



# EVALUATING IMPACT OF IT INVESTMENTS ON CUSTOMER SATISFACTION: AN EMPIRICAL STUDY ON THAILAND'S MINISTRY OF TRANSPORT IT PROJECTS

Pisit Chanvarasuth<sup>1,\*</sup> and Veera Boonjing<sup>2</sup>

<sup>1</sup>Management Technology Program, Sirindhorn International Institute of Technology,  
Thammasat University, Pathumthani 12000, Thailand

<sup>2</sup>Department of Computer Science, Faculty of Science, King Mongkut's Institute of  
Technology Ladkrabang, Bangkok 10520, Thailand

\*e-mail: pisit@siit.tu.ac.th

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## Abstract

In this study, we examine the issue of IT investment impact on customer satisfaction which resulted from three determinants of service quality: timeliness, perceived reliability, and perceived ease of use. Empirically, we test the impact of IT investment on measurement such as responsiveness of services, reliability of services, and convenience for users which corresponding to customer satisfaction. We also conducted a survey on three government projects from the Ministry of Transportation and Department of Highways: E-exam, GPS, and GIS. Our results suggest that determinants of service quality for E-exam, GPS, and GIS have positive relationships with customer satisfaction. In addition, we found that higher IT investment could also have a positive impact on customer satisfaction. To conclude, our results illustrate the important of service quality improvement. Customer satisfaction depends heavily on the perceived level of quality delivered. The empirical results from IT related projects supported the proposition that one of the main factors creating and improving customer satisfaction is IT investments.

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**Keywords:** IT investment, service quality, customer satisfaction, Ministry of Transports

## Introduction

Although there are many attempts to quantify the contribution of IT investment to firm performance in both theoretical and empirical studies over the last two decades, the division still persists between academic and practitioners. While returns on IT investment have been reported in many studies, practitioners seem to be less certain about its contributions.

Recently, there are a number of precise measurements illustrated a positive relationship among IT investments, economic productivity, and business value across distinct measures, however, our knowledge of the specific factor driving these general results remain limited. Therefore, this study is motivated by the lack of understanding about the relationships between IT investments and firm performance measures in the literature. We believe that such a missing link may have contributed directly to the conflict findings in IT impact studies and the on-going IT productivity paradox debate (Brynjolfsson, 1993).

The major purposes of this study are to better understand the overview of IT investments, and also find the answer for the question: "How the government agency should spend in order to



generate efficient service quality that can eventually satisfy the customer?” We examine three selected IT projects invested by Ministry of Transport (MOT). Questionnaires were distributed to 336 Thai people asking their perspective on the government IT investment. Three government projects were chosen as candidates in this study. We categorize these three projects by using two criteria: 1) the project size (total budget invested in each project); and 2) the project type (information providing or transaction processing project). All of these projects are parts of several projects offered by Ministry of Transport considered as “e-government” project (Ministry of Transport 2011). Our results should be able to explain how IT projects invested by MOT succeeded. To examine this question, we first review the literature and present the conceptual framework. Next, we describe the methodology used to conduct our study. Finally, we present our research findings and conclusion.

## **Literature Review**

### *The Current Situation of IT investments in Thailand*

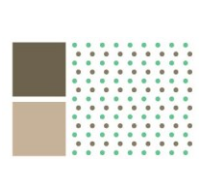
From the research of IT spending in Asia Pacific, Thailand is one of many Asia Pacific countries spending a great deal of money invested in IT (Weekes 2007). Thai government has spent over 755 million US dollars (approximately 26 billion baht) and estimate to be increased up to 1 billion US dollar in 2011. Approximately 33% was spent on education programs. In 2010, the proportion of government IT investments is roughly 21% of total IT investments in the whole country. Michael Barn (2010) estimated that IT investment in Thailand can expand up to 11-13%, of which over 60% came from hardware assets and the rests are IT services and software.

### *Relationships between IT Investment and Customer Satisfaction*

The relationships between people and government agencies are less direct comparing with relationships between customer and many businesses. In business, dissatisfied customers mean decreasing in sales and increasing chances for new competitors. On the other hand, for government agencies, people could express themselves only through elections. Moreover, the impact of dissatisfaction can take years unlike businesses that may take only a few months. As a result, there is a need for government agency to have a timely and effective method in order to assess satisfaction.

Some theoretical variables can determine the customer satisfaction at the firm level, for example, perceived quality, perceived value, and customer expectation (Anderson et al. 1997; Fornell 2001; Fornell et al. 1996). Perceived quality which captures recent consumption experience has two major components: 1) customization, the degree in which firm’s delivering service is customized to meet customer needs; and 2) reliability, the degree in which a product or service is standardized and free from deficiencies. Customer expectation refers to the perspectives of customer on recent consumption experiences as well as customers’ belief in the ability of the firm to deliver high standard and high quality services in the future.

Perceived value refers to customer’s perceived level of product or service quality according to the price paid. Various empirical studies on the relationship among these three determinants of customer satisfaction show that customer expectations do not play a significant role to affect customer satisfaction; rather perceived quality has a greater effect on customer satisfaction than perceived value (Fornell et al. 1996). Therefore, some researchers posit that quality, in this case, service quality, is a measurement of how well that service level



delivered matches customer expectation (Parasuraman et al. 1985). We, therefore, use timeliness, perceived reliability, and perceived ease of use to determine the service quality in order to indicate customer satisfaction.

Since our study has related to the financial figures on IT investment for each government project and the level of customer satisfaction, we constructed variables in order to indicate the relationship between the twos. The variables can be categorized into IT investments part and customer satisfaction. The IT investment consists of project size, project type, and determinant of service quality consists of perceived reliable, timeliness, and perceived ease of use.

### *Overviews of Three Selected IT-related Projects*

Three selected IT projects from Ministry of Transport are:

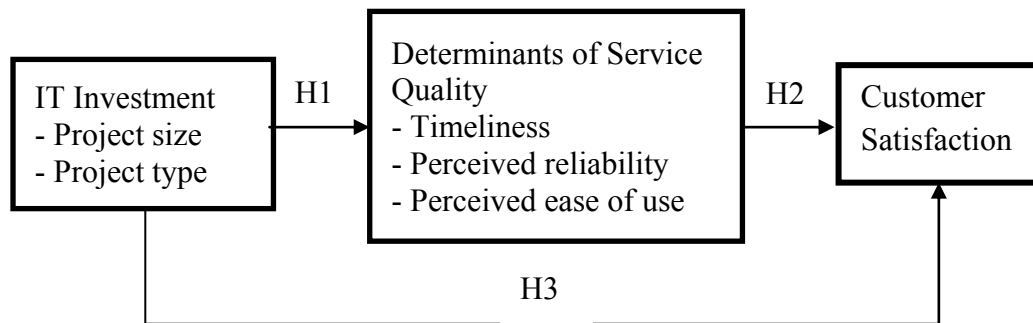
- 1) E-exam (Electronic examination): This is the largest project among all three selected projects. Its value is well over 32 million baht in order to improve the driver license testing system by using computer-based systems (Ministry of Transports Report 2011).
- 2) GIS (Geographic Information System): A system that generates a precise virtual map as well as provides user with information of any geographical location. For example, Ministry of Transports uses this system to store, analyze, and retrieve transportation data; to set the policies and manages the fundamental service network and public utilities in order to serve Thai people more efficiently. Thai government has invested approximately 11.047 million baht in this project. Therefore, we classify this project as the middle size project (Tienchot 2011).
- 3) GPS (Geographic Information System): This is the navigation system that the government is trying to install in all public transportation. It also can be used for managing station department in order to track the location more precisely. We consider this project as the smallest size among all three projects (Rodprasert 2007)

### *Service Quality*

Service quality is one of the most important and essential factors in customer aspects. The quality derived from services can deliver satisfaction to the customer and also build customer relationships as well as motivate customer retention that could create long-term relationship between the firm and the customer and eventually create customer loyalty. The term “quality” means the thing that customers are perceived (Gronroos 1990). In general, service quality is difficult to maintain because the service standard normally cannot be ensured to produce high quality. Since service is intangible in nature and depends upon the customer orders, their performance often varies from producer to producer, customer to customer, and day to day. Unlike goods that can be engineered and produced at a manufacturing plant and delivered to the customer, quality of service occurs during service delivery. While customer purchases and service deliveries happen, the errors seem to occur and cause customer dissatisfaction. As a result, it is beneficial for the marketers if they could understand the gap between service quality and customer expectation.

## Research Model and Hypotheses

Our conceptual model comprises of three major factors: IT investment determinants of service, and customer satisfaction. IT investment consists of project size and project type. The determinants of service quality consist of perceived reliability, timeliness, and perceived ease of use. The final factor, customer satisfaction, will be affected by determinants of service quality. These variables are corresponding with the study of Liu et al. (2010) on e-government service (see Figure 1):



**Figure 1** Research model

### *Project Size*

We divided all projects into three categories: small, medium, and large investment projects. Then, we calculate the investment ratio. These ratios provide a measurement of relative size of IT investment compared to the actual service output in three determinants of service quality which lead to customer satisfaction.

### *Project Type*


We classify our three projects into 2 major types: information providing and transaction processing projects in which e-exam is categorized as a transaction processing project. This project type concerns about tracking record of the customer when he/she does the test, and also process the result which will be kept into the central database. The result will be shown up immediately as it is processed.

GIS and GPS projects are categorized as information providing projects, In fact, GIS and GPS projects can be used together to provide geographical information. Moreover, the combination of these two projects could help customer to locate and navigate the route path to the destination. We also use this variable to measure against three determinants of service quality and customer satisfaction

### *Determinants of Service Quality*

*Timeliness:* Timeliness variables refer to the measurement of the length of time; whether the products or services arrived to customers in the promised time (Mentzer et al. 2001). Furthermore, Maloney (2002) stated that timeliness of service involved with responsiveness which concerns the willingness or readiness of employee who provides service.

*Perceived Reliability:* The important of services trustfulness and usable information is widely acknowledged; because the services must provide information that can be accessed efficiently with least effort by end users (Liu et al. 2010).



*Perceived Ease of Use:* This variable is defined as how easy the government service is for customer to gain access and understand the processes of services. Ba and Johansson (2008) stated that perceived ease of use is dictated by what the system can do and what it allows its customer to do. Therefore, in the case of government services, which consist of website and e-service technology, ease of use measure capabilities embedded in that. A previous study regarding consumer acceptance of virtual stores indicated that the website with poorly designed processes will lead to a negative influence on the website's perceived ease of use (Chen et al. 2004).

## Customer Satisfaction

We define customer satisfaction as a measure of how products and services supplied to a customer need or surpass customer expectation (Shi 2006). There are a number of studies defined customer satisfactions as a post-consumption evaluation judgment concerning product or services (Churchill and Surprenant 1982). In addition, early researches in the 1980s revealed that "satisfaction is obviously more complex and the measurement issues are numerous and cannot determine exactly what criteria to be measured" (Cooper et al. 1989). A number of marketing researches have noted that there are a lot of theoretical variables or constructs that can determine customer satisfaction at the firm level such as perceived quality, perceived value, and customer expectations (Anderson et al. 1997; Fornell 2001).

Hence, according to both IT investment and customer satisfaction variables mentioned above, we try to examine the relationships by hypothesizing that larger size of IT investment; in this case, the spending on E-exam, GPS, and GIS projects, would have some positive relationship or, in other word, more budgets each project spent means higher levels of service quality would appear and can be perceived by customers. Therefore, we hypothesize:

*Hypothesis 1: IT project with higher investments will lead to higher average score for determinant of service quality*

We expected that the result of these determinants would depict and exhibit the positive relationship between customer's perceived service quality and the level of customer satisfaction. Hence, this above discussion leads to our hypothesis 2:

*Hypothesis 2: Determinants of service quality for each project have a positive relationship to the customer satisfaction*

We lastly hypothesized that the project with larger amount of investment leads to a better result of overall customer satisfaction for a certain project. Thus, our final hypothesis is as follows:

*Hypothesis 3: If there is a positive relationship, then IT project with higher investments will also lead to the higher average score of overall customer satisfaction*

## Methodology

We conduct a survey focusing on an impact of IT to the public and how the Ministry of Transport can be success in launching new IT projects. The survey instrument was designed and pilot tested was also conducted.

## Results and Discussion

In order to analyze customer satisfaction and factors affecting customer satisfaction, we apply the criteria below:

Average score of	4.50-5.00	defined as	most satisfied
Average score of	3.50-4.49	defined as	satisfied
Average score of	2.50-3.49	defined as	medium
Average score of	1.50-2.49	defined as	less satisfied
Average score of	1.00-1.49	defined as	least satisfied

Hypothesis 1 and 3 were tested by analyzing customer satisfaction and factors affecting customer satisfaction which is determinant of service quality (independent value) of the respondent by finding the average and standard deviation. Pearson's Correlation Coefficient was calculated. Corresponding with the study by Wong-rattana (1998), the criteria used to analyze correlation coefficient are as follows:

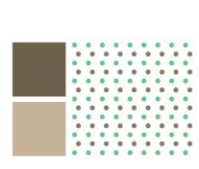
**Table 1** Criteria for correlation coefficient (r)

Correlation Coefficient (r)	Relationships
0.91-1.00	Very high
0.71-0.90	High
0.31-0.70	Medium
0.30 or lower	Low
0.00	No relationships

**Table 2** The average score of customer satisfaction and determinants of service quality for E-exam

	E-Exam Project			GIS Project			GPS Project		
	$\bar{X}$	S.D.	Satisfaction level	$\bar{X}$	S.D.	Satisfaction level	$\bar{X}$	S.D.	Satisfaction level
Overall customer satisfaction	3.67	.98944	Satisfied	2.75	1.295	Medium	3.01	1.142	Medium
Perceived reliability	3.81	1.098	Satisfied	2.90	1.410	Medium	3.06	1.464	Medium
Perceived ease of use	3.58	1.198	Satisfied	2.79	1.290	Medium	2.98	1.211	Medium
Timeliness	3.60	1.167	Satisfied	2.62	1.280	Medium	2.85	1.190	Medium

The results, as shown in Table 2, illustrate that E-exam has the highest determinants and overall customer satisfaction score. E-exam is in a satisfied level followed by GIS and GPS project respectively. Both projects achieve medium satisfaction level. It is obvious that the E-exam, the highest IT investment project, provided the customer with a high service quality and better IT application served to users and/or customers. While GIS and GPS system which involved telecommunication system via satellite may work too slowly. As a result, many users do not satisfy with them. In addition, there are many people suggest to launch 3G networks in Thailand as soon as possible in order to improve the signal strength and its coverage. Our results also indicate that the government or the responsible agency also should spend more capital to improve Thai telecommunication system.



E-exam, GIS, and GPS projects' determinants of service quality are all correlated to customer satisfaction with significant level at  $p < 0.01$ . Furthermore, all determinants of service quality for E-exam, GIS, and GPS also have a positive relationship to the customer satisfaction.

Three factors of determinants of service quality for e-exam have an ability to predict customer satisfaction at 95.8% of the variance (R square = 0.958), GIS has 94.3% (R square = 0.943), and GPS has 94.9% (R square = 0.949) respectively. The minor details for each project are listed below:

E-exam system:

$$Z' = 0.341(\text{PR}) + 0.394(\text{PEU}) + 0.341(\text{PT})$$

GIS system:

$$Z' = 0.418(\text{PR}) + 0.384(\text{PEU}) + 0.231(\text{PT})$$

GPS system:

$$Z' = 0.426(\text{PR}) + 0.352(\text{PEU}) + 0.270(\text{PT})$$

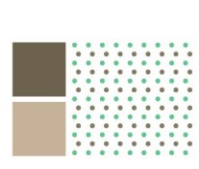
Our results also show that the relationships are very strong. It implies that if customers have high perception of each determinant of service quality, they will definitely have the same level of customer satisfaction. The result of the statistical analysis for E-exam project indicated that perceived ease of use has the highest effect on customer satisfaction which means that customer would prefer to have a test on a very convenient system when they do the test with the new system rather than the old one that was in paper form. The regression standard score for GIS and GPS indicated that perceived reliability has the highest effect on customer satisfaction which means that the satisfaction relies heavily on reliability of the service. Customers also weight more value on reliability and usefulness of the system. As mentioned above, the telecommunication service for GIS and GPS needs to be improved in order to leverage the IT service quality.

The result also indicated that the size of IT investments alone may not sufficient to promote IT project to be widely known by many customers. Our result shows that the number of respondents who do not even know about E-exam is 24.4%, followed by GIS that is 27.7% and GPS that is only 13.8%. The other factors may possibly be the age because E-exam is one of the many recent technology used for only a few years, and the people who has age range from 30 or above might not have a chance to use.

## Conclusion

This study has investigated determinants of service quality and a result of customer satisfaction of services from government sector. The study has constructed the model to reflect customer satisfaction and IT investment attributes. Customer satisfaction is considered to be a good way to increase the government service usages which is a key element to measure effectiveness of a government project.

We found that timeliness, perceived reliability, and perceived ease of use are important factors that influence customer satisfaction and could create customer loyalty. IT investments also affect the level of service quality that perceived by customers. The result of customer satisfaction analysis in IT investments has shown that E-exam has the highest determinants and overall customer satisfaction score compared to both GIS and GPS which all are in satisfied level. It is apparent that e-exam that has the highest investment in IT resulted in high



service quality and IT application served to the users or customers, while GIS and GPS system involving telecommunication system via satellite may work slowly and many users still not satisfied with them.

For each project type, E-exam, a transaction processing project, achieves the highest customer satisfaction. The score for determinants of service quality is also the highest compared to GPS and GIS project which are information providing projects. Therefore, we can conclude that the investment on E-exam project directly improves more in service quality. Customers can perceive more value compared with information providing project which still do not focus much on improving service quality.

This study suggested that IT investment could leverage service quality but once the technology becomes common, the firm may loss competitive advantage derived from IT. The result of this study seem satisfied but marketing aspect such as Integrated Marketing Communication was found to play a significant role helping in terms of promoting, public relating and advertising that can create more customer awareness and demands.

For further study, we are seeking to refine and come up with an appropriate definition of organizational performance related to each type of IT investment. In the field of strategic marketing research, we might be able to understand effectiveness of an IT investment in a larger scale of cross-sectional firm such as manufacturing and servicing firm. Therefore, future research needs to take into account problems of comparing investment levels across industries.

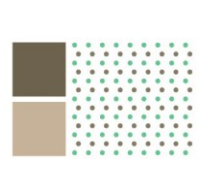
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