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Thailand's Provincial Electricity Authority (PEA): A Structural Equation Model of Factors Determining Customer Satisfaction

Karn Choaknumkij and Wanno Fongsuwan
Administration and Management College, King Mongkut's Institute of Technology Ladkrabang, Chalongkrung Soi1, Ladkrabang Sub-District, Ladkrabang District, Bangkok, 10520, Thailand

Corresponding Author: Karn Choaknumkij, Administration and Management College, King Mongkut's Institute of Technology Ladkrabang, Chalongkrung Soi1, Ladkrabang Sub-District, Ladkrabang District, Bangkok, 10520, Thailand

ABSTRACT

Under the Association of Southeast Asian Nations Economic Community Blueprint 2015, energy security was stated as a top priority. The 10 member community is projected to have a combined gross domestic product of US$ 1.9 trillion by 2020, making this economic block the eighth-largest economy worldwide. With the community's energy consumption rising at a projected 4.4% per year, Thailand with its 67 million people is a key player in both terms of power production, consumption and distribution and at the center of this is the Provisional Electricity Authority which has expanded electricity supply to 73 Thai provinces, covering 510,000 km^2 while servicing 99% of the country's total area and villages. Given the critical importance of the PEA to both Thailand and the region, the researchers undertook a study to examine the variables affecting this organization's capability to serve this vital regional sector. Examining both service quality and electronic customer management systems via structural equation modeling, the study determined that there was a direct effect on customer satisfaction by these factors in power generation and distribution within the Kingdom. Given the rising importance of global energy "Smart grid" systems, the study furthermore opened up this area as follow-on to the present research.

Key words: Servicequality, Thailand, ASEAN, electronic customer relationship management, customer satisfaction

INTRODUCTION

Under the Association of Southeast Asian Nations (ASEAN) Economic Community Blueprint 2015 signed by ASEAN leaders on 20 November 2007, ASEAN's energy security was stated as a top priority. As such, the ASEAN Plan of Action for Energy Cooperation (APAEC) was created which is now in its third iteration working under the title 'APAEC 2010-2015'.

The objective of the APAEC 2010-2015 is to enhance energy security and sustainability for the ASEAN region including health, safety and environment through accelerated implementation of action plans, including but not limited to the: (1) ASEAN Power Grid, (2) Trans-ASEAN Gas Pipeline, (3) Coal and Clean Coal Technology, (4) Renewable Energy, (5) Energy Efficiency and Conservation, (6) Regional Energy Policy and Planning and (7) Civilian Nuclear Energy. The APAEC 2010-2015 contains 26 strategies and 91 actionitems, with Thailand playing a key role within it.

With the formation of the ASEAN Economic Community in 2015, Thailand is preparing for the creation of more integrated energy architecture in the region. A major transformation in the way energy is produced, delivered and consumed will be required as Thailand responds to the emerging dynamics of energy poverty, climate change and resource scarcity. Efforts to achieve this transition are inspired by new possibilities, including new alternative energy sources and technologies which make more efficient use of existing energy sources.

In 2015, the formation of a united ASEAN Economic Community (AEC) commences and with the creation of this single market and production base, its 10 member states are projected to hold a combined Gross Domestic Product (GDP) of US$ 1.9 trillion by 2020, making the AEC the eighth-largest economy worldwide (IMF, 2011).

Continued growth, industrialization and urbanization have led to increased energy consumption from a comparatively low per-capita level which is set to prevail. According to Japan's Institute of Energy Economics, ASEAN's final energy consumption will grow at an average annual rate of 4.4% from 375-1,018 MTOE, in a business as usual scenario (IEEJ, 2011). Southeast Asia's energy resources, including about 10.3 billion barrels of proven oil reserves, 6.6 trillion cubic meters of proven gas reserves, 12.5 billion tons of proven coal reserves and abundant hydropower are relatively meager, as compared to the growing scale of demand (IEA, 2009) while ASEAN remains a net energy exporter, this situation may change in the future.

Thailand currently ranks 46th on the Energy Architecture Performance Index (EAPI), a composite indicator that evaluates the performance of 105 nations across the energy triangle assessing whether their energy architecture supports economic growth and development, in an environmentally sustainable way, while providing energy access and security. Compared to its peers, Thailand has performed well with Thailand scoring the highest amongst other ASEAN nations. Thailand has also been ranked 14th among non-organization for Economic Co-operation and Development (non-OECD) nations and its performance improved over the five years for which data was collected. These improvements were driven by steps to create a sector that is more supportive of economic growth and development (WEF, 2012).

The two main regulatory authorities in Thailand are the Ministry of Energy and the Energy Regulatory Commission. The Ministry which was established in 2002, is in charge of overall governmental energy policy. It works closely with other agencies and the energy industry in driving implementation policy. The Energy Regulatory Commission is an independent agency that regulates the business practices of the electricity sector in terms of pricing, transmission expansion and the power plant development fund.

Electricity Generating Authority of Thailand (EGAT) and Petroleum Authority of Thailand (PTT) are responsible for the majority of the electricity and oil and gas industry value chains in Thailand. The objective of EGATs is to maintain a sustainable electricity supply system while minimizing production costs (WEF, 2012). It is responsible for nearly 48% of power generation and is wholly responsible for electricity transmission. The EGAT has a commitment to purchasing output from independent power producers, providing them with access to the grid under the terms of PPAs which has led to the expansion of the number of organizations involved in the sector.

Distribution and retailing of electricity is the responsibility of both the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA) in Thailand. The MEA is responsible for the distribution of electricity within the Bangkok metropolitan areas while the PEA being under the supervision of the Ministry of the Interior has the main responsibility of producing, distributing and sellingelectricity to households, business and industrial sectors, as well as to the

general public in Thailand's 77 provinces. The PTT on the other hand, is a fully integrated oil and gas company whose activities include exploration and production as well as the marketing of oil and gas. The PTT also operates the country's onshore and offshore pipeline system.

Over the past decade, Thailand's significant economic growth has pushed it into the World Bank's upper middle-income bracket, where it ranks 38th on the World Economic Forum's Competitiveness Index. The country's economy is expected to grow at 4.5% a year between 2010 and 2020 (WEF, 2013).

Knowledge accumulation and capability development have allowed Thailand to develop an increasingly complex economy which competitively manufactures and exports complex machines and electronics, indicating a shift away from the predominantly agriculture-driven exports of the 1960s (Hausmann *et al*., 2011). The manufacturing sector now accounts for more than 30% of GDP.

However, growth in the manufacturing sector carries its own challenges. Despite policy frameworks and financing mechanisms installed by the government to promote energy efficiency, energy intensity has not changed significantly over the last decade. Thailand's rank on the EAPI for energy intensity has, in fact, declined from 69th to 72nd. While the country's energy intensity has declined only slightly over that time period, that of its peers has declined at a sharper rate. This is largely due to the increasing share of energy-intensive industries in the economic structure and inefficiencies in the transport sector, due to high levels of motorization, heavy dependence on road transport and a lack of fuel economy standards (Punse, 2010).

Thailand is also heavily dependent on fossil fuels, as petroleum products make up more than 45% of the total energy supply although the country has limited indigenous resources. With a rapidly growing energy demand expanding at an average rate of 6% annually along with a 9% electricity consumption rate per year over the past 25 years, this has led to greater dependence on energy imports. In 2011, the country imported the energy equivalent of 87% of total domestic production of primary energy including crude oil which accounted for 61% of these imports. Such high levels of imports come at a cost and in 2011, Thailand imported 8.47 billion baht (approximately $265 million USD) of energy, an increase of 26.2% from 2010 (WEF, 2012).

Energy is one of the basic micro dynamics of a general economy with a similar example being found in Turkey. Akdi *et al*. (2008) investigated the long term relationship between electricity energy supply and demand and stated that electric energy is a secondary renewable energy resource obtained by utilizing primary sources. Within the last couple of years, parallel to the high growth, modernization and population trends in the developing countries such as Turkey, demand for energy has been increased rapidly. In Turkey, nearly 30% of the electric energy is produced from hydraulic and the rest from thermic power stations and the capacity utilization ratio is nearly 70%.

As a consequence of its rising import dependence, Thailand's performance on energy access and security has deteriorated. The country has dropped from its former ranking of 39-54th. In response to energy security concerns, Thailand is seeking to diversify its energy mix. Considerable progress has been made, with the country ranking in the top quartile for this indicator. Despite this, individual sectors, most notably power generation in which natural gas takes up 65-70% of the mix, are overly dependent on one type of fuel. The country is also in the process of increasing its strategic petroleum reserve from 36-90 days, in line with IEA guidelines.

From an access perspective, Thailand performs relatively well. The PEA has expanded electricity supply to 73 provinces, covering 510,000 km^2 and servicing 99% of the country's total area.

Currently, the PEA has expanded its operations into 67,446 villages, representing 99% of the total villages of 68,162. Only 716 villages in Thailand are not presently serviced by the PEA (Siriponglee *et al*., 2013).

In March 2011, the PEA announced its smart grid development road map which will be implemented between 2012 and 2026 (Smart Thai, 2012). This process begins with a design and testing phase from 2012-2016, including a smart grid and an advance metering infrastructure pilot to be implemented in Pattaya City. From 2017 onwards, the roll-out of further large-scale projects will take place. While the MEA and EGAT have adopted a series of policies and projects related to the efficiency and strengthening of the grid, neither organization has a clear smart grid strategy. Thailand will thus require a more unified approach if it is to deliver a smart grid effectively.

As can be seen from the above data, PEA's role in Thailand's growth and ASEAN energy security is crucial with the manner in which it operates, either efficient or now a manner of both national and regional priority. The PEA is therefore guided by a policy that covers six main areas which are stated as follows (Wade Thai, 2013):

- Focusing on the organization's value added services while securing a better financial status and sustainable growth by continuous improvement of the management process. Better utilization of available resources as well the searching for investment and business development opportunities both nationally and on international levels through a business a partnership channel which combines investment expansion among affiliated companies
- Aim to be a Customer-Centric Organisation by establishing and developing good customer relations to meet customer's need and satisfaction as well as good performance in providing creative, innovative and high-technology platforms
- To have continuous development of electricity infrastructure in order to enhance quality of life and competence according to the national government's policies, as well as the development of a Smart Grid system which can better serve to deliver adequate electricity power while providing a more efficient return on investments as well as enhancing security and universal reliability
- The promotion of alternative, renewable and efficient energy consumption which could counter effects of global warming. Additionally, take steps to ensure the support and restructuring of the nation's move towards a 'Green Economy'
- Aiming to create a 'Live Organisation' which focuses on the development of human and intellectual resources, the promotion of learning and knowledge management and the prioritization of staffs' quality of life as well as the development to eventually improve the efficiency of work and meet the ultimate goals of the organisation
- To apply 'Good Governance' principles as a key driving force of the organization, along with Corporate Social Responsibility (CSR) for stable and sustainable growth

Operating under these guidelines, the researcher's wanted to study the variables that influence PEA's ability to achieve these goals as well as other factors in achieving both a national and regional power management system and the resultant effects on consumer users.

CONCEPTUAL DEVELOPMENT

Customer satisfaction: Customers today are demanding more knowledge about a product or service while simultaneously requiring more attention. Increasingly, firms are shifting their focus

to the customer, hence the rising importance of Customer Relationship Management (CRM). With the rapid growth of electronic business and proliferation of Internet-based services, a new concept wascreated which today is referred to as electronic Customer Relationship Management (e-CRM) which encompasses all the processes needed to acquire, build and maintain customer relationships through e-business operations. Important CRM concepts such as customization, personalization, making the customer less passive and more active, many-to-many marketing are either enabled or made easier to implement with e-CRM tools (Khalifa and Shen, 2005).

Business is moving online, not as a matter of choice but as a matter of necessity and in a study concerning the effects of electronic customer relationship on customer satisfaction on the banking sector in Saudi Arabia (Abdulfattah, 2012), it was found that e-CRM enables banks to provide appropriate service and products to satisfy the customer and enhance customer loyalty. Furthermore, e-CRM features are vital for managing customer relationships online and enhancing customer satisfaction and service quality. Satisfaction in the service process is not the result of any one factor but instead there are many factors at each stage of the service that affects customer satisfaction. Management efforts necessary to close these gaps include paying attention to employee efforts to keep customers satisfied with frequently used services.

According to Limayem *et al.* (2007) customer satisfaction is the key to retaining customers using a product or service. Moreover, this satisfaction holds a positive correlation with online repurchase intention. Shelly (1975) concluded that satisfaction theory deals with two types of feelings, positive and negative feelings with most feelings fall into these categories. A positive feeling is one which when increased tends to lead to an increase in happiness and other positive feelings. Happiness is distinguished from other positive feelings by its feedback pattern, indicating that it is a more comprehensive feeling, having a greater influence on the person's life.

The study by Tsai and Huang (2007), found that with the increase in overall customer satisfaction, a parallel increase in the customer's desire to purchase and use it also occurs. Tien *et al.* (2012) determined that the perception of quality and the recognition of the value of the service has a direct and positive influence on customer satisfaction and also influences the service in the future or the intention to repeat the purchase.

This corresponds to Ahmed *et al.* (2010) who stated that organizations always look forward to long lasting success. For long lasting benefits and greater returns organizations continuously try to satisfy their customers in order to retain them and get their future repurchase intentions.

Electronic Customer Relationship Management (e-CRM): Today, enterprise management systems have become the tool of choice due to the ability to raise service quality and build better consumer relationships while managing related operations more efficiently. In this era of customer-oriented industries, many companies have implemented Electronic Customer Relationship Management (e-CRM) as a link between businesses and customers (Chen *et al.*, 2011). Obtaining customer data assist companies in understanding customer needs and identifying appropriate strategies for effectively performing data analysis. The e-CRM simulates innovation capability, product innovation processes and customer value. As a result, firms can effectively enhance customer satisfaction and maintain customer relationships which in turn play a critical role in helping businesses achieve competitive advantages and long-term goals.

Electronic Customer Relation Management (e-CRM) is a technology tool that has been used to manage the information system applications and communication technology to increase the size and scope of customer service and due to it being an Internet technology marketing tool, helps with

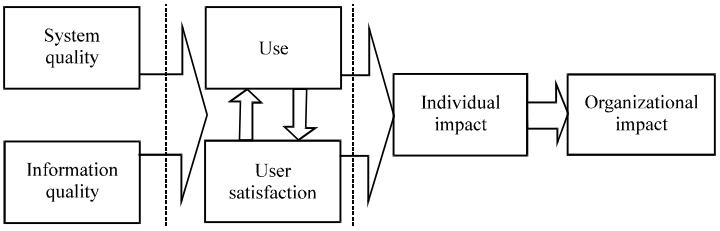

Fig. 1: D and M IS Success Model (DeLone and McLean, 2003)

finding, building and improving long-term relationships with customers, improving an organization's overall potential performance (Blery and Michalakopoulos, 2006).

In a full-scale field survey of 684 customers of Thai commercial banks by Sivaraks *et al.* (2011) it was illustrated that e-CRM implementation has a statistically significant positive relationship with customer-based service attributes and with the quality and outcome of customer-bank relationships as well as an indirect effect on relationship quality and outcome through customer-based service attributes.

This is consistent with the 10-year update to the DeLone and McLean (2003) IS Success Model (Fig. 1) in which e-CRM or system and information quality relates directly to organizational impact. In the updated model "Service quality" was added as an important dimension of IS success given the importance of is support, especially in the e-commerce environment where customer service is crucial. "System use" was also determined to be a critical dimension of IS success measurement.

Today, in power utilities, customer relationship management has taken on a new form from the older, well-known e-CRM systems from the past. In Thailand in particular, a 'Smart grid' electronic system is being deployed using a variable generation of technologies by providing operators with real-time system information that enables them to manage generation, demand and power quality which in turn helps them support the utility consumer (WEF, 2012). This, in turn, serves to improve system flexibility and maintain stability and balance (IEA, 2011).

Service quality: In the literature output there is aconsensus that service quality is a critical determinant of companies' performance and long-term growth (Bolton and Drew, 1991; Gale and Wood, 1994). Service quality has a direct and positive impact on consumers affecting their satisfaction which afterwards leads to customer word-of-mouth, attitudinal loyalty and purchase intentions (Gremler and Gwinner, 2000). In service quality there are many interesting and not clarified questions concerning how perceived service quality is formed which is an ongoing and interesting field of research in management and marketing.

A widely used model of service quality was developed by Parasuraman *et al.* (1985). From the study, the researchers developed 'SERVQUAL' which was a service quality model which assessed service quality along five dimensions via a forty-four question customer survey. A key element of the original SERVQUAL was the "Gap model" of service quality, defining service quality as the difference between a customer's expectations of service and the actual service. Subsequent to this, electronic service quality or e-service quality, was stated to refer to the quality experienced by the user of a service delivered via the Internet (Springer *et al.*, 2010).

Organizations deploy various methods at being successful but one group's method might not necessarily be successful elsewhere. Indeed, as Buzzell and Gale (1987) and Gronroos (1990) stated: 'Quality [of service] is whatever the customers say it is and the quality of a particular service ... is what the customers perceive it to be.'

The meaning of Service Quality can also be classified as two types; (1) Technical Quality refers to the relationship of the results to what the client receives from the service and being able to measure it with the assessment of Product Quality and (2) Functional Quality which is related to the process of evaluating which is in line with Crosby (1988) who stated that Service Quality is a concept that holds to the idea of DRIFT or "Doing it right the first time" and further stated that "Quality is free" with zero defects. This is also consistent with the study by Angelova and Zekiri (2011) 'Measuring Customer Satisfaction with Service Quality Using American Customer Satisfaction Model (ACSI Model) which they found that Service Quality and Customer Satisfaction are very important concepts.

From the above conceptual review and development, the researchers developed the following hypotheses for the study:

- **H1:** Service Quality affects Electronic Customer Relationship Management (ECRM)
- **H2:** Service Quality affects Customer Satisfaction
- **H3:** Electronic Customer Relationship Management (ECRM) affects customer satisfaction

MATERIALS AND METHODS

Data collection: Schumacker and Lomax (2010) stated that Structural Equation Modeling (SEM) uses a variety of models to show the relationships between observed variables with the same basic goal of providing a quantitative test of a theoretical model hypothesized by a researcher. The models developed using SEM can be tested to show how sets of variables define concepts and how they are related. The goal of SEM is to determine the extent to which the model is supported by the data that is gathered during research (Schumacker and Lomax, 2010) and since SEM is capable of statistically modeling and testing complexphenomena, it has therefore become the preferred method for confirming (or not) theoretical models, quantitatively. Another very important consideration is the intended sample size with most authorsrecommending a sample size of at least 100 to generate good results (Cunningham, 2008; Schumacker and Lomax, 2010; Weston and Gore Jr., 2006; Worthington and Whittaker, 2006), therefore a sample size smaller than 100 should not be used as it is unreliable and consequently SEM should notbe used (Meldrum, 2010).

As such, this study drew upon the base of the industrial users under PEA's domain and selected those entities with some form of electronic communications with PEA. From the sample size determined by Schumacker and Lomax (2010), the researchers used the 10-20 sample size suggested for each variable. As the research consisted of 9 variables, a minimum of 90 samples were deemed as acceptable of which 100 were obtained.

Questionnaire design: Quality and content was monitored with tools used in the study and as a measurement of quality. Both content validity and reliability was assured by 5 experts in their respective fields with an evaluation index consistent with the content and the purpose of the research. Additionally, the index of Item-Objective Congruence (IOC) developed by Rovinelli and Hambleton (1977) was employed to carry out the screening of questions. The IOC is a procedure used in test development for evaluating content validity at the item development stage. This measure is limited to the assessment of unidimensional items or items that measure specified composites of skills. The method prescribed by Rovinelli and Hambleton (1977), results in indices of item congruence in which experts rate the match between an item and several constructs

assuming that the item taps only one of the constructs which is unbeknownst to the experts. The research then proceeded to select items that with an IOC index higher than 0.5 which were considered acceptable.

Questionnaires were constructed to be a tool to measure concept definition and practice. The instrument or questionnaire used the 7-Point (Likert, 1972) as the measurement scale and the conceptual framework for determining the internal consistency measured by coefficient alpha (α-coefficient) of Akron BAC (Cronbach) to calculate the average value of the correlation coefficient which ranged from 0.725-0.856 which were considered to be highly reliable as all values lower than 0.50 were eliminated from the measurement.

Measurement (dependent variable)

Customer satisfaction (satisfaction): Analysis used as a measurement instrument or questionnaire utilizing a 7-Point (Likert, 1972) and was constructed with the scales developed enabling measurement of Service System (CRM_SYSTEM) and Customer Satisfaction (CRM_TOTAL) (Khalifa and Shen, 2005; Abdulfattah, 2012; Limayem *et al*., 2007; Shelly, 1975; Tsai and Huang, 2007; Tien *et al*., 2012; Ahmed *et al*., 2010).

Independent variables

Electronic Customer Relationship Management (CRM): Analysis used as a measurement instrument or questionnaire a 7-Point (Likert, 1972) and was constructed with the scales developed enabling measurement of Customer-Centric Services (CRM_C) and Value Added Services (CRM_V) (Chen *et al*., 2011; Blery and Michalakopoulos, 2006; Sivaraks *et al*., 2011; DeLone and McLean, 2003; WEF, 2012; IEA, 2011).

Service Quality (quality) analysis used as a measurement instrument or questionnaire a 7-Point (Likert, 1972) and was constructed with the scales developed enabling measurement of Customer Feedback (Q_RES), Customer Confidence (Q_CON) and Customer Care (Q_EMT) (Bolton and Drew, 1991; Gale and Wood, 1994; Gremler and Gwinner, 2000; Parasuraman *et al*., 1985; Buzzell and Gale, 1987; Gronroos, 1990; Crosby, 1988; Angelova and Zekiri, 2011).

RESULTS

Partial Least Squares has been applied for analysis of quantitative data by the researcher. It is data analysis for Confirmatory Factor Analysis (CFA) relating to the determination of manifest variable and latent variable and testing of research hypothesis exhibiting in structural model analyzed by using the applications of PLS-Graph (Chin, 2001). According to the analysis result of scale validity and reliability, scale investigation was conducted using internal consistency measurement coefficient alpha (α-coefficient) of Akron BAC (Cronbach) to calculate the average value of the correlation coefficients which rangedfrom 0.725-0.856 which is considered to havehigh reliability.

In case of measure variables with reflective analysis, convergent validity has been conducted. Loading is used as consideration criteria and must be positive quantity and indicator loading has been more than 0.707 and all values have been statistically significant ($|t| \geq 1.96$) representing convergent validity of scales (Lauro and Vinzi, 2004; Henseler *et al*., 2009; Wingwon and Piriyakul, 2010) and analysis results as shown in Table 1.

Service Quality (Quality) factors underlying the external variables influencing the Customer Feedback (Q_RES), Customer Confidence (Q_CON) and Customer Care (Q_EMT) with values of

Table 1: Statistic values presenting convergent validity of reflective scales of latent variables

Construct/Item	Loading	t-stat
Service quality (Quality)		
Q_RES: Customer feedback	0.976	402.659
Q_CON: Customer confidence	0.963	157.007
Q_EMT: Customer care	0.956	220.706
Electronic Customer Relationship Management (CRM)		
CRM_C: Customer-centric services	0.976	256.234
CRM_V: Value-addedservices	0.976	306.043
Customer satisfaction (Satisfaction)		
CRM_SYSTEM: Service system	0.979	362.684
CRM_TOTAL: Customer satisfaction	0.978	347.435

Table 2: Results of Confirmatory Factor Analysis (CFA) for measurement model

				Cross construct correlation		
Constructs	CR	R2	AVE	Service quality	ECRM	Customer satisfaction
Service quality	0.976		0.931	0.965		
ECRM	0.976	0.792	0.952	0.890	0.976	
Customer satisfaction	0.978	0.746	0.958	0.802	0.860	0.979

CR: Composite reliability, R^2: Square of the correlation, AVE: Average variance extracted, statistical significance level is at 0.01 and diagonal figures mean $\sqrt{AVE}$

0.976, 0.963 and 0.956, respectively and a significant level of confidence level of 95 (t-stat >1.96) which considers such factors highly reliable. Service Quality (Quality) has an effect on Electronic Customer Relationship Management (CRM) (Fig. 2).

Electronic Customer Relationship Management (CRM) factors underlying the external variables influencing the Customer-Centric Services (CRM_C) and Value-added Services (CRM_V) with values of 0.976 and0.976, respectively and asignificant level of confidence level of 95 (t-stat >1.96) which considers such factors highly reliable. Electronic Customer Relationship Management (CRM) influences Service Quality (Quality) (Fig. 2).

Customer Satisfaction (Satisfaction) factors underlying the external variables influencing the Service System (CRM_SYSTEM) and Customer Satisfaction (CRM_TOTAL) with values of 0.979 and 0.978, respectively and asignificant level of confidence level of 95 (t-stat >1.96) which considers such factors highly reliable.

Therefore, the researcherstook theseven variables Customer Feedback (Q_RES), Customer Confidence (Q_CON), Customer Care (Q_EMT). Customer-Centric Services (CRM_C), Value-added Services (CRM_V), Service System (CRM_SYSTEM) and Customer Satisfaction (CRM_TOTAL) and usedthem in the structural equationmodel analysis (Fig. 2 and Table 3).

The reflective model in Table 1 shows the discriminant validity of the internal latent variables and the correlation of variables. It also depicts the scale reliability which has been analyzed from Composite Reliability (CR) as well as the Average Variance Extracted (AVE) and R^2. The CR value should not go below 0.60 and the AVE values should also drop below 0.50 and R^2 values should not be under 0.20 (Lauro and Vinzi, 2004; Henseler *et al*., 2009; Wingwon and Piriyakul, 2010). In Table 2 the Confirmatory Factor Analysis (CFA) of the independent variables of Service Quality and Electronic Customer Relationship Management on the dependent variable of Customer Satisfaction is shown.

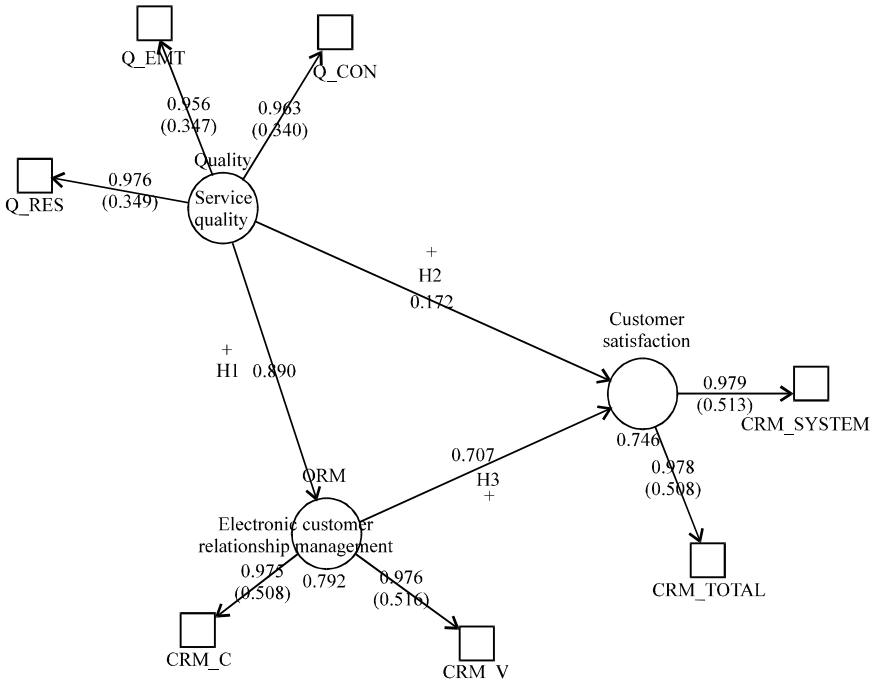

Fig. 2: Final model-analysis of factors that affect Thailand's Provincial Electricity Authority (PEA) customer satisfaction

Table 3: Research hypotheses test results

Hypotheses	Coefficient	t-stat	Results
H1: Service quality affects electronic customer relationship management	0.890	77.5395	Supported
H2: Service quality affects customer satisfaction	0.172	3.1415	Supported
H3: Electronic customer relationship manag ement affects customer satisfaction	0.707	14.4158	Supported

DISCUSSION

The results of the study concerning the influencing variables of ECRM and Service Quality on Customer Satisfaction in this study Thailand's Provincial Electricity Authority (PEA): A Structural Equation Model of Factors Determining Customer Satisfactionopened the door to an even larger discussion concerning global 'smart grid' systems as well as ASEAN energy growth, consumption and growth. Beyond the study's conclusions about the direct influences of both e-CRM and Service Quality on Customer Satisfaction, a related discussion about smart grid systems must also be addressed in the future.

Service quality has been addressed numerous times by many researchers but none probably seem as classic as the model of service quality developed by Parasuraman *et al.* (1985) in which the term 'SERVQUAL' has forever been imprinted in the literature. And with the growth of computers, networks and what today is termed the 'Internet' or 'web', electronic service quality or e-service quality has become the quality experienced by the user of a service delivered via the Internet (Springer *et al.*, 2010).

One also needs to be cautious however as organizations deploy various methods at being successful but one group's method might not necessarily be successful elsewhere. Indeed, as Buzzell and Gale (1987) and Gronroos (1990) state: 'Quality [of service] is whatever the customers say it is and the quality of a particular service ... is what the customers perceive it to be.'

In the literature output there is rather consensus that service quality is a critical determinant of companies' performance and long-term growth (Bolton and Drew, 1991; Gale and Wood, 1994). Service quality has direct positive impact on consumers affecting their satisfaction which afterwards leads to customer word-of-mouth, attitudinal loyalty and purchase intentions (Gremler and Gwinner, 2000).

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Electronic Customer Relation Management (e-CRM) is a technology tool that has been used to manage the information system applications and communication technology to increase the size and scope of customer service and due to it being an Internet technology marketing tool, helps with finding, building and improving long-term relationships with customers, improving an organization's overall potential performance (Blery and Michalakopoulos, 2006).

Thai commercial banks (Sivaraks *et al*., 2011) were found to have seen e-CRM implementation as a statistically significant and positive relationship with customer-based service attributes and with the quality and outcome of customer–bank relationships as well as an indirect effect on relationship quality and outcome through customer-based service attributes. This is consistent with the 10-year update to the DeLone and McLean (2003) IS Success Modelin which e-CRM or System and Information Quality relates directly to Organizational Impact.

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CONCLUSION

Under the Association of Southeast Asian Nations Economic Community Blueprint 2015 energy security was stated as a top priority. The 10 member community is projected to have a combined gross domestic product of US$ 1.9 trillion by 2020, making this economic block the eighth-largest economy worldwide. With the community's energy consumption rising at a projected 4.4% per year, Thailand with its 67 million people is a key player in both terms of power production, consumption and distribution and at the center of this is the Provisional Electricity Authority which has expanded electricity supply to 73 Thai provinces, covering 510,000 km^2 while servicing 99% of the country's total area and villages.

With the results of the research concerning the influencing variables of ECRM and Service Quality on Customer Satisfaction in this study Thailand's Provincial Electricity Authority: A Structural Equation Model of Factors Determining Customer Satisfaction opened the door to an even larger discussion concerning global 'smart grid' systems as well as ASEAN energy growth,

consumption and distribution and Thailand's role within it. Also, beyond the study's conclusions about the direct influences of both ECRM and Service Quality on Customer Satisfaction, a related discussion about smart grid systems must also be addressed in the future.

Given the critical importance of the PEA to both Thailand and the AEC (Asian Economic Community), the study found that service quality and electronic customer management systems had a direct effect on customer satisfaction. The PEA is not just a domestic supplier providing 99.4% of the total land area in Thailand but now an integral member of the larger southeast Asian grid and a critical component of power generation to the 600 million community. Additionally, given the rising importance of global energy 'smart grid' systems, PEA is now leading the implementation of this technology within the region and furthermore research is required concerning its implications and impact.

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