression equation is

determined and commit this same action until it is unable to select Independent equation into equation and cut-off any variable in Equation at all so it can be identified that it is the proper regression equation.

3.5   PROCESS OF DEVELOPING SQM-ME SYSTEM

In this section, several issues are discussed to provide the understanding of developing an innovative SQM-ME system. This section is started with new product development process. A process is a sequence of steps from inputs to outputs. In high-tech industries, companies have to be aware of the selecting of developing new products processes, which is significant because it can lead to success or failure (Clark & Fujimoto, 1991). Various NPD studies focus their research on R&D to develop new products but the selection of NPD process in this study is controlled by limited initial investment for R&D. Consequently, some models that focus on R&D investment seem to be inappropriate. Table 7.1 compares the processes of new product development (NPD) as the fundamental background for selecting NPD process for this thesis.

Table 7.1 A comparison of New Product Development Process

Authors	Year	NPD Process	NPD Stages	Focus
Kagioglou, Cooper, Aouad, Sexton, Hinks, and Sheath	1998	4 main stage gates, containing 10 phases.	Pre-project Pre-construction Construction Post-completion	The design and construct a NPD process based on four stage-gate® systems in the manufacturing industry.
Boer	1999	5 stages	Raw ideas Conceptual project Feasibility Development Early commercialization	Boer approaches the NPD process through the influence of R&D organizational department.
Cooper	2001	6 stage-gate® system	Discovery Scoping Business case Development Testing and validation	Cooper provides an in-depth review and consequently a control checking points called Stage gate. This process is time consumption.

Authors	Year	NPD Process	NPD Stages	Focus
			Launch	
Schroeder	2003	3 Stages	Concept development Product design Pilot production/testing	three typical development phases
Ulrich and Eppinger	2004	6 Stages	Planning Concept development System level design Detail design Testing and refinement Production ramp-up	Ulrich and Eppinger propose a NPD process focus on the product design,

Source: Developed from Ulrich and Eppinger's process (2004)

The result shows that Ulrich and Eppinger's process is a suitable model for this study because this method contains 6 stages that cover all important steps with reasonable time, cost and resource requirement. Although this new product development (NPD) process is the sequence of steps or activities with an enterprise employs to conceive, design and commercialize a product, but this study will be scoped at product prototype only.

3.5.1 The six phases of the generic development process

The NPD process consists of six phases based on Ulrich and Eppinger (2004), as shown in table 3.5. The process begins with a planning phase, which is the link to advanced research, current market situation and selected technology, which is cloud computing. The strategic canvas process is employed. The output of the planning phase is the project's mission statement, which is the input required to begin the concept development phase and which serves as a guide to the development team.

Table 3.5 The Six Phase of the Generic Development Process

Phase	Process Name	Description	Method	Output
0	Planning	The planning activity begins with strategy and includes assessment of technology developments and market objectives.	Strategic Canvas by 6 invited members as the development team.	The output of the planning phase is the project mission statement, which specifies the target market for the product, business goals, key assumptions, and constraints.
1	Concept Development	The needs of the target market are identified; alternative product concepts are generated and evaluated. –Process Mapping	Field Observation and Brainstorming by development team and using idea generation & Screening techniques	One or more concepts are selected for further development and testing.
2	System-level design	The system –level design includes the definition of the product architecture and the decomposition of the product into subsystems and components	SQM Cloud Environmental Design, Overall SQM-ME System Design	. The output of this phase usually includes a geometric layout of the product, a functional specification of each of the product's subsystems.
3	Detail design	The design phase includes the complete specification of the geometry, materials, cloud computing structure and user interface design	Cloud computing infrastructure, Interface design, website design, database design, Online questionnaire design	A Prototype of SQM-ME system

Phase	Process Name	Description	Method	Output
4	Product Testing	This process involves the construction and evaluation of multiple preproduction versions of the product.	Focus group	Feedback of the products
5	Production ramp-up (Future Study)	The product is made using the intended production system. The purpose of this process is to train the work force and to work out any remaining problems in the production processes.	Future Study	Product Catalog, User Manual, Developing a support team, customer service, call center, company set up and financial funding.

The first phase is concept development, which utilizes field observation process. It presents a description about current practice in mobile service shops. Six mobile service shops are selected, which are two AIS shops, two DTAC shops and Two Truemove shops. By doing this observation approach, an in-depth study is also perform in order to get the specific requirements and all constraints for SQM-ME system. The collected data and the conceptual background of SQM-ME is derived. The result of previous study in Chapter 5 is discussed by development team and brainstorming methods for generating idea is used.

In the detail design phase, before going further with cloud computing technology, it is essential to know the basic characteristic of cloud computing. Therefore, the result of literature reviews related to cloud computing is explored and investigated.

In the detail design phase, SQM-ME system adopted the concept of SQM-ME model from Chapter 6. Several activities have to be done in this phase. It begins with the identification of the involved parties. Each team has to be responsible for the task in parallel and commit the timeframe. Key activities in this phase are the cloud computing infrastructure setting up, Interface design, website design, database design, and online questionnaire design.

3.5.2 Sessions and development workshops

New product development process involves several groups of people that have to participate in the project in different timeframe. It requires more specialized skill such as information technology, customer interface and concept generation. Table 3.6 shows the detail of session name and the workshop methodology for developing SQM-ME system.

Table 3.6 Session Name

Session Name	No. of Participants	Location	Time	Workshop Detail
Strategic Planning Session (Planning phase)	6 (NPD Team)	True Tower, Room 1, Level 21	14.00-16.00 15 Febuary 2010	Brainstorming
Process Mapping Session (Concept Development)	15 (Process Owners)	True Tower, Room 2, Level 21	9.00-16.00 25-26 March 2010	In depth Interview
Customer Need Session (Concept Development)	20 (User group)	True Digital Park, Siam Square Soi 4	14.00-16.00 12 April 2010	Focus group
Concept Development Session	6 (NPD Team)	True Tower, Room 2, Level 21	9.00-16.00 25 April 2010	Brainstorming (Idea Generation + Idea Screening)
Product Testing Session	20 (User group)	True Urban Park, Siam Paragon	9.00-12.00 11 May 2010	Focus Group
Monthly Meeting	6 (NPD Team)	True Tower Lounge Level 16	14.00-16.00 Monthly	Update Status

As seen, several sessions have been held by different groups of participation. A major element of improving time-to-market in new product development is to select the right people for working in specific implementation timeframe. There are three main groups, which are (1) new product development (NPD) team; (2) user group is the prospect users

for SQM-ME system, which are service providers in mobile telecom shops and (3) process owners, who can provide information about related processes in mobile telecom shops.

3.5.3   Strategic Planning Session

Strategic planning is a disciplined way of thinking about a new product development direction as a whole in order to determine how decisions made today may affect the organization over a given period of time. It is a process that links short term, medium term and long term plans. In this session, NPD team clarifies the company direction aligning with new product development strategy. It allows management to assess the relative value of alternative courses of action. Typically, it is a document prepared by new product development team designed to provide guidance to the strategic new product development project in order to monitor service quality of mobile service shops by using the concept from SQM-ME model. This session employed strategic canvas technique, which is a critical diagnostic and action tool utilized in the Blue Ocean Strategy process. Kim and Mauborgne (2002) stated that this tool allowed an organization to visualize the competitive factors and the current state of play of those factors within an industry.

Assessing to what extent your company and its competitors offer the various factors is equally challenging. According to Kim and Mauborgne (2002), there are four main steps to visualize the strategy. The first step is visual awakening by comparing business with current competitors by drawing 'as is' strategic line on strategic canvas. Secondly, the NPD team has to observe the distinctive advantages of alternative products and services. Third, the team need to draw 'to be' strategy canvases based on insight from customers. Finally, the result from strategic canvas shows the opportunity gap for the NPD team to create new product and service to serve prospect customers. In addition, customer needs are collected by 20 mobile service staffs from 5 different branches of Truemove shops. The customer needs was analyzed by technology and financial assessment methods in strategic planning session on 15 Feb 2010. The result was ranked by using likert scale from 1(low important requirement) to 5 (high important requirement). The requirement affordability level came from the multiply by technology difficulty and financial investment.

3.5.4 Process Mapping Session

This session was designed for understanding service delivery process of mobile service shops by using a case study approach because it can comprehensively provide information of the selected case organization. This study selected True Corporation as a case study. Yin (1994) stated that interview is one of the most crucial sources of case study information. Partington (2000) revealed that the interview method provided in depth in formation and comparison between existing literature and what actually happen in the real life. The process mapping session was conducted in four phases as shown in figure 3-4.

Figure 3.4 Process Mapping Process

The process mapping approach begins with the secondary research by collecting the data about background information (e.g. company reports, website, management reports). Next, the exploratory interview session is conducted by 15 participants of mobile service shops (i.e. two managers of five different branches, four front-line and one management). This exercise assists the author's understanding of the service delivery process, which facilitates the identification of potential faults from the actual process, and opportunities in the form of solutions using flowcharts. In the third step, the collected information is illustrated by using process mapping techniques. Yin (1994) suggested a good case study should use as many sources as possible. Therefore, the information for process mapping came from many sources of evidence, such as in-depth interview, documentation, and observation. This study allows the author to address a broad range of issues of the service delivery process in mobile service shop. Finally, the 'As-Is' process is developed and confirmed by in-depth interview with the same group.

3.5.5   Customer Requirements Session

Customer requirement management becomes one of the principle factors for new product development succeeded in the market place (McKay, 2001). In order to transform customer needs to functional requirement, the customer requirement is collected by using focus group approach. A focus group is a form of qualitative research in which a group of people are asked about their perceptions, opinions, beliefs and attitudes towards a product, service, and concept (Henderson, 2009). In the customer need collection step, 20 mobile service staffs from 5 different branches joined the session at True digital park, Siam Square, Thailand. The focus group is based on the customer requirement process developed by Jiao (2006) as seen in figure 3.5.
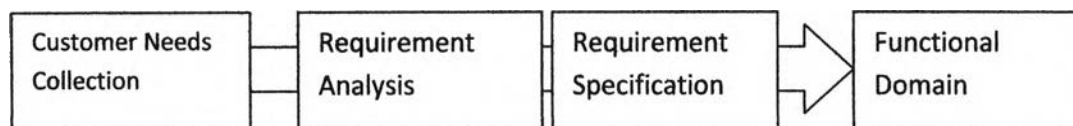
| Customer Needs Collection | Requirement Analysis | Requirement Specification | Functional Domain |

Figure 3.5 Customer requirements Process

First of all, this paper attempts to gather the requirement from customers, which are service providers in mobile service shop who will be the users for SQM-ME system. In the requirement analysis, the author interprets customer need and derives the explicit requirement that can be understood by development team.

3.5.6   Concept Development Session

This step is about mapping customer needs and functional requirement. Clausing (1994) revealed that customer needs and product specification was the key issue in 'design for customer' and increase the opportunity to success in the market. A concept development session is implemented by six members of new product development team. The session begins with idea generation workshop and then screens the idea by using technology, marketing and financial feasibility. The NPD team should generate as many ideas as possible to increase the probability of locating an appropriate idea which satisfies the users (Chohan, 1979). The various idea generation techniques can be seen in Appendix C. The

selected method for this thesis is brainstorming session, which is intended to reduce social inhibitions among group members and stimulate idea generation by focusing on quantity. According to Hubka, V.,(1983), there are four main ground rules, consisting of withhold criticism, welcome unusual ideas, combine and improve ideas. Participants who have ideas but are unable to present them are encouraged to write down the ideas into the idea notes and present them later. It will be conducted in three rounds. Next, the screening process is to develop the criteria used to evaluate the ideas. Hamilton (1974) stated that there are various screening methods, but this thesis selected the particular method used, which are customer and company opportunity matrix. The result of this study is shown in Chapter 7.

3.5.7 Product Testing Session

Product testing session provides a significant opportunity for reducing risk. The sessions in the workshop will cover the entire dimensions of SQM-ME system. The workshop is designed to appeal to a wide variety of participants and include 5 mobile service providers, 5 mobile service shop managers, 5 IT engineers and 5 mobile service shop customers. This session began with product demonstration and explanation. Then, participants provide the feedback into the answer sheet.

3.6   CONCLUSIONS

This research is started by reviewing literature in four main areas which are service quality measurement, research methods, cloud computing and service encounter in Thai mobile industry. These initial studies can be considered as the fundamental works that are utilized for constructing a conceptual model by using systematic literature review method. After the screening by using inclusion criteria, the remaining list was 454 papers. The result of this phase provides the conceptual background for the next stage. The conceptual model is then developed by Delphi study in the second phase. This Delphi method is a tool for discovering consensus by sharing the criticism. The panel consists of 24 experts from five expert categories. The result from Delphi study shows the SQM-ME model for mobile telecom service encounter. Next, the SQM model is verified by using factor analysis and

multiple regressions. Fifteen-thousand questionnaires are distributed to mobile service shop customers in Bangkok metropolitan area. A total of 1,121 questionnaires are returned (74.73 % response rate). Finally, SQM-ME system is developed by using 6 steps of NPD process, which are strategic planning, concept development, system-level design, detail design, product testing and production ramp-up. Several NPD workshops are conducted, which are strategic planning session by using strategic canvas, process mapping session, customer need session, concept development session, product testing session and monthly meeting for NPD team. Chapter 4 provides key finding from the reviews of literature in phase one of research methodology.