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Organizational Structure and Technology Acceptance of RFID Technology on Performance Management: A Structural Equation Model of the Bangkok Bus Transit Systems

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ABSTRACT
From Moscow to Bangkok, the world's busiest transit systems use Automatic Fare Collection (AFC) systems based on RFID (Radio Frequency Identification). Sweden using RFID, oversees a 13,000 km network of trains and track keeping the heavily used mechanical equipment from breaking. With RFID Technology being heralded as a prime solution to the problem of real-time tracking in the transportation arena, the researchers therefore undertook a study to discover the factors influencing the performance management of a 'smart grid' bus system within the Bangkok Metropolitan area by use of a structural equation model. Since, mass transit systems are a critical component of urban environments today, adoption of RFID technologies as a tool to help manage transportation networks can have far ranging advantages, including preventive maintenance, cost savings, convenience, safety and commuter time savings. Organizations can reduce operational costs as well lowering trip cycles. They can also reduce transit times per round trip and know in real time when a vehicle has been deployed. Additionally, the RFID market has huge potential to technology forms as it has increased from USD $6.51 billion in 2011 to $9.2 billion in 2014, projecting to reach globally in 2024 $30.24 billion. Thus far Thailand has been a small player in both consumer terms and technology implementation. Understanding the affects might aid in its implementation and use. The study determined that both organizational structure and technology acceptance had a direct and positive effect on performance management.

Key words: RFID, technology acceptance, performance management, organizational structure

INTRODUCTION
Motivated by the increasing competition in global markets, companies have started to grasp the importance of technological innovation, since swiftly changing technologies and severe global competition rapidly erode the value added of existing products and services. With this rapid change comes new technologies which when embraced, can often times save time and create greater conveniences. One such tool is RFID technology used in public transportation systems.

There is always a constant pressure for the betterment of the customer service, security, safety and contentment while streamlining the process of commuting. The topic of radio frequency identification-RFID, for short is a phenomenon. RFID technology was first used in World War II for identification as a 'friend or foe' (IFF) system and has been available in one form or another since the 1970's. There is no one definitive "RFID technology" but instead there is a wide range of technical solutions ranging from simple, inexpensive and common to those with more functionality, performance and cost. RFID is part of our daily lives, used in car keys, toll tags and access cards (DHS, 2007).

Although, RFID is still far from widespread mass application, in debates on economic and innovation policy RFID has rapidly emerged as an area of great promise for industry and retail. The significance of RFID is borne out by downright explosive growth in the use of RFID tags which is projected to increase 450-fold over the next ten years (Bovenschulte *et al*., 2007) with the entire RFID market increasing from $6.51 billion in 2011 to $7.67 billion in 2012 (Harrop and Das, 2013), reaching $9.2 billion in 2014 with a projected global RFID market worth $30.24 billion by 2024 (IDTechEx, 2014).

In retail, RFID is seeing rapid growth for apparel tagging-that application alone demands 3 billion RFID labels in 2014-which still has some way to go with RFID penetrating about 7% of the total addressable market for apparel in 2014. The tagging of animals (such as pigs, sheep and pets) is now substantial as it becomes a legal requirement in many more territories, with 425 million tags being used for this sector in 2014. This is happening in regions such as China and Australasia. In total, 7.1 billion tags will be sold in 2014 versus 5.9 billion in 2013. Most of that growth is from passive UHF RFID labels, with UHF tag sales overtaking HF and LF tag sales by volume in 2012. However, in 2013 UHF tag sales by value will only be 11% of the value of HF tag sales (Fig. 1).

RFID in the form of tickets used for transit will demand 700 million tags in 2014 (Harrop and Das, 2013). Thailand could add to that count if it followed Sweden's example of using RFID to oversee Sweden's 8,000 mile (13,000 km) network of trains and track. Thailand has had a consistent and frustrating series of train derailments due to the age and quality of both equipment and material (Hynes, 2013).

Like Thailand however, Sweden had a formidable task of keeping the heavily used mechanical equipment from breaking. Knowing that preventative maintenance was key to providing uninterrupted service and controlling costs, Sweden developed a radio frequency identification solution to monitor the condition of wheels, axles and other equipment by identifying each vehicle with RFID and obtaining exact measurements making it now possible to detect problems early which results in a huge cost savings related to avoiding damage to tracks and a diminished risk of a derailment due to an equipment failure (Greengard, 2013). In addition, more effective operations will lower the carbon footprint for rail transportation and the technology will play a key role in taking railways into the 21st century.

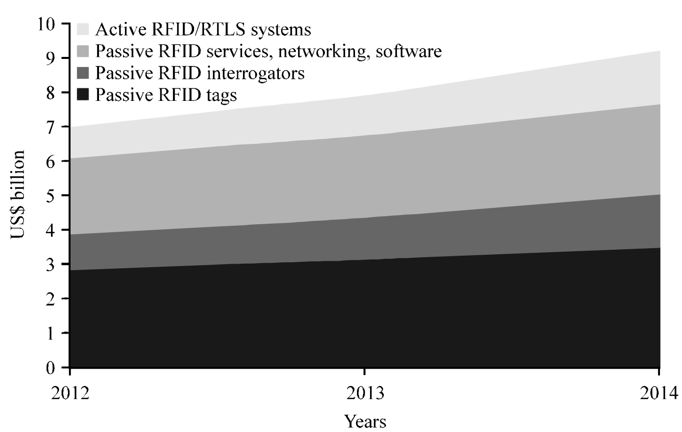

Fig. 1: Total RFID market projections in USS billions

In the Moscow Metro System which is one of the world's busiest metro systems, with 12 lines and 172 stations, an Automatic Fare Collection (AFC) system was implemented based on RFID technologies. Moscow's population is just under 9 million and every day the metro system carries more than 8 million passengers, with time being a major concern for many urban commuters.

Using RFID Moscow's Metro System speeded up journey times and cut down on ticket fraud while also increasing reliability. Every month, passengers consume millions of tickets equipped with RFID inlays. With the new system in place, passengers use an RFID ticket that can be tracked by an RFID reader as they enter the boarding area. This means: Reduced congestion, less delays and fewer headaches for the millions of people using the metro (Swedbergm, 2007).

While manufacturers currently employ two forms of automated data collection: Barcodes and RFID systems; there is much hype as to whether RFID will end up taking over the barcode. One data collection method is not essentially better than the other; they do both carry product information however both differ a great amount.

Radio frequency-identification technology (RFID) involves a tag affixed to a product which identifies and tracks the product via., radio waves. These tags can carry up to 2,000 bytes of data. This technology has three parts: A scanning antenna, a transceiver with a decoder to interpret the data and a transponder (RFID tag) pre-set with information. The scanning antenna sends out a radio-frequency signal providing a means of communication with the RFID tag. When the RFID tag passes through the frequency field of the scanning antenna; it detects the activation signal and can transfer the information data in holds to be picked up by the scanning antenna. Advantages of RFID technology include the following (LMH, 2012):

- Can read RFID tags from a greater distance than barcodes
- RFID tags don't need to be positioned in a line of sight with the scanner
- RFID tags can be read at a faster rate than barcodes; as approximately 40 RFID tags can be read at the same time
- RFID tags can work within much greater distances; information can be read from a tag at up to 300 ft
- RFID tags are read/write devices
- RFID contain high levels of security; data can be encrypted, password protected or set to include a 'kill' feature to remove data permanently
- RFID tags carry large data capabilities such as product maintenance, shipping histories and expiry dates; which can all be programmed to the tag
- Once these are set up; it can be run with minimal human participation
- RFID tags are more reusable and rugged as they are protected by a plastic cover

Current RFID technology is good and when applied along with supply chain management and logistics in various businesses and industry, characteristics of the products available are extremely diverse. In process management, the selection of RFID, particularly as an internal management process, helps with distribution and services. It also helps with standardizing procedures and reducing redundancy. It also increases the ease of management.

Azevedo and Carvalho (2012) explored the deployment of RFID technology in Fashion Supply Chain Management (FSCM) and concluded that RFID in FSCM supported faster logistics activities, with greater product quality along with lower costs. It also aided more responsiveness while improving customer satisfaction. It was however mentioned that the main barrier to the deployment of RFID was the problem of interoperability and the costs associated with the technology.

RFID has also been considered in Free Trade Agreements (FTA) as well because of the need to reduce the overwhelming reliance on system documentation. RFID's newer technology increases competitiveness over the use of older barcodes.

As technological capability has developed in Thailand over the past four decades, factors contributing to maintaining or enhancing the competitiveness of corporate and national competitiveness has been to a certain extent, unsuccessful. Furthermore, the potential for using technology to make the country greater has been diminished to by being unable to further develop scientific knowledge and technology. As a result, innovation, especially innovative technologies, are an important component of the race to the top.

For these reasons, whether in small, medium or large corporate enterprises, or on production lines or service establishments, or even government organizations, they must all rely on technology as an inevitable consequence of global competition while maintaining a business presence in a global market that competes with intellectual capital.

Public transport systems come in many forms including buses, taxis, boats, trains, vans, etc. In Thailand, bus transportation is ranked first as the most important form of public transportation within the country. However, bus transportation has been faced with many problems, with safety being a high concern (Wattanasukchai, 2014).

One of the major issues in using a passenger bus service on a regular basis is the problem with traffic density and congestion as well as poor and unsafe driver services. This makes the service very unsafe in terms of quality of service. As can be seen from the daily news or from personal observation buses often stop in places with unmarked bus stops that are unsafe for the loading and unloading of passengers. Additionally, bus schedules are notoriously erratic which causes serious inconvenience to commuters nationwide.

RFID technology however has been known to be one of the noteworthy converging technologies of the 20th century. The application of RFID in Intelligent Transport Systems (ITS) is gaining popularity with its widespread use in the field of toll management and the management of the overall transport sector (Fig. 2). There are many RFID applications available in the market such

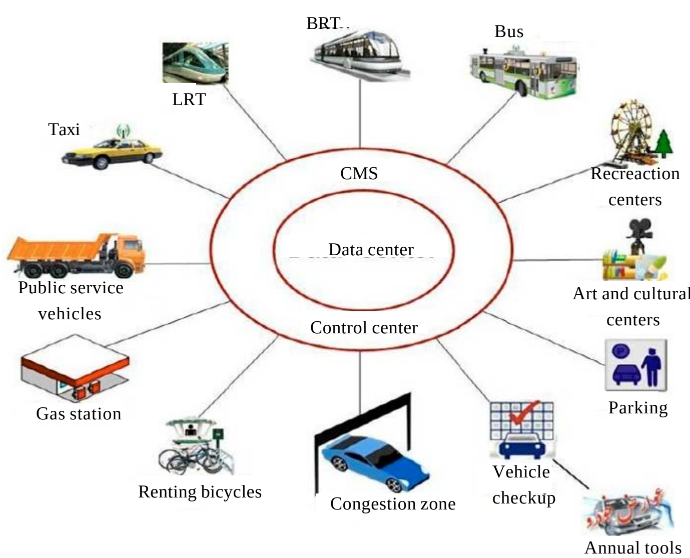

Fig. 2: RFID to control management system applications (Samadi, 2013)

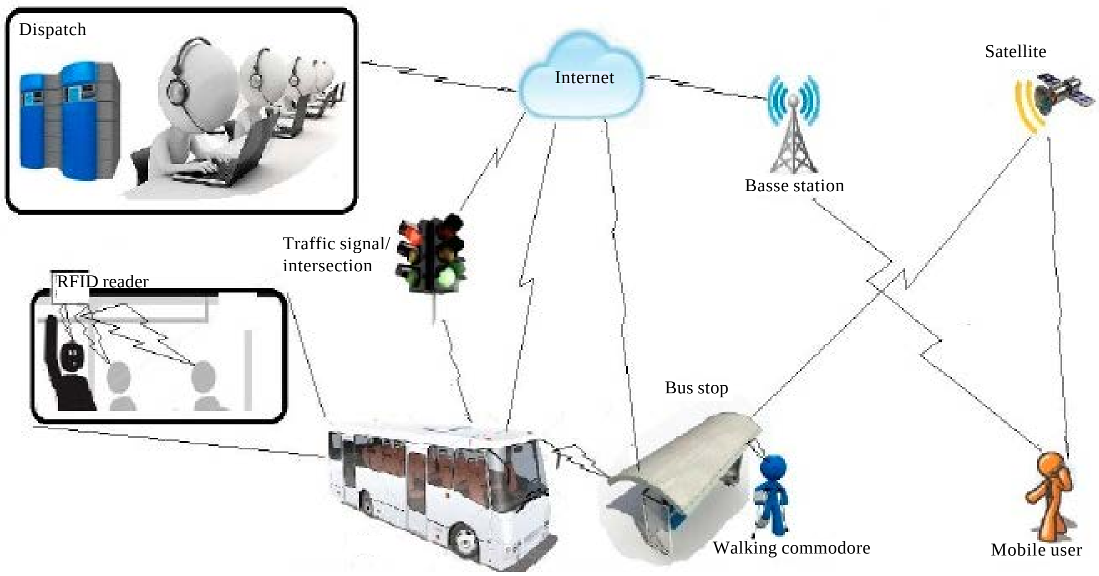

Fig. 3: Conceptual architect of a RFID bus transit system (Hamilton and Sankaranarayanan, 2013)

as RFID contactless smart card commonly used in buses and LRTs, Automatic Vehicle Identification (AVI), Electronic Toll Collection (ETC), smart parking and congestion zone pricing (Samadi, 2013).

Thailand's public and private Bangkok bus transit systems need to embrace RFID technologies. What is needed is a bus system that is more secure, safe and efficient if we wish to increase productivity of the daily commuters. There must also be a heavy focus on increasing commuter safety through a process of driver education with higher safety standards and road awareness. There must also be a process to help with the routing of vehicles around major traffic congestion and road hazards such as accidents and road construction projects.

The above bus transportation systems in Bangkok are increasing in ridership more every day. As road congestion increases, safety, quality and time become ever more increasing issues for both commuters and drivers. This is the reason why the researchers have undertaken this study to research the variables affecting performance and schedule management by organizations and companies that implement and use RFID technologies. It is also hoped that this study is useful for planners and government officials (Fig. 3) in their efforts to develop and define the requirements for mass rapid transit use and better meet the satisfaction of Bangkok's commuters.

ORGANIZATIONAL STRUCTURE

Organizational structures can inhibit or promote performance, depending how effectively the supervisory relationships and workflow influence productivity. Performance management involves goal-setting activities and periodic reviews by managers in the reporting hierarchy. Without defined policies and procedures that are consistently enforced throughout the organization, performance management strategies can fail to achieve their desired goal of improving product and service quality for end-user customers.

Steps associated with performance management include reviewing organizational goals, prioritizing work, specifying targets, identifying specific measures and metrics, aligning employees' goals to the company's strategic objectives and defining standards. Prior research has suggested that organizational units not only hold specialized knowledge but also have the opportunity to learn from other units (Huber, 1991). In a multiunit organization, a unit can access new knowledge through a network of interunit links (Hansen, 1999).

In research conducted in Austria and China on the relationship between organizational structure and performance, especially through organizational learning and innovation, the findings reinforced the importance of infrastructure position of organizational structure on performance (Hao *et al.*, 2012). Furthermore it was found that organizational structure has more effects on organizational learning than on innovation while managers in Austria thought that structure has a more important effect on performance. Austrian companies prefer structural-oriented innovation whereas Chinese prefer learning-oriented innovation. Third, in a Hi-technology or knowledge intensive industry, organizational structures affect organizational performance mainly through innovation and organizational learning. But in traditional industry, such as labor or capital intensive industry, organizational structure impacts organizational performance mainly through innovation. Fourth, for younger firms, learning is important in the relationship of organizational structure with performance but in older firms, innovation is the mediator for structure on performance. Finally, senior managers think organizational structure improves performance directly and through innovation. But the middle and junior managers think organizational learning has an important mediating effect on performance (Hao *et al.*, 2012).

Like buildings, with floors, hallways, rooms and stairs, organizations have structure as well (Dalton *et al.*, 1980). The organizational structure can either allow access and the free flow of information or hinder it. Technology has however 'flattened' the organizational structure and allowed for a freer flow of information, probably best witnessed in the beginnings of micro-computer networking and internal email in organizations beginning in the early 1980s.

Like personal computer networking, RFID technology also allows the organizational to better observe and act on information received from the sensors placed within and used by the personnel, equipment or goods. The RFID value chain reveals that RFID can be mainly divided into two development stages. In the first stage, front-side technology, hardware research and development are emphasized. In the second stage, there is focus on management-side collaboration (Lin and Ku, 2009).

From the Lin and Ku (2009) studied, the following Table 1 (Fig. 4) reveals the results of how the organization implements RFID within the structure of the organization, the RFID characteristics of the industry and how it affects business performance.

PERFORMANCE MANAGEMENT

Performance management focuses not only on individual employees but also on teams, programs, processes and the organization as a whole. A well-developed PM program addresses individual and organizational performance matters necessary to properly create and sustain a

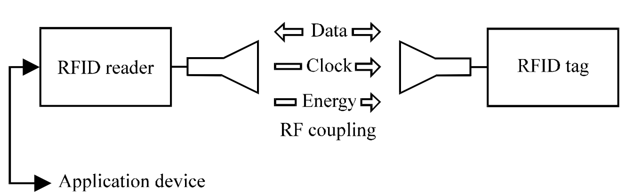

Fig. 4: Main components of the RFID system

Table 1: Research results from the impact of RFID application to business performance: Towards a systemic view

Industries	RFID characteristics	Systems thinking	Business performance
Containerization industry	Real-time processing of data	Organizational process	Organizational
	Continuous data and non-continuous data tracking		efficiency performance
	Reusability		
Consumer goods retailing	Real-time processing of data	Organizational process	
industry	Reduction of labor cost	Organizational leadership	
Information, communications	Improvement in system operation and flexibility in	Organizational process	
and IC distribution industry	data processing	Organizational design	
	Reduction of labor cost		
	Reusability		
	Read-write function		
Financial industry	Capacity for determining the distance from the	Organizational leadership	
	object		
	System and data security		
	Reusability		
	Penetration		
Medical industry	Resistance	Organizational process	Operational
	Reusability	Organizational leadership	performance
	Penetration		
Computer manufacturing	System and data security	Organizational process	
industry	Small and diversified appearance	Organizational leadership	
	Penetration	Organizational design	

Lin and Ku (2009)

healthy and effective results-oriented culture. Effective PM helps organizations raise individual performance, foster ongoing employee and supervisor development and increases overall organizational effectiveness (US OPM, 2010).

As such, performance management can be achieved when current RFID technology is applied along with supply chain management and logistics in various businesses and industry. Characteristics of the products available are extremely diverse with the technology affecting the business and daily life of most at many levels because RFID can be applied in diverse activities. Keen and Macintosh (2001) even go so far to state that RFID technologies will be part of the "universal infrastructure" that will support mobile commerce.

Other areas for RFID implementation and use include businesses such as retail and wholesale, manufacturing and production, supply chain's logistics systems, security and access control which is quickly replacing older bar codes which once kept track of records and track animals, etc.

Manufacturing managers can expect improved operational performance to result from the implementation of RFID technology with RFID technology utilization directly and positively impacts operational performance (Zelbst *et al*., 2010). The RFID utilization should not be seen by the practitioner simply as a cost of doing business but rather as a way to improve efficiency and effectiveness which ultimately will lead to increased profits. RFID has many advantages over older barcode systems as it is wireless, more secure and can transfer data more efficiently resulting in greater convenience to users, thereby reducing the overall document procedures (Myerson, 2006).

Research from Chandra and Kumar (2000) showed that one of the common problems encountered in managing a supply chain is that of synchronization of activities throughout the life cycle of its products. That means the stronger the supply chain capabilities (e.g., customer focused capabilities, delivery capability and distribution flexibility) the lesser the focus on supply chain strategy needed (customer relationship, supplier relationship and SCM strategies) in Thai garment industry, because a stronger capability will facilitate a firm to be more responsive to demand and hence will facilitate its strategy implementation or an efficient strategy will provide unmatched capability and vice versa.

RFID technologies hold the promise of closing some of the information gaps in the supply chain, especially in retailing and logistics. As a mobile technology, RFID can enable "Process freedoms" and real-time visibility into supply chains (Angeles, 2005).

TECHNOLOGY ACCEPTANCE

New equipment and information technologies are introduced and, applied especially to the Internet. These same technologies can be developed for use in public transport systems as well as dealing with the effects and issues of these networks. These same technologies can now be used as well to more effectively allow commuters to use public facilities and increase their security and confidence of the service.

In adopting Radio Frequency Identification (RFID), a technology which is gaining popularity around the world right, RFID technology will affect both businesses and daily life. The RFID has many applications to various activities including retail, wholesale trade, manufacturing and production, supply chain's logistics systems, security and access control, replacing of bar codes and the keeping of animal records and tracking, etc.

This is because RFID is an electronic data collection system which has the ability to carry large data applications and contains high levels of security. It can transfer data using electromagnetic waves instead of physical touch. This results in greater convenience to users allowing them to store and edit historical documents in its original form.

Information technology acceptance research was studied in terms of human behavior to explain how and why an individual recognizes new Information Technology (IT). Venkatesh *et al.* (2003) developed a theory based on the prediction of individuals or organizations in the adoption of information systems. Hevner *et al.* (2004) went to an explanation and forecasting for the adoption of information technology. Brancheau *et al.* (1996) examined how to build an understanding of the influence of various factors for the catalyst for the adoption and use of information technology for individuals or individual organizations. Xu *et al.* (2004) also demonstrated the rationality of IT investment in the future.

Chen and Tseng (2012) used the Technology Acceptance Model (TAM) to examine factors influencing the intention to use Web-based e-learning by junior-high school teachers in central Taiwan. The results showed that motivation to use and Internet self-efficacy were significantly positively associated with behavioral intentions regarding the use of web-based e-learning for in-service training through the factors of perceived usefulness and perceived ease of use. The factor of computer anxiety had a significantly negative effect on behavioral intentions toward web-based e-learning in-service training through the factor of perceived ease of use. Perceived usefulness and motivation to use were the primary reasons for the acceptance by junior high school teachers of web-based e-learning systems for in-service training.

The basic RFID system (Fig. 4) consists of two main components, the small transponder, more commonly known as a tag which is attached to the item needing identification and the interrogator, or reader which in some cases is used to both power the tag and read its data without contact:

- The RFID tag or transponder is designed using various styles and sizes which is appropriate for each job application. The tag is attached or fastened to an object or product to indicate identity with RFID technology which tracks or counts. A typical RFID tag consists of a major component in the antenna and the IC
- The reader or interrogator serves to communicate with RFID tags and can be used to read or write data into RFID tags by using radio frequency. And communicate with users through an access point (interface)

The tag is known as a passive transponder if it is unable to function without the reader since the reader supplies the power to it. If the tag has its own power supply such as a battery, then it is an active transponder. Note that 'reader' is somewhat of a misnomer as the device in some cases can actually be used to write to the tag to change its data as well as reading from it. The basic components of the RFID system are shown in Fig. 4.

RFID systems use a transponder (more commonly just called a tag) that is programmed with information that uniquely identifies itself, thus the concept of "Automatic identification". The tags include the antenna and micro- chip with record numbers (ID) or information about that object. The second part is the bar code reader attached to the tag of the product RFID system reader. And the third part includes the system applications, including hardware and software applications or database.

METHODOLOGY

The format of the survey or unit of analysis is the RFID industry in Bangkok metropolitan area.

Data collection: RFID industry entrepreneurs were queried using quantitative research methods of which 200 responded (Hair *et al.*, 2006). Questionnaires were constructed as a tool to measure concept definition and practice. Questionnaires were constructed as a tool to measure concept definition and practice using a 7-Point Likert Scale. This research first conducted Confirmatory Factor Analysis (CFA) and subsequently reliability analysis to measure Cronbach's alphas for this scale items to ensure internal consistency. Multi-item measures were developed based on Cronbach's alpha >0.68. This study then calculated Cronbach's alphas for each construct. If the value is below 0.50, the research question was cut off. This is considered highly reliable. The responses to the questions capturing focal constructs used a five-point Liker scale (rating statements 1-7; 1: Strongly disagree and 7: Strongly agree).

Measurement

Dependent variable: Performance Management of a smart grid bus system using radio-frequency identification (RFID) analysis used a measurement instrument or questionnaires utilizing a 7-Point Likert Scale (Likert, 1970) which were developed and constructed from scales enabling the measurement of Cost (cost), Quickness (rapid) and Security (safe) (US OPM, 2010; Keen and Macintosh, 2001; Zelbst *et al.*, 2010; Myerson, 2006; Chandra and Kumar, 2000; Angeles, 2005).

Independent variables: Organizational structure analysis used a measurement instrument or questionnaires utilizing a 7-Point Likert Scale (Likert, 1970) which were developed and constructed from scales enabling the measurement of human recourse quality (qual_hr), Strategy (strategy), Technologies (techno) and Environment (environ) (Huber, 1991; Hansen, 1999; Hao *et al*., 2012; Dalton *et al*., 1980; Lin and Ku, 2009).

Technology acceptance analysis used a measurement instrument or questionnaires utilizing a 7-Point Likert Scale (Likert,1970) which were developed and constructed from scales enabling the measurement of the Values and Benefits (acc_valu), Ease of Use (easy_use) and End-User Attitudes (attitude) (Venkatesh *et al*., 2003; Hevner *et al*., 2004; Brancheau *et al*., 1996; Xu *et al*., 2004; Chen and Tseng, 2012).

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 coefficient, whose range was found to be highly reliable.

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; Boontawan and Montree, 2010) and analysis results as shown in Table 2.

Organizational structure (Org_factor) factors underlying the external variables influencing human resource quality (quality_hr), Strategies (strategy) and Technologies (echno) (Fig. 5) with values loading from 0.707 and a significant level of confidence percentage 95 (t-.stat>1.96) which considers such factors highly reliable. Organizational Structure (Org_factor) has a direct and positive influence on performance management (capability).

Technology acceptance (accept) factors underlying the external variables influencing value and benefits (acc_valu), ease of use (easy_use) and end-user attitudes (attitude) (Fig. 5) with values

Table 2: Statistic values presenting convergent validity of reflective scales of latent variables

Construct/item	Loading	AVE	t-test
Organizational structure (Org_factor)			
Human resource quality (quality_hr)	0.9100	0.770	67.1046
Strategies (strategy)	0.8594		33.5659
Technologies (echno)	0.8506		28.0882
Environment (environ)	0.8884		61.7202
Technology acceptance (accept)			
Value and Benefits (acc_valu)	0.9436	0.867	98.6857
Ease of Use (easy_use)	0.9507		117.2021
End-User Attitudes (attitude)	0.8987		52.8711
Performance management (capability)			
Cost (cost)	0.9038	0.844	52.2605
Quickness (rapid)	0.9178		49.9602
Security (safe)	0.9337		77.4564

Statistical significance level is at 0.01 and diagonal figures mean $\sqrt{\text{AVE}}$

loading from 0.707 and a significant level of confidence percentage 95 (t-.stat>1.96) which considers such factors highly reliable. Technology acceptance (accept) has a direct and positive impact on performance management (capability).

Performance management (capability) factors underlying the external variable influencing human resource quality (quality_hr), strategies (strategy), technologies (echno) and environment (environ) (Fig. 5) with values loading from 0.707 and a significant level of confidence 95% (t-.stat>1.96) which considers such factors highly reliable.

Convergent validity: Technically, convergent validity can be evaluated by three tests: item reliability, composite reliability and Average Variance Extracted (AVE) (Chau, 1997). The first measure, item reliability, captures the amount of variance in a measure due to the construct rather than the error. Item reliability is indicated if items have significant factor loadings of 0.50 or above

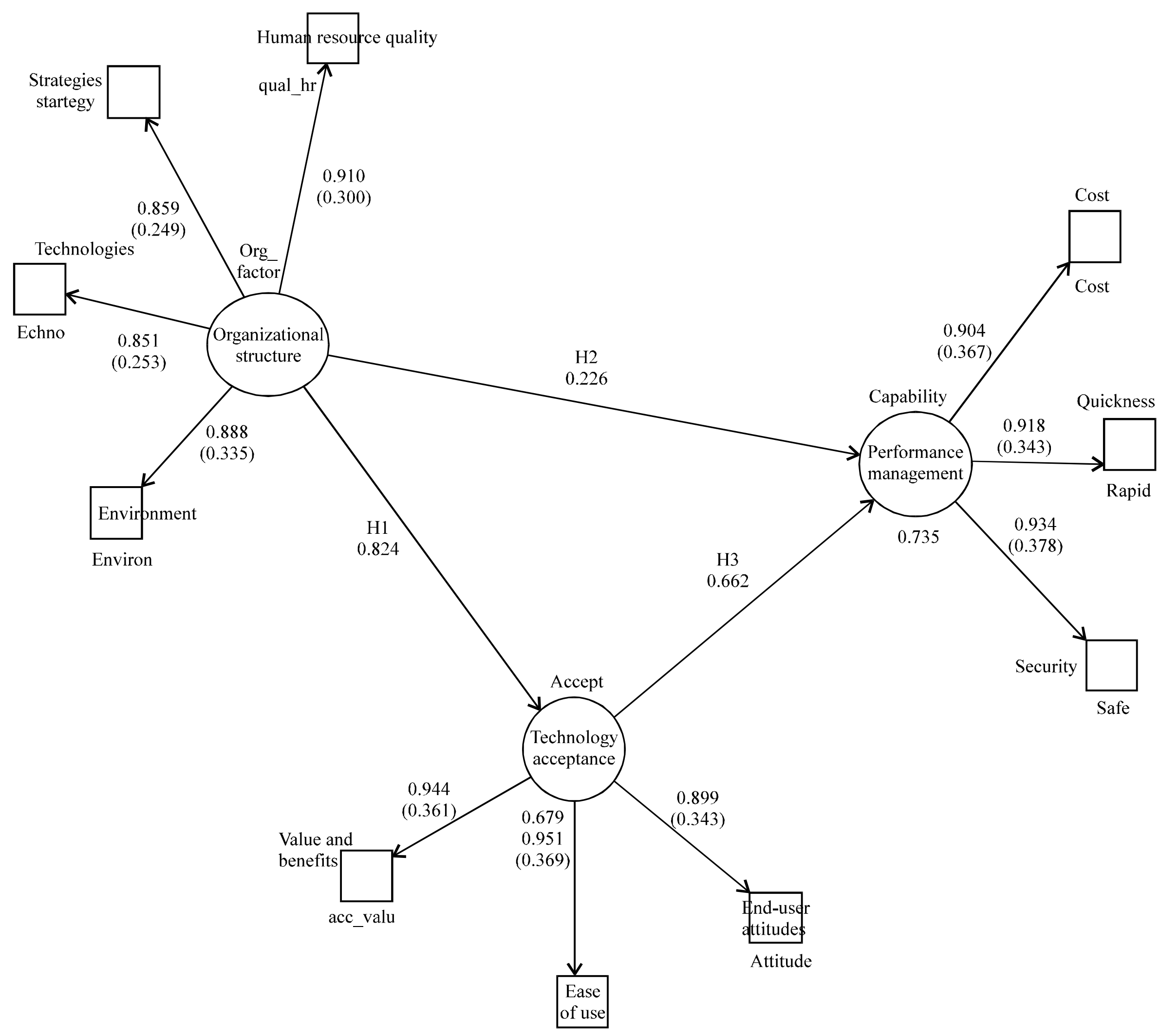

Fig. 5: Final model-analysis of factors that affect RFID performance management

(Hair *et al*., 1995). The second measure, construct composite reliability, is assessed based on the criteria that the indicator's estimated pattern coefficient is significant on its underlying factor (Nunnally, 1978). The threshold value for construct reliability is 0.70 or above. The interpretation of the resultant coefficient is similar to that of Cronbach's alpha, except that it also takes into account the actual factor loadings rather than assuming that each item is equally weighted in the composite load determination. The third measure, Average Variance Extracted (AVE) for each construct, similar to item reliability, indicates the amount of variance in the item explained by the construct relative to the amount due to measurement error. The threshold value for AVE is 0.50 or above.

The above 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; Boontawan and Montree, 2010).

Table 3 shows the results of factor analysis affecting performance management. The data also shows the CR values are higher than 0.60, with all AEV values higher than 0.50 for all values and R^2 values higher than 0.20, representing the reliability of the measurement. It found that data sets in the $\sqrt{\text{AVE}}$ have higher values than all of the corresponding values in the 'cross construct correlation' in the same column, representing discriminant validity of the measure in each construct and with a greater value than 0.50 of AVE as shown in Table 3. The samples were analyzed to answer the research hypotheses criteria in the three assumptions presented in Table 4.

Furthermore, the structural analysis model framework was used to research the t-test coefficients and their relationship of each path of the t-test hypothesis with significance greater than 1.96. This explains the results obtained from analysis as shown in Table 1 and 2 as well as the test results presented in Table 4.

Table 3: Confirmatory Factor Analysis (CFA) of the independent variables of public perception, government policy and community participation and their effects on the dependent variable, environmental impact

				Cross construct correlation		
Construct	CR	R^2	AVE	Organizational structure	Technology acceptance	Performance management
Organizational structure	0.930		0.770	0.877		
Technology acceptance	0.951	0.6787	0.867	0.824	0.931	
Performance management	0.942	0.7351	0.844	0.771	0.848	0.919

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

Table 4: Research hypotheses test results

Hypotheses	Coef.	t-test	Results
H1: Organizational structure has direct and positive influence on RFID acceptance	0.824	28.7911	Supported
H2: Organizational structure has a direct and positive influence on performance management	0.226	2.4636	Supported
H3: Technology acceptance has a direct and positive influence on performance management	0.662	7.2329	Supported

Coefficient refers to the Beta (β). t-stat is the t-value. 95% confidence level

CONCLUSION

Introduction of new equipment and technology, along with the application of technology, especially the Internet in conjunction with RFID technologies can be used to help in the development of mass transit systems. There are numerous advantages to RFID systems in mass transit systems including commuter time savings and convenience. Used in logistics with containers, cost savings and security are enormous benefits. To be more effective and accepted, these systems must allow the user to get easy access to these services which in turn enhances public safety.

To meet the objectives of the operation of an organization, RFID is a technology that has gained ready acceptance around the world which also increases the efficiency of the organizations which implement the technology. This technology affects both business and daily life with RFID systems having various applications at all levels.

Bangkok presently uses RFID technology in the both the BTS (Skytrain) and MRT (subway) systems but implementation with the larger Bangkok Metropolitan Transit Authority (BMTA) bus system still in the discussion stage. The BMTA network however is huge with 117 routes serving over 3 million commuters per day.

It is hoped that this research gives some insight to decision makers on the implementation and use of RFID technologies and its use by Bangkok citizens and consumers as it also helps reduce cost and enhance security, safety and convenience. It is also hoped that it can be seen how RFID can help with more effective management of transit systems while gaining a greater competitive advantage for Thailand.

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