Exploring Satisfaction/Dissatisfaction and Public Confidence in the ITS Environment; Implications to CRM and Public Policy

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RAHMAN, A.K.M. Anisur

THESIS

Submitted to

KDI School of Public Policy and Management

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Part I

Exploring Satisfaction/Dissatisfaction and Public Confidence in the ITS Environment; Implications to CRM and Public Policy

Abstract

With the advent of the Internet and Mobile Communications, the nature of communication has changed significantly over the past few decades .The promotion of technologies among the common people has been found to be an important element of public policy to reduce the digital divide. The rapid advancement of information technology (IT), automation systems and data communications systems leads to improvement of intelligent transport systems (ITS). ITS covers all branches of transportation and involves all dynamically interacting elements of transportation system, i.e. transport means, infrastructure, drivers and commuters. However, few researches have been carried out in the context of public sectors, especially that involving ITS. The purpose of this study is to investigate the justice dimensions that influence satisfaction and public confidence in the context of ITS and to explore implications to Citizen/Customer Relationship Management (CRM) and public policy. This study investigates the following research questions: i) Do levels of perceived justice (distributive, procedural and interactional) in ITS environment affect levels of satisfaction/dissatisfaction? ii) Do levels of satisfaction form ITS affect levels of public confidence? iii) Do levels of dissatisfaction form ITS affect levels of willingness to complain? iv) Do levels of dissatisfaction form ITS affect levels of complaining behavior? v) Do levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on three dimensions (distributive, procedural and interactional)of justice? vi) Do levels of willingness to complain in ITS environment affect levels of public confidence? vii) Do levels of satisfaction with complaint handling in ITS environment affect levels of public confidence?

The findings of this study imply that ITS users are more importantly perceive to equity and equality issues, or distributive justice. The employment of ITS should not be

limited to the technical aspects of ITS, but should focus more attention on the subjective domain of justice. The results of this study also have important implications for public complaint handling in terms of increasing public satisfaction with ITS, which is crucial for CRM.

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I. Introduction

1.1 Impact of Information Technology

With the advent of the Internet and Mobile Communications, the nature of communication has changed significantly over the past few decades. It is important to examine their impact on people's lives and wellbeing (Kraut et. al.,2002)since these forms of communication become increasingly ubiquitous. Some studies (Chesley, 2005; Gross, 2004) have found that the advancements of communications technology have positive impact on subjective well-being (people's perceptions of their well-being) and their satisfaction with life. However, well-being is a relatively broad measure with many facets of standard of living. These individual facets are more susceptible to change than the overall measure, and more likely to be affected by factors such as the use of technology (Diener, Oishi, & Lucas, 2003). Technology has made the availability of information much faster (Valkenburg & Peter, 2007) than ever before. The interactive nature of technology has made it user-friendly (Wang, 2012) so that the users can get almost any information they need.

Accesses to information and communication technologies through cell phones, the internet, and electronic media have not only increased convenience, but have had substantial impact on economic growth and productivity (Litan &Rivlin, 2001). The effects on growth and productivity are quite significant in the OECD countries, where widespread access to the technologies has been in place for several decades (Koutroumpis, 2009). A recent study (Czernich, Falck, Kretschner&Woesmann, 2011) found that broadband infrastructure significant impacts of on GDP growth rates in Europe and the OECD, ranging from 0.1 to 0.4 percent in the past two decades. Another recent study (Kavetsos & Koutroumpis, 2011) examined the effects of cell-phones, television, music players, computers, and internet access on life satisfaction in Europe, and found them to be overall positive.

1.2 Technology and Public Policy

The promotion of technologies among the common people has been found (Baron & Gomez,2013) to be an important element of public policy to reduce the digital divide. Public policy makers should be aware of the fact that personal attitudes of the people towards adoption of newly introduced technology are shaped by complex decision-making processes based on their knowledge, values, and risk perception (Costa-Font, Gil & Traill, 2008). Some other factors, such as desired outcomes of using new technology (Coninck & De Sagar, 2015) and past hardships prior to adoption of technology (Kamp, 2004) have been found to affect public opinions towards technologies as well (Adger et al., 2008). Therefore, policy planners are required to consider these factors in order to make the policy user-friendly (Karakosta & Askounis,2010) so that it is easily adopted by the target group.

1.3 Technology and Transportation System

The rapid advancement of information technology (IT), automation systems and data communications systems leads to improvement of intelligent transport systems (ITS) as well(James, 2012). ITS covers all branches of transportation and involves all dynamically interacting elements of transportation system, i.e. transport means, infrastructure, drivers and commuters (Jarašūnienė, 2009). The benefits provided by ITS save lives, time, money, energy and environment(Faktor,2012).Integrated into transportation system infrastructure, ITS technologies are capable of visualizing traffic flow, reduce traffic congestion(Atev et. al., 2005), provide alternative routes, save time and money(Shladover, 1993).The major advantages of ITS are to instantaneously collect information on existing traffic conditions and traffic flows in the road network (Beymer, McLauchlan, Coifman, &Malik,1997)and provide it accurately via a central management system that is responsible for processing gathered information and then to provide for passengers (Lindley, 1989). Such transportation systems thus provide an opportunity to collect, compile and analyze data on system operation during

peak hours (Ceder& Eldar,2002) that increase traffic participants' possibilities to consider traffic congestion, traffic accidents, weather conditions and other capacity-reducing factors (Henk, 1989).

ITS has been found to be not only a low-carbon and environment-friendly travelling mode (Duan&Mao,2012), but also a return to healthy and leisure lifestyle(Quan, Liu, & Chen, 2007). The extensive use of ITS is good for ease of traffic congestion (Yin& Li, 2009) and the decrease of energy consumption for energy conservation (Liu, 2001). It also facilitates the reduction of exhaust emission for improvement of air quality, the reduction of carbon emission for decrease of greenhouse effect(Li, Waterson & McDonald, 2009), and the construction of livable cities for improvement of citizen health(Cao& Xia, 2015). ITS is believed to strengthen the concept of sustainable development, which is the transition from vehicle-oriented to people oriented (Shibata et. al., 2006) as it coordinates with ecological environment and urban development (Liu, 2001).

1.4 ITS and Public Policy

Externality costs in the context of automobile use include unintended costs the passengers at large experience as consequences of individual decisions (Fielding,1995).These involve congestion costs (the increased time spent by other passengers using the road as a consequence of the marginal increase in congestion generated by an additional car)(Hoh, Gruteser, Xiong, & Alrabady, 2006),increased air, water and noise pollution(Ben-Akiva, Palma,& Isam, 1991), increased risk of traffic accidents and increased deterioration of the roads(Fujii, Garling, &Jakobsson,2004) which may be as high as $22 billion annually in the USA according to an estimate (Hanks & Lomax, 2011).ITS informs the passengers about the current congestion on their regular travel route (Kim, Schmocker, & Fujii,2013). The passengers, upon learning of congested conditions, will presumably choose to travel using alternate routes, modes or times of day (Arnott, de Palma & Lindsey, 1991)resulting into

overall reduction of travel times. Individual travelers derive additional benefits from ITS, which include expanded information sets and choices about available routes (Brand, 1993) and greater certainty about expected travel times(Mahmassani & Jayakrishnan, 1991) that further between potential private benefits associated with auto driving and public benefits associated with ITS.

Apart from inducing congestion, private automobile driving induces air, water and noise pollution (Chen& Yu,2007) which may be as high as $9 billion annually in the USA (Krupnick, 1993). ITS can substantially reduce per capita emission and pollution (De Haan & Keller,2000) as it makes public transportation more attractive compared to the individual auto driving (Walls, 1992) and therefore, can be regarded as better environmentally friendly solution (Kousoulidou et. al., 2013) of travelling.

1.5 ITS and User Attitude, Satisfaction and Dissatisfaction

Quality of service provided by ITS is very important in order to ensure travelers' satisfaction(Awasthi, Chauhan, Omrani, & Panahi, 2011). It includes assessment of various parameters related to service quality (Anderson, Fornell & Rust, 1997). In the use of ITS, negative incidents, such as delay of vehicles, lack of proper information regarding route availability, or poor service offered by the ITS staff (Friman, 2004) have highest impact on travelers' satisfaction. Cumulative overall and different attribute-specific satisfactions with ITS (Miller,1995) are related to the remembered frequency of negative critical incidents during the journey.

Travelers' satisfaction in the context of ITS can be viewed as overall level of attainment of their expectations about the quality of service provided by ITS (Morfoulaki, Tyrinopoulos, & Aifadopoulou, 2007) and hence can be measured as the percentage of traveler's expectations which have actually been fulfilled (Ichoua, Gendreau & Potvin, 2000). Passengers' perception of performance of transit between bus and subway depends on the

variability of offered services between operators (Tyrinopoulos & Antoniou, 2008). Therefore, to enhance the satisfaction level of passengers using ITS, homogeneity of services (Eboli & Mazzulla, 2007) between the service providers is to be ensured. The urban road network structure has implications on satisfaction (Eboli & Mazzulla, 2009) of passengers of ITS. Ease to accessibility of ITS, which is evaluated from the view point of the regional features and existing road network of the city (Ji & Gao, 2010), is interconnected with the satisfaction of passengers toward ITS.

The service performance of ITS should be evaluated on the basis of a combination of subjective and objective measures used to assess the service quality(Hassan, Hawas, & Ahmed, 2013),which should incorporate the opinions of the different stakeholders of ITS such as regular passengers, service operators, and service providers. The key operating conditions of ITS, such as following strict schedule, dissemination of useful information regarding access and transfer(Dell, Ibeas, & Cecin, 2011), ease of purchasing tickets and ease of payment of transit fares (Holmgren, 2013) have strong influences on overall travelers' attitude and satisfaction.

Travelers' attitude towards ITS and satisfaction is also influenced by whether it can satisfy the needs and motivations of different groups of passengers on the basis of age groups and profession (Zak, 2011), along with improved operating conditions and policies to internalize costs of personal motor vehicle use (Badami & Haider, 2007). To address the challenge of providing financially viable and affordable ITS, it should be comprised of bus and subway services(Spivey&Powell,2004) along different routes that constitute a well-distributed and well-connected public transit network (Sheth, Triantis, & Teodorovic, 2007) taking into consideration of the requirements of the passengers and the service providers.

1.6Development of ITS

ITS has been developed in some of the developed countries over the past few years. Though there are some differences in the development process of ITS among the countries, there are some similarities as well. The major objectives, current status, recent policies and future strategies (Ministry of Land, Infrastructure, and Transport, & KDI School, Korea, 2013) of development of ITS in some developed countries can be summarized in the following table:

Country (Starting Year)	Objective	Current Status	Recent Policy	Future Strategy
Korea (2000)	Improve traffic congestion, road safety and traffic conditions.	Provides transportation services using networks of bus, train and subway.	Improve the existing Advanced Traffic Management System (ATMS)	Establish integrated traffic information system to encompass all different modes of public transportation.
US (1997)	Deliver the appropriate transportation service to users effectively	Provides i) services related to the ITSto metropolitan and local areas and ii) information sharing, positioning, and navigation for commercial purpose vehicle. Establishes automatic fare collection system.	Seek standardization of ITS throughout the country.	Setup the projects to verify the concept of, to test run and prepare for the commercialization of C-ITS and form ITS America Connected Vehicles Task Force as a consortium to discuss relevant issues.
EU (1986)	Establish the transportation system to provide stable and reliable traffic service.	Installed road facilities and relevant information and communications facilities to improve the traffic safety and efficiency in the member states.	Deal with driver safety, unmanned driving, and resolution of conflicts of interest among the member states.	Setup the projects to verify the concept of, to test run and prepare for the commercialization of C-ITS.
Japan (1996)	Inaugurate comprehensive transportation system and to provide accurate information to the users.	An integrated agency involving government, industry and research institute is established. An integrated traffic control system is established to address the urban traffic problems.	Provide traffic information through the most advanced vehicle navigation technologies and traffic information technologies.	Setup the projects to verify the concept of, to test run and prepare for the commercialization of C-ITS and launch the C-ITS project nationwide.

Table 1. The Status of ITS Development

1.7Purpose of the Study and Research Questions

Customer satisfaction and loyalty have widely been explored in the case of private entrepreneurships. However, few researches have been carried out in the context of public sectors, especially that involving ITS. The purpose of the study is to investigate satisfaction and public confidence in the context of ITS and this study will explore implications to Citizen/Customer Relationship Management (CRM) and public policy. The aforementioned purpose of the current study will be explored with the aid of following research questions:

i) Do levels of perceived justice (distributive, procedural and interactional) in ITS environment affect levels of satisfaction/dissatisfaction?

ii) Do levels of satisfaction form ITS affect levels of public confidence?

iii) Do levels of dissatisfaction form ITS affect levels of willingness to complain?

iv) Dolevels of dissatisfaction form ITS affect levels of complaining behavior?

v) Do levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on three dimensions (distributive, procedural and interactional)of justice?

vi) Do levels of willingness to complain in ITS environment affect levels of public confidence?

vii) Do levels of satisfaction with complaint handling in ITS environment affect levels of public confidence?

II. Literature Review

2.1 Impact of Information Technology (IT) on Transportation System

With a larger distribution of personal smart devices and navigation tools, there are several novel sources for real time data collection and better means for information transmission (Javed, Lim, & Rus, 2012). At the same time, application of information processing, communication, sensing, and control technologies (Heiko, Yadong, Michael, & Alois, 2013) have become more advanced and play a key role in improving transportation. In this context, large amounts of data are processed and presented to the participant vehicles (Cipriani & Guarino, 2008)through their navigation systems. In most of the cases, drivers trust real time information and follow the navigation recommendations.

Models of information dissemination (Petri, Jensen, & Polak, 2009) have been studied for networks with congested and uncongested nodes where the information detail (such as congestion, flow or occupancy) was either local or global. Information is used to control the node's outgoing traffic flow (Scellato et al.,2010), influencing this way the routing choice for vehicles. Urban street models (Treiber, Hennecke, & Helbing, 2000)were implemented for various topologies ranging from naturally evolved ones such as Bologna or London to grid-like cities such as Los Angeles or Washington. Both the cases mentioned above show that the best performance is achieved when local information is used.

Several researches (Lim et al., 2009) have been conducted on Information Control Systems for traffic planning in the presence of congestion in which a fleet of drivers used a Web based application to specify trip origin, destination and departure time and receive route recommendations. Congestion is estimated using traffic data from loop detectors, GPS location and time data from a roving fleet where the congestion model is used in multi-agent system (computing socially optimal paths) and also in a single agent's route planning

(computing greedy path). The study (Lim et al., 2009) performs an experimental comparison between actual travel paths, with socially optimal and greedy path congestion-aware planning and the results show that socially-optimal congestion aware routing achieves 15% reduction in travel time.

2.2 Public Policy for Information Technology (IT)

Scholars have long recognized that an effective public policy for Information Technology (IT) occurs in tandem with collaboration of key stakeholders such as government, research institutions, industry and firms (Rothwell & Dodgson, 1992). Such collaborations are required not only in formulating policies but also in ensuring implementation (Morlacchi & Martin, 2009). Broadly speaking, public policy for IT entails investments in research and development activities, and development of human capital through education and training (Dodgson, 2000). On the other hand, technology policy encompasses developing technological infrastructure to support the development and utilization of existing and new technologies, whereas, innovation policy focuses on actions by public organizations to help develop capabilities and capacity of firms to innovate (Dodgson, 2009).

Past studies have suggested that enhancing local firms' capacity requires resources, training and development as well as effective policies that remove business and innovation obstacles (Aghion, David, & Foray, 2009). National public policy for IT is an integration of these three dimensions (Vitta, 1990) towards fostering economic development and national competitiveness. It may evolve over time to reflect the needs of the country or changes in the political environment (Rath, 1990). There is mounting evidence that indicates that public policy for IT entails developing and shaping the rules of the game to create conditions for innovation and technological development to flourish (Beerepoot & Beerepoot, 2007). A growing stream of scholarly works indicates that the development of a national innovation

system partly depends on quality of formal institutions such as law, regulations and government policies (Lemola, 2003). Lack of effective regulatory framework or clear government policies can stifle the innovativeness and development of domestic firms (Rothwell, 1992).

Previous studies indicate that central institutions such as national councils and agencies can help to coordinate national research and development activities as well as promote the development of science and technology (Vitta, 1990). Such supporting institutions and organizations are essential in equipping firms to perform at the technological forefront to develop and sustain competitive edge (Padilla-Pérez & Gaudin, 2014). Research (Peil, 1996) has attributed the greater success of some emerging economies and newly industrializing nations in the Asia Pacific region to their ability to formulate effective science, innovation and technology policies. These have helped to foster innovation. National policies of such countries are geared towards enhancing the capacity and capabilities of local firms to innovate and compete effectively in the global environment (Hilson & Potter, 2005).

Researchers (Chen, Wakeland, & Yu, 2012) have pointed out that indigenous firms' ability to take advantage of the policy environment to continually innovate can become a pivotal source of competitive advantage for the nation. This can be seen as a kind of technology foresight defined as the process for linking science and technology more effectively to wealth creation and improvements in the quality of life (Martin &Johnston, 1999). It has the potential to provide countries with the route to formulate policies and strategies to develop capacities and leap to the next stage in their economic development. It also entails long-range, forward-looking activities by governments to help foster technology utilization and consequently economic development (Chen, Wakeland, & Yu, 2012). It is the concurrent attempt to explore the relationships between technology and science as well as harnessing technology to foster development and wellbeing of the wider population.

Technology foresight has been identified as playing a pivotal role in wiring up the national innovation system to foster learning, efficient utilization of resources as well as meeting future challenges (Debrah,2007). The technology foresight process is a mechanism through which future requirements, scenarios and priorities are defined in collaboration with stakeholders (Barker &Smith, 1995). Therefore, effective formulation and implementation of public policy for IT require involvement of interested parties and changes in a party's circumstances are more likely to alter their level of resources, involvement and commitment (Adei, 1990). Indeed, changes in government would not only affect the level of resources and commitments, but also lead to the re-prioritization of policies with the wider economy. Changes in government can disrupt previous government policies for IT and even destroy the foundations laid by the previous regime (Amankwah-Amoah, 2015).

2.3 Public Policy for Transportation System

It is evident from the general trend that the general population relies primarily on private vehicles, supplemented with public transportation. The high percentage of private vehicle usage causes not only more frequent traffic congestion and, consequently, more travel time but also environmental pollution, and contributes to problems associated with energy consumption (Bliemer & Rose, 2013). How to promote public transportation use and discourage the usage of motorcycles and cars is, therefore, one of the top government policy priorities.

Several studies have investigated the factors that contribute to public transportation versus car use. Swimmer and Klein (2010) showed that the occupancy rate of public transportation and the utility of public transport services were positively correlated and that trip distance and the utility of public transport services were negatively correlated. Taylor, Miller, Iseki, &Fink (2009) concluded that certain policy variables could be utilized to

improve the usage of public transportation and that the sensitivity of average public transportation fares and annual service mileage could be used to predict the usage of public transportation in the area. Mulley and Tanner (2009) showed that higher household vehicle-kilometers travelled (VKT) were associated with longer walks to the closest public transportation and longer wait times; but when geographical area was considered, the average number of households was smaller in remote areas, which had a negative impact on household VKT.

Only a few studies (Kitamura,1989; Messenger &Ewing, 2007)have examined the relationship between the usage of cars and public transportation. The former study (Kitamura,1989) found that changes in car usage could affect public transportation usage; however, changes in public transportation had only minor impacts on car usage. The latter study (Messenger &Ewing, 2007)found a negative correlation between population density and bus usage and it further showed that public transportation usage was subject to an interactive impact of the three factors analyzed, which reflected socio-economic factors, land use, and public transport services.

Although some studies (Zhou, Yang, & Xu, 2007; Yu, Gu, & Li, 2008) have investigated the usage of public transportation and cars, individually or jointly, few studies have considered the relationships among the usage percentages of the three transportation modes (public transportation, cars, and motorcycles) and investigated their impact on one another. It is crucial to include the motorcycle in the study due to its second-highest usage in urban area. For the development of policies aimed at improving public transportation usage, it is essential that the usage percentages of public transportation, cars, and motorcycles in various townships be considered simultaneously in one model (Wang, Wu, & Wang,2006). Thus, the factors that affect usage percentages of these three modes in various townships can be determined (Cao&Xia,2015) and can also be applied to assess environmental policy

effects, considering the increasing focus, recently, on reducing greenhouse gas emissions (Liu,2001).

To provide efficient transportation systems that would reduce emission of CO_2 and other Green House Gases (GHG) is one of the core issues in rapidly growing urban areas, especially in developing countries.The reduction of GHG emissions by the vehicles used for transportation remains as a key challenge, which can be reached through various instruments and strategies. One of the recent studies(Nakamura & Hayashi, 2013) gives an overview of the feasible strategies and instruments for low-GHG solutions in urban transportation and mentions that the effectiveness of different GHG mitigation measures is highly dependent on the development process of the city under consideration and the types of urban land-use transport systems.

Expansion of the public transport system represents an effective measure to reduce transport related GHG emissions aiming at a shift from private to public vehicles (Stanley, Hensher, & Loader, 2011). Another study (Wright & Fulton,2005)analyzed GHG mitigation costs by the introduction of a Bus Rapid Transit (BRT) system including the construction costs of network infrastructure and found that a diverse and integrated package of public transportation promoting a shift from high-GHG emission by the large numbers of private vehicles towards low-GHG modes is the most cost-effective measure to achieve GHG emission reductions. Thus, ITS promotes an environment-friendly solution of GHG emission due to transportation by encouraging the public transportation system.

2.4 Intelligent Transportation System (ITS) for Transportation Management

Due to the large flow of information and diverse parameters, communication systems which would efficiently transfer unchanged information flow from one point to another is essential to improve the performance of the transportation system (Caulfield&

O'Mahony,2007). Information flows are required for material flow management. Accurate, reliable and quick information provides an opportunity to accelerate the material flow– materials and goods to be delivered to addressee faster (Chu, Eitan, &James,1998). Information systems applied in multimodal transportation are diverse and must perform certain functions (Chua, Balkunje, & Goh, 2011) such as facilitate problem identification, enable to coordinate management equipment and perform logistics tasks. Multimodal transport chain comprises a unity of business entities engaged in cargo transportation. Members of this chain solve issues related to technical cargo transportation, exchange information on cargo to be transported and further process (Church & Smyth, 2008).

Intelligent Transportation System (ITS) is a general term referring to integrated connections, control and information processing technology application in transport system (Church & Smyth, 2009). ITS tools are based on information collection, processing, integration and presentation (Dziekan & Vermeulen, 2006). ITS employs intelligent travelling information systems which present data for the travelers providing prerequisites for route selection and transport modes (Eboli & Mazzulla, 2012). Accumulated data provide more accurate information for transport developers enabling transport planning optimization. Intelligent transport management systems (ITMS) may be determined by the qualitative parameters such as management scope, expedition, management algorithm, efficiency of data collection systems, diversity and usefulness of the provided information (Eboli & Mazzulla, 2007).

Electronic Intelligent transport management system usually consists ofdata collection subsystem, data transmission subsystem, management subsystem, and separate subsystems of different hierarchical levels (Ferris, Watkins, & Borning, 2010). Electronic Intelligent transport management systems comprise a number of technical means connected into general information processing complex. Minimal integrated system can store at least two systems

that operate under general algorithms and connected interfaces, thus electronic intelligent transport management system is an integrated system (Ferris & Borning, 2011). Data processing systems are used for automatic data processing, whereas information management systems function as an operation management tool. No ordinary and casual operations, but operation management is central in these systems. Information management system accumulates acquired information from diverse internal and external sources and appropriately transfers it to responsible parties (Ioana, Mirea, & Balescu, 2009). Such systems are capable of simple management of large information flows and generation of standard and non-standard reports. Each connected user must have an access to report that is generated according to the need of the user.

Transportation information systems are administrative, organizational, economic methodology designed for efficient operations, planning, management and accounting solutions in transportation (Kjeldskov et al., 2003). On the basis of the type of the activity can be divided into Geographical information systems, Logistics information systems, and Company's administrative management information systems (Kim, Kim, & Wachter, 2013). Generally, information management systems, with the main function of managing data-flow, data-bases, technological data processes can be regarded as information systems. Logistics chain data model would exist in the development of information systems only when marketing, production and financial supply information projects are developed and implemented (Matsumoto & Hidaka, 2014).

Activities of transport and logistics enterprises are very accessible to information technologies. Enterprises constantly work with large amounts of information and it is necessary to manage it quickly. Intelligent transport systems include extensive wireless and wired communications-based information and electronic control technologies (Nandan,2010). Integrated into transport system infrastructure, these technologies are capable of visualizing

traffic flow, reduce traffic congestion, provide alternative routes, save time and money (Nishiuchi & Todoroki, 2013). Intelligent transport management systems provide an opportunity to collect, compile and analyze data on system operation during peak hours. Such accessible data increase traffic participants' possibilities to consider traffic accidents, weather conditions and other capacity-reducing factors (Sohn, Li, Griswold, &Hollan, 2008).

The main goal of intelligent transport management system is to collect information on traffic conditions and transport flows in the roads and provide it accurately via management systems. The gathered information is processed, integrated and thus provided for users. Operational requirements for Intelligent transport systems are often directed at Operation or Management Centers in major ITS service points (Takahashi et al., 2012): advanced traffic management systems through regional and local management centers; advanced travellers' information systems through multimodal transport travellers' information centers; and advanced public transport systems through public transport management centers.

2.5 Artificial Intelligence (AI) and ITS

In recent years, there has been increased interest in exploring the feasibility of applying AI paradigms in the context of ITS to improve the efficiency, safety, and environmental-compatibility of transportation systems (Li, Yang, Zhu, & Meng, 2012).AI methods applicable to ITS can be divided into symbolic AI, which focuses on the development of Knowledge-Based Systems (KBS)and computational AI, which includes such methods as Neural Networks (NN), and Fuzzy Systems (FS)(Poorzahedy & Rouhani, 2007).

A KBS can be defined as a computer system capable of giving advice in a particular domain, utilizing knowledge provided by a human expert (Wanga, Meng, &Yang, 2013). A distinguishing feature of KBS lies in the separation behind the knowledge, which can be

represented in a number of ways such as rules, frames, or cases, and the inference engine or algorithm which uses the knowledge base to arrive at a conclusion (Xu, Wei, & Huc, 2009).NNs are biologically inspired systems consisting of a massively connected network of computational neurons, organized in layers (De Castro& Timmis, 2003). By adjusting the weights of the network, NNs can be trained to approximate virtually any nonlinear function to a required degree of accuracy (Król, 2014).

Fuzzy set membership functions provide a way to show that an object can partially belong to a group (Tianze, Heng, & Zhuan–De, 2009). Fuzzy membership functions allow for gradual transitions between sets and varying degrees of membership for objects within sets (Kim, Kim, & Song, 2008).In recent years, GA has been applied to a wide range of difficult optimization problems for which classical mathematical programming solution approaches were not appropriate. GA starts with a randomly generated initial population of individuals, where each individual or chromosome represents a potential solution to the problem under consideration (Nie,Shao,&Yang,2007). Each solution is evaluated to give some measure of its fitness and a new population is then formed by selecting the more fit individuals (Pinninghoff, Contreras, & Atkinson, 2008).

ITS involves both quantitative as well as qualitative data. The fact that ITS has to deal with qualitative data in transportation makes the use of FS an obvious choice (Sun, Song, He,&Chen,2009). ITS often deals with systems whose behavior is very hard to model with traditional approach, either because the interactions among the different system components are not fully understood or because it has to deal with a lot of uncertainty stemming from the human component of the (Luathep et al.,2011). For such complex systems, building empirical models, based on observed data are, may be the only option remaining (Kirkpatrick, Gelatt, & Vecchi, 1983). NNs, given their universal function approximation capabilities, are perfect tools for building such models (Zhang, Lu, &Xiang,2008). ITS often leads to optimization

problems that are quite challenging to solve using traditional mathematical programming techniques, either because the relationships are hard to specify analytically or because of the size of the problem and its computational intractability (De Castro& Von Zuben,2000). To mitigate these problems, KBSs may provide an alternative solution approach (Chiou, 2007). Finally, the complex nature of ITS and the fact its behavior emerges as a result of interactions among the system components makes GA techniques quite appropriate for study the behavior of the system (Kirkpatrick, Gelatt, &Vecchi, 1983).

2.6 Different Types of ITS

There are different kinds of ITS that are more prevalent in current uses. Advanced Traffic Management System (ATMS) has been proven to be one of the most effective components of ITS (Tang, 2003). ATMS is widely used in determining the traffic flow or volume (the number of vehicles passing a point per unit of time), vehicle speed (the distance travelled by a vehicle per unit of time), and traffic density (the number of vehicles occupying a road lane per unit of length at a given point in time) (Mok, Landphair, & Naderi, 2006). It has also been found to be very effective in measuring road incidents (any unplanned event that occurs within a roadway that impacts the capacity of the roadway) and weather conditions (relevant details such as wind speed, humidity, visibility, temperature etc.) (Perez, 2006).

Travelers have an increasing desire and need for accurate, timely information to help them decide on their destinations and reach them quickly and safely (Christie et al., 2007). Advanced Traveler Information Systems (ATIS) can serve this need. Traveler information falls into two broad categories: pre-trip and en-route (Son, Park, & Lee, 2005). This information may be distributed using several existing and evolving communications technologies (Fukuda, Tangpaisalkit, Ishizaka, & Sinlapabutra, 2005). ATIS has been found very effective in addressing the demand of travelers. Both pre-trip and en-route traveler

information had generally positive impacts (Hadayeghi, Shalaby, & Persaud, 2003). The availability of pre-trip information has increased driver confidence to use freeways and allowed commuters to make better informed transit choices (Wong, Sze, & Li, 2007). En-route information and guidance saves travel time, helps a traveler avoid congestion, can improve traffic network performance, and is more efficient than paper maps or written instructions (Abdel-Aty & Pande, 2006).

In establishing Electronic Fare Payment System (EFPS), it is necessary to take into account several important facts affecting the activity and organization of integrated transport system, the quality of transport process, and the associated satisfaction of passengers (Chen, Shyu, Peeta, & Zhang, 2003). An alternative is to use non-cash check-in technology RFID (Radio Frequency Identification) allowing contactless identification and data transmission by synergies of electromagnetic alternating fields acting between the chip and the sensor and passive or active chips are used as data media (Feng, Zhou, & Du, 2005).. The application of the technology can be found not only for public transport check-in system, it is also used as warehouse automation technology, attendance, access respectively, catering systems etc. (Wang, Wen, & Ting, 1994).

In public transport the trend is in the application of smart cards for checking regular passengers, which replace paper travel documents. Electro-magnetic cards are used primarily for their speed and ease of use by passengers (Stamatiadis, Jones, & Hall, 1999). The most widespread smart card uses Smart Card chip, one of the most progressive and the most widespread in their domain. The card is an intelligent storage medium with a high degree of security and therefore its use is safe for many other applications (Kim, & Yamashita, (2002).

Advanced Public Transportation System (APTS) is another useful component of ITS to facilitate public transportation. It consists of two related technologies: Digital Geographic Database (DGD) and Automated Trip Scheduling System (ATSS) (Bernhardt, & Virkler,

2002). The DGD allows maps of the service area to be displayed to the scheduler or operator and the commuters or clients on the computer screen (Espino, Gonzalez, & Gan, 2003). The ATSS subsystem has the specific objectives of reducing commuters waiting time at bus terminals by auto mating trip booking thus assuring a passenger of the availability of a bus (Hwang, Tsai, & Ou, 2005). The ATSS subsystem also keeps an inventory of passengers and trips made by commuters and the vehicles or carriers (Ivan, 2005).

Systems for Commercial Vehicles Operations (CVO) include the features of traffic and travel management systems in the sector of commercial vehicles. The services provided refer to automatic localization, classification, and weigh-in vehicles to collect taxes (Pei & Dai, 2005). Technological solutions developed for CVO include navigation systems mounted on vehicles, accident notification systems, electronic payment systems, sensors embedded in the road, video technology for traffic control, weather information services, vehicle fleet tracking, and vehicle weight measuring on the move technology (Pei & Ding, 2005).

The term Advanced Vehicle and Highway Service (AVHS) refers to advanced technologies that are applied to motor vehicle transportation and traffic operations, such as technologies for automatic vehicle identification and billing, weighing vehicle in motion, collision warning and avoidance, driver information and route guidance, advanced traffic signal control and optimization, automatic incident detection, and automatic vehicle spacing – both steering (lateral) and headway (longitudinal) (Pei, 2006). Since a large portion of congestion is caused by accidents, significant benefits can result from reducing both the number of accidents and the time it takes to clear the roadway after an accident occurs - actions that can be made easier by them (Sullivan, 2004). AVHS can be viewed as a means for reducing fuel consumption and air pollution, making commercial shipping more efficient, and easing the driving task for physically limited drivers (Kurschner et al., 2006).

2.7 Previous researches directly related to research questions

Customer behavior, satisfaction and loyalty have extensively been examined in the context of the private entrepreneurs. But few researches have explored these issues in the context of the transportation sector, especially that involves ITS. The negative aspects of satisfaction contain consideration of the confirmation/disconfirmation paradigm (Oliver, 1980), defensive marketing (Chu, Gerstner, &Hess, 1998), and Hirschmans (1970) theory of exit.

In particular, research into negative aspects of satisfaction have largely failed to consider voice and loyalty in the context of the transportation sector involving ITS. The notion of justice arises from studies of equity that date back to the early of 1960s (Cho & Sai, 2013). Perceived justice, fairness, and equity are valuable frameworks for explaining customer reactions to complaint episodes in organizational behavior and in federal workplace (Blodgett, Hill, &Tax, 1997; Cho & Sai, 2013).

The concept of perceived justice to and examination of the causes of complaints, repeat purchase intention, and loyalty has been applied in private sector (Cho, 2013). Perceived justice is a broad, multifaceted construct that encompasses three dimensions: distributive justice, interactional justice, and procedural justice (Bies & Shapiro, 1987; Clemmer & Schneider, 1996). Theories of distributive justice focus on the allocation of benefits and costs (Deutsch 1985, cited in Tax, Brown, & Chandrashekaran, 1998).

In the context of consumer complaints, distributive justice encompasses the perceived fairness of policies and procedures used by the seller (Blodgett, Hill, &Tax, 1997, as cited in Cho, 2013). The notion of fairness is almost synonymous with equity in that it explicitly implies a form of distributive justice whereby individuals get what they deserve based on their inputs (Oliver, 1997). Equity, equality, and need are concepts of distributive justice that affect dissatisfaction (Tax, Brown, & Chandrashekaran, 1998).

Procedural justice relates to the manner in which the outcomes are delivered (Oliver, 1997) and refers to the perceived fairness of the policies, procedures, and criteria used by decision makers in deciding the outcome of a dispute or negotiation (Thibaut &Walker, 1975; Lind & Typer, 1988; cited in Blodgett, Hill, &Tax, 1997). Prior studies (Folger, 1987; Greenberg, 1990) have shown that procedural justice is meaningful because it aims to resolve conflicts in ways that encourage the continuation of a productive relationship between disputants, even when outcomes are unsatisfactory to one or both parties. Interactional justice refers to the manner in which people are treated during the conflict-resolution process (e.g., courtesy, respect, rudeness; Bies & Shapiro, 1987; Blodgett, Hill, &Tax, 1997).

As the third dimension of perceived justice, interactional justice refers broadly to the fairness of the interpersonal treatment that people receive during the enactment of procedures (Bies &Shapiro, 1987; Gilliard, 1993; cited in Tax, Brown, & Chandrashekaran, 1998). Oliver (1997) stated that interactional justice pertains to the person-to-person dealings that are the crucial elements of complaint handling (Maxham & Netemeyer, 2002) and relationship marketing (Tax, Brown, & Chandrashekaran, 1998).

III. Theoretical Background

3.1 Justice Theory

Customers expect consumption experiences to be fair, and they engage in negative reactions when they believe that they have been subjected to unjust outcomes or procedures (Hunt, 1977). The affected users may experience dissatisfaction and elicit a desire to switch providers. Thus, individuals have a justice motive and judge their relationships with institutions and salespersons using fairness as a fundamental base (Westbrook, 1980). Perceived justice is thought to bean additional factor in the satisfaction response that is not reflected in the expectancy disconfirmation paradigm (Oliver &Swan, 1989).

Previous research has focused primarily on the role of different facets of justice in the understanding of customer reactions to failures and organizational recovery efforts (Blodgett, Hill, &Tax, 1997; Goodwin &Ross, 1989).Nevertheless, justice perceptions also are involved in overall customer satisfaction (Clemmer & Schneider, 1996). Customers are able to evaluate the justice of outcomes and procedures related to the purchase of products and services (Bolton, 1998), even without the existence of failures, customer complaints, and recovery efforts. Justice perceptions are always present in consumption experiences, beyond the very small percentage of customers who complain(Swan & Oliver, 1989).

Although the influential research by Oliver and Swan (1989) facilitated the introduction of the justice framework into the investigation of customer satisfaction with products and services, little is known about the relative impact of the different justice dimensions beyond the well-established expectancy disconfirmation paradigm. Prior work explored the joint influence of perceived justice and the expectancy disconfirmation paradigm on satisfaction, showing that both processes coexist as separate significant antecedents of customer satisfaction (Patterson, Johnson, & Spreng, 1997).

Some studies (Oliver & Swan, 1989) focused only on the distributive component of justice. Others did not distinguish between the different dimensions of justice (Pathak, Kucukarslan, & Segal,1994). Nevertheless, the distinction between distributive justice on the one hand and procedural and interactional justice on the other hand is particularly relevant because it reflects the existence of two traditions in the study of justice (Cropanzano, Rupp, Mohler, &Schminke, 2001). Distributive justice is more outcome oriented, while Procedural and Interactional justice are more relationship oriented (Patterson, Johnson, & Spreng, 1997).Despite the fact that consideration of these different dimensions of justice provides a richer portrait of the relationships between justice and user satisfaction, there is a lack of empirical studies on the topic.

Considering distributive, procedural, and interactional justice, significant relationships have been obtained between these different dimensions of justice and customer satisfaction (Smith, Bolton, & Wagner, 1999). These findings were not congruent with the dominant relationship marketing framework, given that the results supported the predominance of distributive justice, which is outcome oriented, over procedural and interactional justice, which are relationship oriented. This unexpected result could be motivated by the fact that the impact of the expectancy disconfirmation paradigm was not controlled for in the study. With this in mind, some studies (Devlin, Gwynne,& Ennew, 2002) aim to extend this effort by controlling for the impact of disconfirmation of expectations and performance perceptions (expectancy disconfirmation paradigm) and by assessing whether or not justice dimensions make a significant contribution beyond these controls. Thus, this extension serves to test more accurately the relative impact of justice dimensions on user satisfaction.

3.1.1Distributive Justice

An Outcome-Oriented Approach Based on the work carried out by Adams (1965), researchers traditionally have focused on distributive justice in order to predict customer satisfaction. Theories of distributive justice argue that perceptions of justice result from customer evaluations of outcome fairness (Lapidus & Pinkerton, 1995). In purchase transactions, customers invest inputs (e.g., money) and receive outcomes (e.g., service quality). Also, customers compare their own outputs and inputs to the outputs and inputs of the other party in an exchange (Oliver & DeSarbo, 1988). The customer expects reciprocity in terms of tangible matters (e.g., relating quality to price), and the degree to which he or she perceives the exchange as inequitable determines negative post-transaction affect. This form of negative affect is usually interpreted as dissatisfaction (Oliver &Swan, 1989).

Distributive justice is based on equity theory, given that this framework aims to understand how individuals respond to outcome distribution. Equity theory has been a tremendously influential model in different research areas, including customer satisfaction (Oliver &Swan, 1989). In fact, for a long time, the concept of justice in the study of customer satisfaction has been considered synonymous with equity theory. Adams' (1965) equity theory is described as a classical social exchange theory, which assumes that humans are motivated instrumentally in their relationships with others (Cropanzano, Rupp, Mohler, & Schminke, 2001).With respect to the distribution of outcomes, individuals seek to maximize gains and minimize losses. Interpersonal aspects are relatively neglected in equity theory because they are conceptualized only in outcome oriented terms (Olsen, 2002). In contrast, a more relationship-centered approach to social exchange is present in the concepts of procedural and interactional justice.

3.1.2Procedural Justice

Thibaut and Walker (1975) identified a second dimension of perceived justice, labeled procedural justice, which involves the process used to arrive at the outcome. Research in consumer behavior has confirmed that customers define fairness not only by considering the outcomes received, but also in terms of procedural justice, which is defined as the perceived fairness of the means by which the ends are accomplished (Goodwin &Ross, 1989).While procedural justice is a complex concept, there are focal issues (e.g., accessibility, speed) that are particularly relevant in service businesses(Tax, Brown, & Chandrashekaran, 1998). In servicemen counters, contact employees should provide products and resolve conflicts in a correct and functional manner. The perceived unfairness of waiting too long in service situations (Katz, Larson, &Larson, 1991) and lack of accessibility of contact employees can resultin customer dissatisfaction.

3.1.3Interactional Justice

Although research has been focused primarily on the aforementioned dimensions of distributive and procedural justice, individuals use a third basis for judging fairness: interactional justice (Bies &Moag, 1986). In service encounters, interactional justice refers to the fairness of the interpersonal reatment customers receive during the consumption experience(Blodgett, Hill, &Tax, 1997). While procedural justice focuses on process issues that are functional and not interpersonal in nature (e.g., timing/speed, accessibility),interactional justice refers to the more interpersonal issues of procedures (e.g., politeness, empathy); (Clemmer &Schneider, 1996). The literature shows the central role of interactional justice in customer evaluations and behaviors (Blodgett, Hill, &Tax, 1997).Both procedural and interactional justices are linked directly to contemporary social exchange theories (Cropanzano, Rupp, Mohler, &Schminke, 2001).

Theorists argue that in social exchanges, subjects not only consider the economic importance of outcomes, but also their socio-emotional value. This socio-emotional value focuses on the quality of the relationships among individuals(Bitner, Booms, & Tetreault, 1990), including aspects such as the status and dignity people perceive. Current thinking on social exchange considers procedural and interactional justice as particularly relevant (Cropanzano, Rupp, Mohler, &Schminke,2001), emphasizing the role of relationships in social exchange. In contrast, distributive justice has been given less attention (Masteron, Lewis, Goldman, &Taylor,2000). This trend is also present in the study of service management and customer satisfaction, as it reflects the predominance of the relationship marketing approach (Gro¨nroos, 1994).

3.1.4Justice Dimensions and User Satisfaction

Theory and research distinguish between three dimensions of perceived justice: distributive justice (perceived fairness of outcomes), procedural justice (perception that fair procedures were used to arrive at outcomes), and interactional justice (perceived fairness of interpersonal treatment). This differentiation is well established, not only in the study of consumer behavior, but also in other research areas such as organizational justice (Beugre' & Baron, 2001).

In addition, Clemmer and Schneider (1996) reported that not all justice dimensions have the sameimportance in predicting customer satisfaction. They observed that distributive justice was the most important predictor of customer satisfaction, followed by procedural justice and, finally, interactional justice. Distributive justice reflects a more outcome-oriented and instrumental evaluation, given that a satisfactory outcome-to-input ratio is desired. In contrast, procedural and interactional justice are more relationship oriented, reflecting the functional and interpersonal manner in which contact employees provide the service. As Clemmer and Schneider (1996) pointed out, their findings did not confirm the dominant role of relationship marketing in service management because social aspects underlying procedural and interactional justice were secondary. Relationship marketing assumes that social interaction is critical in creating satisfied customers (Gro¨nroos, 1994).

Employees are frequently the primary contact point for the user; therefore, it is argued that employees are responsible for the quality of the service offered to customers (Bradley & Sparks, 2000). However, this study observed that service outcomes associated with distributive justice were the most critical factors in predicting user satisfaction, while the influence of the interpersonal issues included in procedural and interactional justice was secondary. Thus, this study raised the possibility that procedural and interactional justices are

subordinate to distributive justice. From the dominant relationship marketing approach, it is suggested that procedural and interactional justice should be relevant. However, the few empirical results that exist (Goodwin &Ross,1989) support the predominance of distributive justice. Thus, because not enough effort has been devoted to the study of the relative influence of justice concepts on user satisfaction, there is a need to test the predictive power of the justice dimensions more accurately.

From the expectancy disconfirmation paradigm, two principal constructs have emerged as significant and robust direct predictors of customer satisfaction in different types of products and situations: disconfirmation of expectations (Oliver & DeSarbo, 1988) and perceived performance (Churchill &Suprenant,1982). Disconfirmation of expectations refers to the degree to which outcomes meet or do not meet intrapersonal customer expectations, while performance is based on the absolute level of perceived outcomes taken alone. Controlling for the impact of disconfirmation and performance is necessary not only because these constructs are central in predicting customer satisfaction, but also because they tend to be correlated significantly with justice (Patterson, Johnson & Spreng, 1997).

As Pathak, Kucukarslan, and Segal (1994) did not consider the expectancy disconfirmation paradigm, their results could be explained by the links of justice with disconfirmation and performance, and not by the specific contribution of justice dimensions. This is particularly relevant with regard to distributive justice. The predominance of this justice component in this study could be a result of the fact that, although they are conceptually distinct, distributive justice, disconfirmation of expectations, and performance refer to outcome-oriented evaluations. The predictive power of distributive justice may be inflated artificially because this justice dimension shares variance with disconfirmation and performance (Spreng & Mackoy, 1996).

3.2Satisfaction Theory

3.2.1Cognitive Dissonance Theory

The theory of cognitive dissonance (Festinger, 1957) made a significant mark in the history of social psychology. It challenged the long-standing dominance of reinforcement theory (Aronson, 1992). Inmid-1950s, the reinforcement theory was dominant in social psychology research. Psychologists were explaining social-psychological phenomena through behavioral approaches (Cooper & Fazio, 1984). Reinforcement theorists explained conformity as an attempt not to feel anxious to be alone against a unanimous majority in Asch's well-known conformity experiment (Stone & Cooper, 2001). The reward was the comfort to be in agreement with others.

In addition, reinforcement theorists explained that a credible source would be more persuasive because it was more rewarding (Aronson, 1992).With the development of Festinger's Cognitive Dissonance theory (1957) and its classic experiment, a new era was opened for cognitively-oriented social psychologists. Many researchers departed from reward-reinforcement based explanations and moved to cognitively oriented explanations, generated from cognitive dissonance theory (Festinger & Carlsmith, 1959). It inspired researchers to apply this theory in a wide array of topics such as attitudes toward smoking and conservation of water and energy (Aronson, Fried,& Stone, 1991).

The impact of cognitive dissonance theory continued from the late 1950sto the mid-1970s. With a growing interest in purely cognitive processes such as information processes, the popularity of dissonance theory declined (Gibbons, Eggleston, & Benthin, 1997). However, the dwindling interest in dissonance theory did not have a long run. Motivational processes were combined with cognitive processes in mini-theories, which indicate reminiscent of dissonance theory in 1980s (Aronson, 1992).

The theory is built upon the notion that individuals strive toward consistency. If there are inconsistencies, they try to rationalize them to reduce psychological discomfort (Festinger, 1957). Festinger (1957) uses the term "consonance" in terms of consistency and uses the term "dissonance" in terms of inconsistency. According to this theory, dissonance might arise from logical inconsistencies, cultural values, inconsistency between a cognition and a more encompassing cognition and past experiences. There is at least one cognitive element dissonant with behavioral elements (Matz &Wood, 2005). In the existence of dissonance, individuals are motivated to reduce the dissonance and avoid situations that increase it (Comegys, 1976).The magnitude of dissonance depends on importance or value of the elements (e.g. knowledge, belief, attitudes) that are dissonant (O'Neill &Palmer, 2004). If a person gives importance to these elements, the magnitude of the dissonant relation between elements would be greater. Accordingly, the magnitude of the dissonance would influence pressures to reduce or eliminate the dissonance (Connole, Benson, &Khera, 1977). As the magnitude increases, pressures to reduce dissonance and avoidance from situations that generate dissonance increases.

Similarly, Festinger (1957) explains the same processes in his cognitive dissonance theory. Nevertheless, Festinger might be considered as the first person who formulated these notions in a precise and applicable form, by providing implications in a variety of contexts. The theory has wide implications and applications to a variety of contexts. For instance, in the process of decision making, people should handle the unpleasantness of having rejected an attractive alternative(Cummings &Venkatesan, 1976). According to Lewin (1935, as cited in Festinger, 1957), once a decision has been made, individuals tends to stick to their decisions. This process results from establishing consonant relations with the decision (e.g. chosen alternative seems to be more attractive) and eliminating dissonant relations (e.g. unchosen alternatives seem to be less attractive). Similarly, Brehm (1956,as cited in Aronson,

1992) found that after a decision has been made, subjects enhanced their liking for the chosen alternative and downgraded the unchosen alternative.

However, dissonance arises after a choice has been made (Oshikawa, 1969). The magnitude of the post decision dissonance depends on the importance of the decision, relative attractiveness of the unchosen alternative and the degree of cognitive overlap of the alternatives (Sweeney, Hausknecht, & Soutar, 2000). In other words, if the decision is important, unchosen alternatives are attractive and the degree of overlap is low, the post decision dissonance is stronger (Draycott &Dabbs, 1998).In order to reduce post decision dissonance, an individual may change or revoke the decision, change the attractiveness of the alternatives (e.g. by magnifying the importance of chosen alternative and minimizing attractiveness of unchosen alternative) or establish cognitive overlap (e.g. by creating similarities among chosen and unchosen alternatives) (Fazio, Zanna, &Cooper, 1977).

3.2.2Assimilation Theory

Assimilation theory is based on Festinger's (1957) dissonance theory. Dissonance theory posits that consumers make some kind of cognitive comparison between expectations about the product and the perceived product performance. This view of the consumer post-usage evaluation was introduced into the satisfaction literature in the form of assimilation theory (Hovland, Harvey, & Sherif, 1957). According to Anderson (1973), consumers seek to avoid dissonance by adjusting perceptions about a given product to bring it more in line with expectations.

Consumers can also reduce the tension resulting from a discrepancy between expectations and product performance either by distorting expectations so that they coincide with perceived product performance or by raising the level of satisfaction by minimizing the relative importance of the disconfirmation experienced (Sherif, Taub, & Hovland,

1958).Peyton, Pitts, & Kamery (2003) argue that Assimilation theory has a number of shortcomings. First, the approach assumes that there is a relationship between expectation and satisfaction but does not specify how disconfirmation of an expectation leads to either satisfaction or dissatisfaction (Zellner, Strickhouser, & Tornow,2004). Second, the theory also assumes that consumers are motivated enough to adjust either their expectations or their perceptions about the performance of the product (Cardello & Sawyer,1992). A number of researchers (Olson& Dover, 1979) have found that controlling for actual product performance can lead to a positive relationship between expectation and satisfaction. Therefore, it would appear that dissatisfaction could never occur unless the evaluative processes were to begin with negative consumer expectations (Deliza & MacFie,1996).

3.2.3Contrast Theory

Contrast theory was first introduced by Hovland, Harvey and Sherif (1957).Dawes, Singer and Lemons (1972) define contrast theory as the tendency to magnify the discrepancy between one's own attitudes and the attitudes represented by opinion statements. Contrast theory presents an alternative view of the consumer post-usage evaluation process than was presented in assimilation theory in that post-usage evaluations lead to results in opposite predictions for the effects of expectations on satisfaction (Luo & Homburg, 2007).While assimilation theory posits that consumers will seek to minimize the discrepancy between expectation and performance, contrast theory holds that a surprise effect occurs leading to the discrepancy being magnified or exaggerated (McCollough,Berry,&Yadav,2000).

According to the contrast theory, any discrepancy of experience from expectations will be exaggerated in the direction of discrepancy (Ma¨gi&Julander,1996). If the firm raises expectations in his advertising, and then a customer's experience is only slightly less than that promised, the product/service would be rejected as totally unsatisfactory

(Luong,2005).Conversely, under-promising in advertising and over-delivering will cause positive disconfirmation also to be exaggerated (MacKenzie&Lutz,1989).Several studies in the marketing literature have offered some support for this theory (Oliver & Hanming, 1994). The contrast theory of customer satisfaction predicts customer reaction instead of reducing dissonance; the consumer will magnify the difference between expectation and the performance of the product or service (Nyer,1997).

3.3Customer Satisfaction Theory

The specification and identification of social aspects in business relationships has made a great leap forward during the past decade. Customer satisfaction, as well as trust and commitment have become focal constructs in relationship marketing research (Doney &Cannon, 1997). More recently, researchers have started to theorize about value concepts in the context of business relationships (Flint, Woodruff & Fisher, 1997). Considering theory as well as practice in relationship management, it has been found that satisfaction, trust, value and commitment represent the most important aspects of business relationships (Aarts, Verplanken, & van Knippenberg,1998).

Customer satisfaction has been discussed extensively as a central element of a firm's marketing concept during the past two decades (Churchill & Suprenant, 1982). In marketing research there is a tendency towards a cumulative view of satisfaction, measuring it as the general level of satisfaction based on all experiences with the firm (Sharma, Niedrich & Dobbins, 1999). Various models and theories have been developed in order to define and explain the phenomenon, of which the Confirmation-Disconfirmation paradigm and perceived performance or quality seem to be the dominating approaches (Churchill & Suprenant, 1982).

The Confirmation-Disconfirmation paradigm states customer satisfaction as developing from a customer's comparison of post-purchase and post-usage evaluation of a product with the expectations held prior to purchase (Babin, Darden, & Griffin, 1994). This implies a transaction-specific rather than a cumulative view of customer satisfaction, since customer satisfaction occurs immediately after purchasing or using a product or service (Garbarino & Johnson, 1999). The transaction specific approach of customer satisfaction provides valuable insight into particular short-run product or service encounters (Bauer, Barnes, Reichardt, &Neumann, 2005). In the case of durable products, as in industrial markets, customer satisfaction may develop over time, being determined by product performance or perceived quality rather than initial expectations (Bhattacherjee, Limayem, & Cheung, 2012).

Customers require experience with a product to determine how satisfied they are with it (Anderson, Fornell,& Lehmann, 1994). Therefore customer satisfaction may be defined as attribute satisfaction, i.e. the customer's subjective satisfaction judgment resulting from observations of attribute performance (Oliver & DeSarbo, 1988)regarding a product or service purchased from an industrial supplier.

The interest in studying satisfaction and service quality as the antecedents of customer behavioral intentions has been stimulated, firstly, by the recognition that customer satisfaction does not, on its own, produce customer lifetime value (Appiah-Adu,1999). Secondly, satisfaction and quality are closely linked to market share and customer retention (Fornell, 1992). There are overwhelming arguments that it is more expensive to win new customers than to keep existing ones (Ennew & Binks, 1996). This is in line with arguments (Athanassopoulos, Gounaris & Stathakopoulos, 2001) that customer replacement costs, like advertising, promotion and sales expenses, are high and it takes time for new customers to become profitable. And lastly, the increase of retention rate implied greater positive word of

mouth (Appiah-Adu, 1999), decrease price sensitivity and future transaction costs (Reichheld & Sasser, 1990) and, finally, leading to better business performance (Fornell, 1992; Ennew & Binks, 1996).

Customer satisfaction seems to be the subject of considerable interest by both marketing practitioners and academics (Churchill & Suprenant, 1982). Companies and researchers first tried to measure customer satisfaction in the early 1970s, on the theory that increasing it would help them prosper (Coyles & Gokey, 2002). Throughout the 1980s, researchers relied on customer satisfaction and quality ratings obtained from surveys for performance monitoring, compensation as well as resource allocation (Bolton, 1998) and began to examine further the determinants of customer satisfaction (Churchill & Suprenant, 1982). In the 1990s, however, organizations and researchers have become increasingly concerned about the financial implications of their customer satisfaction (Rust & Zahorik, 1993).

While satisfaction has been examined by many researchers in different industries (Fornell, 1992; Anderson & Sullivan, 1993; Caruana, 2002), service quality is also likely to influence consumer behavioral intentions (Bitner,1990). Cronin, Brady and Hult (2000)stated that examining only one variable at a time may confound the understanding of consumer decision-making and this may lead to inappropriate marketing strategies. This view is supported by Caruana (2002) and it is crucial to study the effect of other constructs such as quality on behavioral intentions in addition to customer satisfaction.

3.4 Customer Relationship Management (CRM)

CRM is an approach that stems from the need to create a new business environment, which allows a more effective management of relationships with customers (Galbreath & Rogers, 1999). The CRM can be considered as a comprehensive strategy and the process of

acquiring, retaining and collaborating with selected customers to create superior value for the company and the customer. It involves the integration of marketing, sales, customer service, and the supply-chain functions of the organization to achieve greater efficiencies and effectiveness in delivering customer value (Giannakis-Bompolis & Boutsouki, 2014; Navimipour & Soltani, 2016).

Successful firms and organizations often strive for competitive advantages through the relationships with their customers (Navimipour, Rahmani,Navin, & Hosseinzadeh, 2015). Many of them have implemented CRM techniques in the hope that it will enable them to better target profitable segments, improve customer service, enhance customer loyalty, increase customer retention and ultimately increase the firm's financial performance (Josiassen, Assaf, & Cvelbar, 2014). In today's business environment, top managers invest in CRM systems as a strategic tool for processing end-to-end customer information to develop customer relationships(Chuang & Lin, 2013).

Many researchers have demonstrated that CRM systems significantly improved customer relationship performance (Keramati, Mehrabi, & Mojir, 2010).Also, the CRM systems have become the backbone of customer relationship development by advancing customer information processing capabilities (Kim & Choi, 2010). This is because CRM is a widely implemented strategy for managing organizational interactions with customers. It involves the processes offinding, attracting, and retaining new customers, nurturing and retaining customers the organization already has, enticing former customers back into the fold, and reducing the costs of marketing and customer service. The overall goals of CRM are to create customer satisfaction, trust, loyalty, and retention (Siriprasoetsin, Tuamsuk,& Vongprasert, 2011). Five dimensions named as strategy, organization, technology, segmentation and process, are necessary to implement a CRM project effectively (Lin, Su, & Chien, 2006).

IV. Hypotheses Development

Customer behavior, satisfaction and loyalty have extensively been examined in the context of the private entrepreneurs. But few researches have explored these issues in the context of the transportation sector, especially that involves ITS. The negative aspects of satisfaction contain consideration of the confirmation/disconfirmation paradigm (Oliver, 1980), defensive marketing (Chu, Gerstner, &Hess, 1998), and Hirschmans (1970) theory of exit. In particular, research into negative aspects of satisfaction have largely failed to consider voice and loyalty in the context of the transportation sector involving ITS.

Since the improvement of digitalized systems in the 1980s, diverse applications of IT have been increasingly prevalent in all spheres of citizen life, including transportation, infrastructure, and frameworks (Norris, 2008). The virtual state of the central public administration is as a portal that provides cross-agency services in a citizen-oriented way (Garson, 2006). Governmental agencies face accelerating public demand for electronic services and the internal need to adopt technology to achieve operational efficiency and superior outcomes (Mehdi, 2009). Conventional techniques and tools are being radically reshaping and are evolving into modernize electronic methods for conducting governmental activities (Mehdi, 2009). Compared to the usual offline environment, citizen perceptions and attitudes have been affected by the use of IT to provide advanced services at all stages of decision making in their everyday life, such as interaction, transportation, transaction, and transformation flow (White, 2007; Garson, 2006). The application of advanced and integrated services through web-based, electronic, or virtualized environments has its origins in customer relationship management, whereby a citizen-centered management approach is employed to influence public behavior and improve public-sector performance (Cho, 2001; West, 2007). With the development of a customer-centric approach, IT aims to improve

quality of life for its citizens and satisfaction with transportation services (Mehra, 2004; Nandan, 2009).

Various studies explored issues on applications of IT in public administration. One study (Welch, Hinnant, &Moon, 2004) addressed citizen trust and satisfaction with e-government by examining transparency and interactivity in electronic transactions. Another study (Kim & Lee, 2012) addressed the relationship between electronic participation and trust in local government by focusing on users' satisfaction and different dimensions of the electronic participation process. While the emergence of e-governance has undoubtedly changed governance practices (Malkia, Anttiroiko, & Savolainen, 2004), however, the adoption rate by citizens and their corresponding satisfaction levels remain unclear. The current study explores the relationships between perceived justice, dissatisfaction, willingness to complain, complaining behavior, satisfaction with complaint handing, and public confidence in the context of ITS. The model upon which this study is based was adapted from previous models (Blodgett, Hill, &Tax, 1997; Tax, Brown, & Chandrashekaran, 1988; Oliver, 1980) and is presented in Figure 1. The model describes the proposed relationships between the types of justice experienced, dissatisfaction, and post-dissatisfaction processes (satisfaction with complaint handling and public confidence) in the context of ITS.

Satisfaction in using ITS is supposed to result into public confidence. So this study used satisfaction as independent variable and public confidence as dependent variable. On the contrary, dissatisfaction is supposed to cause willingness to complaint and complaining behavior. Therefore this study used dissatisfaction as independent variable and willingness to complaint and complaining behavior as dependent variables. As a result, this study used the opposites of the same concept i.e., satisfaction & dissatisfaction to test different types of hypotheses in the data analysis part.

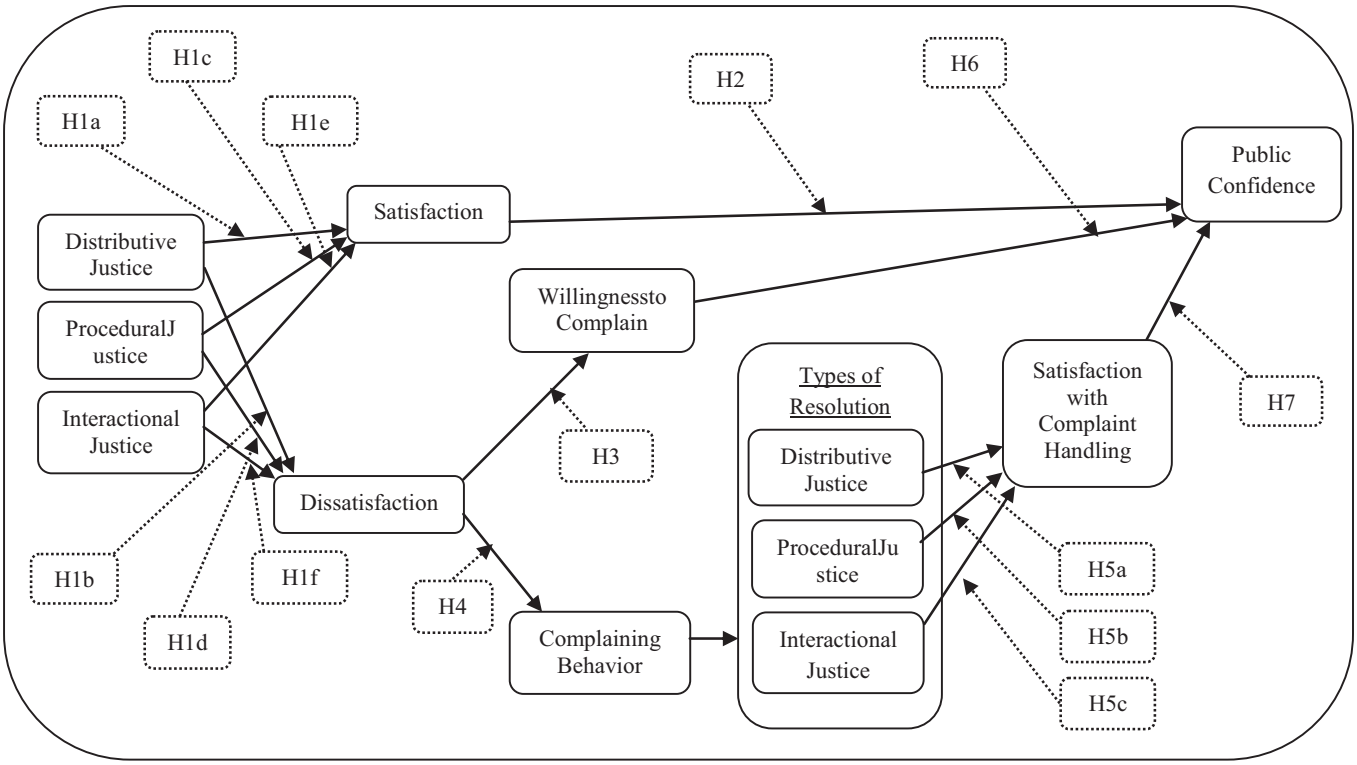

Figure 1. Model of Satisfaction/Dissatisfaction, Complaining Behavior, &Public Confidence: Role of Justice Dimension(Modified from Cho 2015, Blodgett, Hill, and Tax 1997, Tax, Brown, and Chandrashekaran 1988,and Oliver 1980)

4.1 Motivation of research

Customer behavior, satisfaction and loyalty have extensively been examined in the context of the private entrepreneurs. But few researches have explored these issues in the context of the transportation sector, especially that involves ITS. The negative aspects of satisfaction contain consideration of the confirmation/disconfirmation paradigm (Oliver, 1980), defensive marketing (Chu, Gerstner, &Hess, 1998), and Hirschmans (1970) theory of exit. In particular, research into negative aspects of satisfaction have largely failed to consider voice and loyalty in the context of the transportation sector involving ITS.

4.2 Significance of the research questions

The notion of justice arises from studies of equity that date back to the early of 1960s (Cho & Sai, 2013). Perceived justice, fairness, and equity are valuable frameworks for explaining customer reactions to complaint episodes in organizational behavior and in federal

workplace (Blodgett, Hill, &Tax, 1997; Cho & Sai, 2013). In elementary terms, equity refers to fairness, rightness, or deservingness in comparison to other entities (Oliver, 1997).

On the contrary, discrepancy, disconfirmation, and inequity imply a negative deficit. Equity and justice are classical experimental paradigms; researchers can manipulate outcome-to-input ratios and observe a direct path between outcome and input combinations and satisfaction that includes fairness in purchasing and consumption (Oliver, 1980; Oliver, 1997). Studies across several contexts such as legal, organizational, and buyer-seller relationship have found the concept of justice valuable for explaining reactions to conflict situations (Gilliand, 1993; Goodwin &Ross, 1992; Lind & Tyler, 1988; cited in Tax, Brown, & Chandrashekaran, 1998).

The concept of perceived justice to and examination of the causes of complaints, repeat purchase intention, and loyalty has been applied in private sector (Cho, 2013). Perceived justice is a broad, multifaceted construct that encompasses three dimensions: distributive justice, interactional justice, and procedural justice (Bies & Shapiro, 1987; Clemmer & Schneider, 1996). The present study explored the effects of each justice dimension on dissatisfaction, handling complaints, and confidence in the context of ITS.

4.3 Effects of Perceived Justice on Satisfaction/Dissatisfaction

The notion of justice arises from studies of equity that date back to the early of 1960s (Cho &Sai, 2013). Perceived justice, fairness, and equity are valuable frameworks for explaining customer reactions to complaint episodes in organizational behavior and in federal workplace (Blodgett, Hill, &Tax, 1997; Cho & Sai, 2013). In elementary terms, equity refers to fairness, rightness, or deservingness in comparison to other entities (Oliver, 1997). On the contrary, discrepancy, disconfirmation, and inequity imply a negative deficit. Equity and justice are classical experimental paradigms; researchers can manipulate outcome-to-input ratios and observe a direct path between outcome and input combinations and satisfaction

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4.3.1 Effects of Distributive Justice on Satisfaction/Dissatisfaction

Theories of distributive justice focus on the allocation of benefits and costs (Deutsch 1985, cited in Tax, Brown, & Chandrashekaran, 1998). Developed from *social exchange theory*, marketing exchanges are an example of benefits and costs that involve consumers (Blodgett, Hill, &Tax, 1997; Deutsch, 1985). Distributive justice explains the expectations of each party regarding the role of the other (Berger, Conner, & Fisek, 1974; Oliver, 1997; Cho, 2013) and its concepts are classified into three dimensions: equity, equality, and need. Equity is defined as the provision of outcomes that are proportional to the inputs to an exchange (Goodwin & Roos, 1992; Oliver & DeSarbo, 1988; Oliver, 1997), equality is defined as equal outcomes regardless of the contributions to an exchange (Greenberg, 1990, Deutsch, 1985), and need is defined as outcome based on requirements, regardless of contributions (Deutsch, 1985, as cited in Tax, Brown, & Chandrashekaran, 1998). In the context of consumer complaints, distributive justice encompasses the perceived fairness of policies and procedures used by the seller (Blodgett, Hill, &Tax, 1997, as cited in Cho, 2013). The notion of fairness

is almost synonymous with equity in that it explicitly implies a form of distributive justice whereby individuals get what they deserve based on their inputs (Oliver, 1997).

Dissatisfaction is a negative aspect of satisfaction that can be explained by theories that address psychologically uncomfortable tension states, such as dissonance theory (Festinger, 1957). Equity, equality, and need are concepts of distributive justice that affect dissatisfaction (Tax, Brown, & Chandrashekaran, 1998). Various previous researches studied the effects of distributive justice on users satisfaction/dissatisfaction, while few focused on these effects in the context of ITS. This study hypothesized that the higher expectation of perceived distributive justice from ITS significantly affects satisfaction/dissatisfaction.

H1a~b: Levels of perceived distributive justice from ITS affect levels of satisfaction/dissatisfaction.

4.3.2 Effects of Procedural Justice on Satisfaction/Dissatisfaction

Procedural justice relates to the manner in which the outcomes are delivered (Oliver, 1997) and refers to the perceived fairness of the policies, procedures, and criteria used by decision makers in deciding the outcome of a dispute or negotiation (Thibaut &Walker, 1975; Lind &Typer, 1988; cited in Blodgett, Hill, &Tax, 1997). The concepts of procedural justice are defined and classified according to the following dimensions: i) process control, which is freedom to communicate views on a decision process (Goodwin &Ross, 1992; Lynd &Tyler, 1988), ii) decision control, which includes the extent to which a person is free to accept or reject a decision outcome (Brett, 1986, Heide &John, 1992), iii) accessibility which is defined as the ease of engaging in a process (Bitner, Booms, & Tetreault, 1990), iv) timing, or speed, which refers to the perceived amount of time taken to complete a procedure (Fisk &Coney, 1982, Taylor, 1994), and iv) flexibility, which is defined as the adaptability of procedures to reflect individual circumstances (Tax, Brown, & Chandrashekaran, 1998). Prior

studies (Folger, 1987; Greenberg, 1990) have shown that procedural justice is meaningful because it aims to resolve conflicts in ways that encourage the continuation of a productive relationship between disputants, even when outcomes are unsatisfactory to one or both parties. Different preceding researches analyzed the effects of procedural justice on users satisfaction/dissatisfaction, while only few focused on these effects in the background of ITS. By considering procedural justice as a cause of dissatisfaction, this study hypothesized that the higher expectations of perceived procedural justice from ITS significantly affects satisfaction/dissatisfaction.

H1c~d: Levels of perceived procedural justice from ITS affects levels of satisfaction/dissatisfaction.

4.3.3 Effects of Interactional Justice on Satisfaction/Dissatisfaction

Interactional justice refers to the manner in which people are treated during the conflict-resolution process (e.g., courtesy, respect, rudeness; Bies &Shapiro, 1987; Blodgett, Hill, &Tax, 1997). As the third dimension of perceived justice, interactional justice refers broadly to the fairness of the interpersonal treatment that people receive during the enactment of procedures (Bies &Shapiro, 1987; Gilliard, 1993; cited in Tax, Brown, & Chandrashekaran, 1998). Oliver (1997) stated that interactional justice pertains to the person-to-person dealings that are the crucial elements of complaint handling (Maxham &Netemeyer, 2002) and relationship marketing (Tax, Brown, & Chandrashekaran, 1998). As reviewed in Tax, Brown, and Chandrashekaran (1998), the concepts of interactional justice are defined and classified according to the following dimensions: i) provision of reason for failure that is related to the attributions for failure, satisfaction, and fairness (Bies & Shapiro, 1987; Bitner, Booms, & Tetreault, 1990), ii) honesty, which includes the perceived veracity of information provided (Goodwin &Ross, 1989), iii) politeness, including well-mannered and courteous behavior

(Blodgett, Hill, &Tax, 1997; Goodwin & Roos, 1989), iv) effort, or the amount of positive energy put into resolving a problem (Folkes, 1984), and v) empathy, including provision of caring, individual attention (Parasuraman, Zeithaml, &Berry, 1988). Various studies analyzed the effects of interactional justice on users satisfaction/dissatisfaction, while a few studied these effects in the case of ITS. Based on these considerations, this study hypothesized that the higher expectations of perceived interactional justice from ITS significantly affects satisfaction/dissatisfaction.

H1e~f: Levels of perceived interactional justice from ITS affect levels of satisfaction/dissatisfaction.

4.4 Satisfaction/Dissatisfaction, Willingness to Complain, Complaining Behavior, &Public Confidence

This study investigated the effects of justice dimension on satisfaction/dissatisfaction, willingness to complain, and complaining behavior in the context of ITS using the model described above (Figure 1) and the traditional criteria of attitudes and intentions (Oliver, 1980; Bearden &Teel, 1983; Cho, 2013). A previous study (Welch, Hinnant, &Moon, 2004) found that satisfaction in the context of public administration is associated with citizens' perceptions of online service convenience (transactions), information reliability (i.e., transparency), and engaged electronic communication (i.e., interactivity). Various earlier researches studied the relationships between satisfaction/dissatisfaction, public confidence, willingness to complain, and complaining behavior of the users, while only a few analyzed theserelationshipsin the perspective of ITS. The relationships between satisfaction/dissatisfaction with ITS, public confidence, willingness to complain, and complaining behavior are described in the current study in the following hypotheses:

H2: Levels of satisfaction from ITS affects levels of public confidence.

H3: Levels of dissatisfaction from ITS affects levels of willingness to complain.

H4: Levels of dissatisfaction from ITS affects levels of complaining behavior.

4.5 Justice, Dissatisfaction, Complaint Handing, & Public Confidence

In addition to satisfaction/dissatisfaction and complaint behaviors, this study investigates the events that follow complaints, specifically satisfaction with complaint handling and public confidence. Previous research (Tax, Brown, & Chandrashekaran, 1998) suggested that satisfaction with complaint handling is the central mediator that links perceptions of the fairness to post-complaint attitudes and behavior. Complaint handling can be viewed as a sequence of events whereby a procedure, beginning with communication of the complaint, generates a process of interaction from which a decision is made, resulting in a specific outcome (Tax, Brown, & Chandrashekaran, 1998). Previous studies have addressed the relationships between satisfaction with the handling of complaints and perceived justice, including distributive justice (dealing with decision outcomes), procedural justice (dealing with decision-making procedures), and interactional justice (dealing with interpersonal behavior in the enactment of procedures and delivery of outcomes; Tax, Brown, & Chandrashekaran, 1998; Cho, 2013). Complaint handling is addressed by defensive marketing strategies that are designed to handle complaints by dissatisfaction customers (Chu, Gerstner, &Hess, 1998) and to manage the long-term relationships by examining structural constraints (Ping, 1993; cited in Cho, 2013). This study explored how the handling of complaints in the context of ITS affects citizen confidence and overall perceptions of ITS.

Multiplicative expectancy value models that incorporate a confidence component have consistently related confidence to attitudes and behavior (Bennett &Harrell, 1975, as cited in Dick &Basu, 1994). Confidence refers to the overall confidence of buyers (i.e., the degree of certainty) and the ability to judge or evaluate attributes (Bennett &Harrell, 1975; Howard &

Sheth, 1969). A decline of public trust in government implies the loss of public confidence in political and administrative performance as well as dissatisfaction with public services (Welch, Hinnant, &Moon, 2004). Several former researches studied the effects of resolution of complaints on the basis of three types of perceived justice on level of satisfaction, while few focused on these effects in the setting of ITS. This study examines how complaint handling on the basis of three components of perceived justice affects overall satisfaction in the context of ITS. The effects of complaining behavior on overall satisfaction in the case of resolved cases are based on the three types of perceived justice: distributive, procedural, and interactional. Accordingly, this study developed the following hypotheses:

H5a: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on distributive justice.

H5b: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on procedural justice.

H5c: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on interactional justice.

Different previous researches studied the effects of willingness to complain and complaint behavior on public confidence, while few focused on these effects in the framework of ITS. This study examines how willingness to complain and complaint behavior affect public confidence in the case of ITS. Accordingly, this study also developed hypotheses regarding the relationship between willingness to complain, overall satisfaction, and public confidence.

H6: Levels of willingness to complain in ITS environment affects levels of public confidence.

H7: Levels of satisfaction with complaint handling in ITS environment affects levels public confidence.

V. Methodology

This study examined the effects of justice dimensions on users' satisfaction/dissatisfaction, willingness to complain, and complaining behavior in the context of ITS. This study conducted the pretest by applying both online and offline surveys to collect data from the respondents. A total of 507 respondents completed the survey, yielding a response rate of 6.1% for online and 85.2% for offline survey. Respondents include employees in both public and private sector and students from universities. For the main study, it is expected to collect more data. Multi-item scales were used to measure each of the constructs that served as the basis for the questionnaire items. The survey employed a 7-point Likert scale where 1 = strongly disagree and 7 = strongly agree.

A sample of 507 respondents participated in the survey. They were asked whether they used public transportation or private transportation or both. Depending on their answer, their data were stored either in the group of public transportation, or private transportation or both. Then the data were pooled together to perform the regression.

The items developed for this survey were based on scales from previous studies (Cho, 2013; Oliver, 1997, 1980; Blodgett, Hill, &Tax, 1997; Blodgett, Granbois, &Walters, 1993) and were modified to serve the objectives of this study. Specifically, this study developed questionnaire items for the concept of distributive justice by considering qualitative measures (fairness, accessibility, and subjective invisible perception) and quantitative measures (time and cost). This study applied the concepts of efficiency and effectiveness to items for procedural and interactional justice, and considered entry, execution, and results for procedural justice. Survey items for measuring justice followed the dimensions outlined by

Tax, Brown, and Chandrashekaran (1998). The following criteria were applied to each category: i) equity, equality, and need for distributive justice; ii) process control, decision control, accessibility, timing/speed, and flexibility for procedural justice; and iii) explanation/causal account, honesty, politeness, effort, and empathy for interactional justice (Tax, Brown, & Chandrashekaran, 1998). Items for measuring confidence included the concepts of public trust in general and in the government.

Cronbach's alpha was applied for each major construct to test the construct reliability for multi-item scale. In the case of satisfaction, Cronbach's alpha values were 0.83 for distributive justice, 0.81 for procedural justice, 0.84 for interactional justice, and 0.89 for satisfaction.In the case of dissatisfaction, Cronbach's alpha values were 0.91 for distributive justice, 0.87 for procedural justice, 0.86 for interactional justice, 0.91 for dissatisfaction, 0.88 for willingness to complain, and 0.88 for complaining behavior. In regard to the handling of complaints, Cronbach's alpha values were 0.87 for distributive justice, 0.82 for procedural justice, and 0.84 for interactional justice. Finally, the Cronbach's alpha for public confidence was 0.81.

VI. Data Analysis

6.1 Demographics

Of the 507 respondents, 47.2% were female and 52.8% were male, 41.2% were18-25 years old, 39.1% were26-35 years old, 12.6% were 36-45 years old, and 7.1% were 46-55 years old. In regard to highest education level, 15.6% were undergraduate students, 69.2% were Masters students, and 15.2% were Ph.D. students. In terms of income, 29.7% of respondents had an annual household income of less than $10,000, 26.4% had annual incomes between $10,000 and $20,000, 30.1% had annual incomes between $20,000 and $30,000, and13.8% had annual incomes above $30,000.

6.2 Hypotheses Testing

The study applied factor analysis to check validity of major constructs.

Items		Components		
Factors	**Scale Items**	**1**	**2**	**3**
DISTRIBUTIVE 3	I think that uses of ITS are fair compared to conventional transportation system.	.727		
DISTRIBUTIVE 1	I think that it is convenient to use ITS compared to conventional transportation system.	.802		
DISTRIBUTIVE 2	I think that ITS is more easily accessible compared to conventional transportation system.	.637		
PROCEDURAL 2	I think that uses of ITS reduce any inconvenient process compared to conventional transportation system.		.843	
PROCEDURAL 4	Overall, I think that procedure to use ITS meets my expectation.		.691	
PROCEDURAL 1	I think that the services offered by ITS are easy to get information compared to conventional transportation system.		.797	
INTERACTIONAL 3	I think that interaction in the use of ITS is satisfactory after adopting advanced information technology compared to conventional transportation system.			.857
INTERACTIONAL 2	I think that use of ITS is more efficient compared to conventional transportation system.			.637
INTERACTIONAL 4	I think that information and explanation provided in the use of ITS are enough compared to conventional transportation system.			.734

Table 2.Results of Factor Analysis for Justice Dimensions on Satisfaction

Items		Components		
Factors	**Scale Items**	**1**	**2**	**3**
DISTRIBUTIVE 5	I think that it is inconvenient to use ITS compared to conventional transportation system.	.703		
DISTRIBUTIVE 2	I think that ITS is less easily accessible compared to conventional transportation system.	.801		
DISTRIBUTIVE 4	I think that uses of ITS are not fair compared to conventionaltransportation system.	.643		
PROCEDURAL 4	I think that uses of ITS do not reduce any inconvenient process compared to conventional transportation system.		.640	
PROCEDURAL 1	I think that the services offered by ITS are not easy to get information compared to conventional transportation system.		.804	
PROCEDURAL 3	I think that procedure to use ITS is complicated and not very clear compared to conventional transportation system.		.762	
INTERACTIONAL 4	I think that use of ITS is less efficient compared to conventional transportation system.			.697
INTERACTIONAL 1	I prefer to use conventional transportation system due to direct interaction rather than information via online.			.833
INTERACTIONAL 5	I think that the overall interaction in the use of ITS does not meet my expectation compared to conventional transportation system.			.701

Table 3.Results of Factor Analysis for Justice Dimensions on Dissatisfaction

Using principal components analyses as the extraction method and Varimax rotation methods with Kaiser Normalization, the most relevant data emerged. The results of factor analyses show that successfully represented the major constructs, with Eigen values greater than 1.00. Table 2 and 3 summarizes the result of factor analysis for justice dimension on satisfaction and dissatisfaction respectively.

On the basis of the results of factor analysis for three justice dimensions on satisfaction and dissatisfaction, only the questions used in the survey questionnaire having a factor score higher than 0.6 were used. Therefore, the questions that are more strongly related to distributive, procedural, and interactional justice dimensions were used.

Table 4 provides the results of multiple regression analysis for the effects of three justice dimension on satisfaction and dissatisfaction. In the case of satisfaction, the results of the ANOVA indicated that the models were significant at the 0.01 level with $F = 702.381$ (*r-square* = 0.743). Based on these findings, hypotheses 1c and 1e were accepted, but hypothesis 1a was rejected. In the case of dissatisfaction, the results of the ANOVA indicated that the models were significant at the 0.01 level with $F = 598.762$ (*r-square* = 0.724). Based on these findings, hypotheses 1d and 1f were accepted, but hypothesis 1b was rejected.

Variable (Independent ->Dependent)	**Standardized Coefficient (t-value-Sig)**	**Variable (Independent ->Dependent)**	**Standardized Coefficient (t-value-Sig)**
Distributive Justice->Satisfaction (H1a)	0.102 (1.381)	Distributive Justice-> Dissatisfaction (H1b)	0.037 (0.997)
Procedural Justice ->Satisfaction (H1c)	0.297 (8.023***)	Procedural Justice -> Dissatisfaction(H1d)	0.223 (8.937***)
Interactional Justice ->Satisfaction (H1e)	0.499 (20.054***)	Interactional Justice -> Dissatisfaction(H1f)	0.634 (18.037***)

*** Significant at 0.01 level (2-tailed).

Table 4. Effects of Justice Dimension on Satisfaction/Dissatisfaction

This study examined the effects of satisfaction from ITS on public confidence and the results are shown in Table 5. Overall, the results of the ANOVA find the models significant

at the 0.01 level with $F = 61.792$ (*r-square* = 0.301).Based on these findings, hypothesis H2 was accepted.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Satisfaction ->Public Confidence (H2)	0.302 (5.397***)

*** Significant at 0.01 level (2-tailed).

Table 5. Effects of Satisfaction on Public Confidence

This study conducted factor and regression analysis for willingness to complain and actual complaining behavior and the results are shown in Table 6. Overall, the results of the ANOVA find the models significant at the 0.01 level with $F = 594.097$ (*r-square* = 0.537) and $F = 121.067$ (*r-square* = 0.299). Based on these findings, hypotheses H3 and H4 were accepted.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Dissatisfaction ->Willingness to Complain(H3)	0.703 (19.037***)
Dissatisfaction ->Complaining Behavior (H4)	0.507 (10.038***)

*** Significant at 0.01 level (2-tailed).

Table 6. Effects of Dissatisfaction on Willingness to Complain and Actual Complaining Behavior

This study also examined the effects of justice dimension on overall satisfaction with complaint handling. Additional factor analyses were applied to valid constructs for three justice dimension on resolution and satisfaction with complaint handling. The results of multiple regression analyses are shown in Table 7. Overall, the results of ANOVA indicated that the models were significant at the 0.01 level with $F = 52.387$ (*r-square* = 0.406).Hypotheses 5a & 5c were accepted, and hypothesis 5b was rejected. Thus, the effects distributive and interactional justice dimensions, but not procedural justice, on satisfaction with complaint handling were significant.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Distributive Justice->Satisfaction with Complaint Handling(H5a)	0.504 (10.038***)
Procedural Justice ->Satisfaction with Complaint Handling(H5b)	0.186 (1.006)
Interactional Justice ->Satisfaction with Complaint Handling(H5c)	0.426 (5.792***)

*** Significant at 0.01 level (2-tailed).

Table 7. Effects of Justice Dimension on Satisfaction with Complaint Handling

This study also examined the effects of willingness to complain and satisfaction with complaint handling on public confidence. The results of regression analyses are shown in Table 8. Overall, the results of the ANOVA find the models significant at the 0.01 level with $F = 31.864$ (*r-square* = 0.189) and with $F = 91.637$ (*r-square* = 0.183). Therefore, hypotheses 6 and 7 were accepted. In other words, higher levels of willingness to complain were associated with lower levels of public confidence, and higher levels of satisfaction with complaint handling were associated with higher levels of public confidence.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Willingness to Complain->Public Confidence (H6)	-0.196 (-6.792***)
Satisfaction with Complaint Handling ->Public Confidence (H7)	0.497(9.637***)

*** Significant at 0.01 level (2-tailed).

Table 8. Effects of Willingness to Complain and Satisfaction with Complaint Handling on Public Confidence

VII. Conclusions

Overall, procedural and interactional justice, but not distributive justice, had significant effects on satisfaction/dissatisfaction, and the effects of interactional justice on satisfaction/dissatisfaction were stronger than those of procedural justice. In the case of public confidence, satisfaction of the users of ITS has positive effect on public confidence. In the instance of willingness to complaint and complaining behavior, dissatisfaction of the ITS users has positive effect on both willingness to complaint and complaining behavior. In regard to satisfaction with complaint handling, the effects of distributive and interactional justice, but not procedural justice, were significant, and the effects of distributive justice were stronger than those of interactional justice. These findings imply that ITS users are more importantly perceive to equity and equality issues, or distributive justice. The results also showed that willingness to complain was negatively associated with public confidence, while satisfaction with complaint handling was positively associated with public confidence. These findings imply that the employment of ITS should not be limited to the technical aspects of ITS, but should focus more attention on the subjective domain of justice. The results of

ANCOVA suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction.

During the implementation of ITS, factors affecting procedural justice such as process control, decision control, accessibility, timing, speed, and flexibility and factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be focused on. In regard to satisfaction with complaint handling, factors affecting distributive justice such as equity, equality and need and factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be emphasized.

Willingness to complain would reduce public confidence, but if complaint handling can be done satisfying distributive, procedural and interactive justice, public confidence can be restored. Since the results suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction, there is no importance of extra measure to address the special need of any particular age group or gender.

This study provides implications for policy makers and future research. Previous studies rarely examined the negative side of satisfaction in ITS. In particular, few previous studies have investigated the effects of complaint handling on public confidence. Theoretically, this study applied customer satisfaction theories that are often applied in private sector, in the case of ITS to measure users' satisfaction. This study also applied justice theory to classify causes and remedies for complaints. By applying the three dimensions of justice, this study contributes information about the post-stage of dissatisfaction and its effects on public confidence. The results of this study also have important implications for public complaint handling in terms of increasing public satisfaction with ITS, which is crucial for CRM. The importance of the successful management of dissatisfaction for stability and profitable growth and the determination of

how comprehensive a complaint response strategy must be to satisfy the public and gain their confidence has not been well addressed in the context of ITS (Choi, 2007; Levesque &McDougall, 1996). By addressing dissatisfaction, complaint handling, and confidence from ITS, the present study provides information for ITS that can be used to improve user-centered management in ITS.

This study has limitations. The response rate for online survey was relatively low. Future studies should consider higher response rate and a cross-cultural environment for comparison and generalizability. Future studies should include more respondents having diverse background including experts on ITS. Structural equation model should be used apart from multiple regression analysis to find out the causal effect. Future study should compare the effects of different justice dimensions on satisfaction/dissatisfaction of the ITS users in developed and the developing countries. It should also include the effects of Social Networking Sites (SNS) on satisfaction/dissatisfaction in the context of ITS. Finally, the suitable financing mode for ITS should be included into the future study.

There are more or less 7 types of ITS services available. Present study deals ITS in general. It did not distinguish among the different types of services offered by ITS. Future study may develop different types of questionnaire for different types of services provided by ITS. Also simultaneous linear equations can be developed to better understand the causal and sequential relationship between and among the variables.

References

Aarts, Henk, Verplanken, Bas, and van Knippenberg, Ad(1998), "Predicting Behavior from Actions in the Past: Repeated Decision Making or a Matter of Habit?" *Journal of Applied Social Psychology*, 28 (15), 1355–1374.

Adams, J. Stacy (1965),*Inequity in Social Exchange*, NewYork: Academic Press.

Adei, Stephan(1990), "Technological Capacity and Aborted Industrialization in Ghana: The Case of Bonsa Tyre Company," *World Development*, 18 (11), 1501–1511.

Adger, Neil W., Dessai, Suraje, Goulden, Marisa, Hulme, Mike, Lorenzoni, Irene, Nelson, R.Donald, Naess, L.Otto, Wolf, Johanna, and Wreford, Anita(2008), "Are There Social Limits to Adaptation to Climate Change?" *Climatic Change*, 93(3–4), 335–354.

Aghion, Philippe, David, A.Paul, and Foray, Dominique (2009), "Science, Technology and Innovation for Economic Growth: Linking Policy Research and Practice in 'STIG Systems'," *Resource Policy*, 38 (4),681–693.

Akhtar, Ali Shah (2008), "System Architecture of a Decision Support System for Freeway Incident Management in Republic of Korea," *TransportationResearch Part A: Policy and Practice*, 42 (5), 799-810.

Alton, Chua YK., Radhika Balkunje S., and Dion Goh HL. (2011), "Fulfilling Mobile Information Needs: A Study on the Use of Mobile Phones," Proceedings of the 5th InternationalConference on Ubiquitous Information Management and Communication,92-98.

Amankwah-Amoah, J. (2015), "Solar Energy in Sub-Saharan Africa: The Challenges and Opportunities of Technological Leapfrogging," *Thunderbird International Business Review*, 57 (1), 15–31.

Andaleeb, Syed S. (1992), "The Trust Concept: Research Issues for Channel ofDistribution," *Research in Marketing*, 11, 1-34.

Anderson, Erin W. and Barton, Weitz (1992), "The Use of Pledges to Build and SustainCommitment in Distribution Channels," *Journal of Marketing Research*, 29 (February), 18-34.

Anderson, Eugene W. and Sullivan, W. Mary (1993), "The Antecedents and Consequences of CustomerSatisfaction for Firms," *Marketing Science*, 12 (2), 125–143.

Anderson, Eugene W., Claes Fornell, and Donald R. Lehmann (1994), "CustomerSatisfaction, Market Share, and Profitability: Findings from Sweden," *Journal of Marketing*,58 (July), 53-66.

Anderson, James C. and Narus, A. James (1991), "Partnering as a Focused MarketStrategy," *California Management Review*, 33, 95-113.

Anderson, Richard E. (1973), "Consumer Dissatisfaction: The Effect of Disconfirmed Expectancy on Perceived Product Performance," *Journal of Marketing Research*, X (February), 38-44.

Andreasen, Alan R. and Kotler, Philip (2008), *Strategic Marketing for Nonprofit Organizations*, 7th edition, Prentice Hall, New Jersey.

Appiah-Adu, Kwaku (1999), "Marketing Effectiveness and Customer Retention in the ServiceSector," *TheService Industries Journal*, 19(3), 26-41.

Arnott, Richard, de Palma, Andre, and Lindsey, Robin (1991), "Does Providing Information to Drivers Reduce Traffic Congestion?"*Transportation Research*, 25 (A), 309-318.

Aronson, E. (1992), "The Return of Repressed: Dissonance Theory Makes A Comeback,"*Psychological Inquiry*, 3, 303-311.

Aronson,E., Fried, C., and Stone, J. (1991), "AIDS Prevention and Dissonance: A New Twist on an Old Theory," *American Journal of Public Health*, 81, 1636-1638.

Arrow, Kenneth J. (1962), "The Economic Implications of Learning by Doing," *The Reviewof*

Economic Studies, 29 (3), 155-173.
Aryee, S., Budhwar, P. S., and Chen, Z. X. (2002), "Trust as a Mediator of the Relationship between Organizational Justice and Work Outcomes: Test of a Social Exchange Model,"*Journal of Organizational Behavior*, 23, 267-286.
Atev, Stefan, Arumugam, Hemanth, Masoud, Osama, Janardan, Ravi, and Papanikolopoulos, P.Nikolaos (2005), "AVision-Based Approach to Collision Prediction at Traffic Intersections," IEEETransactions on Intelligent Transportation Systems, 6(4), 416–423.
Athanassopoulos, Antreas D., Gounaris, Spiros and Stathakopoulos, Vlassis (2001), "Behavioral Responses toCustomerSatisfaction: An Empirical Study," *European Journal of Marketing*, 35 (6), 687-707.
Awasthi, Anjali, Chauhan, S. Satyaveer, Omrani, Hichem, and Panahi, Ariyo (2011), "A Hybrid Approach Based on SERVQUAL and Fuzzy TOPSIS for Evaluating Transportation Service Quality," *Computers & Industrial Engineering*, 61, 637–646.
Babin, B.J., Darden, W.R., and Griffin, M. (1994), "Work and/or Fun: Measuring Hedonic and Utilitarian Shopping Value," *Journal of Consumer Research*, 20 (4), 644–656.
Badami, Madhav G. and Haider, Murtaza (2007), "An Analysis of Public Bus Transit Performance in Indian Cities,"*Transportation Research Part A*, 41 (10), 961–981.
Barbeau, Joseph(2010), "Travel Assistance Device: Utilizing Global Positioning System-Enabled Mobile Phones to Aid Transit Riders with Special Needs,"*Intelligent Transport Systems*, 4(1), 12-23.
Barker, D. and Smith, D.J. (1995), "Technology Foresight Using Roadmaps," *Long Range Planning*, 28(2), 21–28.
Baron, Luis Fernando and Gomez, Ricardo (2013), "Relationships and Connectedness: Weak Ties that Help Social Inclusion through Public Access Computing," *Information Technology for Development*, 19(4), 271–295.
Bauer, Hans H., Barnes, Stuart J., Reichardt, Tina, and Neumann, Marcus M. (2005), "Driving Consumer Acceptance of Mobile Marketing: A Theoretical Framework and Empirical Study," *Journal of Electronic Commerce Research*, 6 (3), 181–192.
Baum, Christopher H. and Andrea Di Maio (2000), "Gartner's Four Phases of E-government Model,"*http://www.gartner.com*.
Bearden, William O. and Jesse E. Teel (1983), "Selected Determinants of Consumer Satisfaction and Complaint Reports," *Journal of Marketing Research*, 20, February, 21-28.
Beerepoot, M. and Beerepoot, N. (2007), "Government Regulation as an Impetus for Innovation: Evidence from Energy Performance Regulation in the Dutch Residential Building Sector," *Energy Policy*, 35 (10), 4812–4825.
Ben-Akiva, M., Palma, A.D., and Isam, K. (1991), "Dynamic Network Models and Driver Information Systems," *TransportationResearch Part A: General*, 25 (5), 251-266.
Bennett, Peter D. and Harrell, Gilbert D. (1975), "The Role of Confidence in Understanding and Predicting Buyers' Attitudes and Purchase Intention,"*Journal of Consumer Research*, 2, September, 110-117.
Berger, Joseph, Thomas L. Conner, and Hamit M. Fisek (1974), *Expectation States Theory: A Theoretical Research Program*, Winthrop Publishers, Cambridge, MA.
Berry, Leonard L. (1995), "Relationship Marketing of Services-Growing Interest, Emerging Perspectives," *Journal of the Academy of Marketing Science*, 23 (4), 236-245.
Berry, Leonard L. and Parsuraman, A. (1991),*Marketing Services-Competing ThroughQuality*, New York: Free Press.
Beugre', Constant D. and Baron, Robert A. (2001), "Perceptions of Systemic Justice: TheEffects of Distributive, Procedural, and Interactional Justice," *Journal ofApplied Social Psychology*, 31, 324-339.
Beymer, D., McLauchlan, P., Coifman, B. and Malik, J. (1997), "A Real-Time Computer

Vision System for Measuring Traffic Parameters," Proceedings of IEEEworkshop computer vision and pattern recognition, 495–501.
Bhattacherjee, A., Limayem, M., and Cheung, C.M. (2012), "User Switching of Information Technology: A Theoretical Synthesis and Empirical Test,"*Information & Management*, 49 (7), 327-333.
Bickert, J. (1992), "The Database Revolution," *Target Marketing*, 35 (3), 14-18.
Bies, R. J. and Moag, J. S. (1986), "Interactional Justice: CommunicationCriteria of Fairness," In R. J. Lewicki, B. H. Sheppard, & M. H. Bazerman(Eds.), Research on negotiation in organizations Greenwich, CT: JAI Press, 1, 289-319.
Bies, Robert J. and Debra L. Shapiro (1987), "International Fairness Judgments: The Influence of Causal Accounts," *Social Justice Research*, 1, 199-218.
Bitner, Mary J. (1990), "Evaluating Service Encounters: The Effects of Physical Surroundings and Employee Responses," *Journal of Marketing*, 54(2), 69–82.
Bitner, Mary J. (1995), "Building Service Relationships: It's All about Promises,"*Journal of the Academy of Marketing Science*, 17 (5), 246-251.
Bitner, Mary J., Booms, B. M., and Tetreault, M. S. (1990), "The Service Encounter: Diagnosing Favorable and Unfavorable Incidents," *Journal ofMarketing*, 54, 71-85.
Bliemer, M. and Rose, J. (2013), "Confidence Intervals of Willingness-To-Pay for Random Coefficient Logit Models," *Transportation Research Part B*, 58, 199–214.
Blodgett Jeffrey G., Donald. H. Granbois, and Rockney. G. Walters (1993), "The Effects of Perceived Justice on Negative Word-of-Mouth and Re-patronage Intentions," *Journal of Retailing*, 69 (Winter), 399-428.
Blodgett, Jeffrey G., Donna J. Hill, and Stephen S. Tax (1997), "The Effects of Distributive, Procedural, and Interactional Justice on Post-complaint Behavior," *Journal of Retailing*, 73 (2), 185-210.
Bolton, Ruth N. (1998), "A Dynamic Model of the Duration of the Customer's Relationship with a Continuous Service Provider: The Role of Satisfaction,"*Marketing Science*, 17, 45-65.
Bradley, GrahamL. and Sparks, Beverley A. (2000), "Customer Reactions to Staff Empowerment: Mediators and Moderators," *Journal of Applied Social Psychology*,30, 991-1012.
Brand D. (1993), "Intelligent Vehicle Highway System Benefits Assessment Framework," Transportation Research Record 1408,National Research Council, Washington, DC.
Brett, Jeanne M. (1986), "Commentary on Procedural Justice Papers," in Research on Negotiation in Organizations, 1, Roy Lewicki. Max Bazerman, and Blair Sheppard, eds. Greenwich, CT: JAI Press, 81-90.
Brian, Caulfield and O'Mahony, Margaret (2007), "An Examination of the Public Transport Information Requirements of Users," *IEEE Transaction Intelligent Transportation System*, 8 (1), 21-30.
Brian, Ferris and Borning, Alan (2011),"OneBusAway: Results from Providing Real Time Arrival Information for Public Transit," Proceedings of the SIGCHIConference on Human Factors in Computing Systems, 1807-1816.
Brian, Ferris, Watkins, Kari, and Borning, Alan (2010), "Location-aware Tools for Improving Public Transit Usability," *IEEE Pervasive Computing*, 9 (1), 13-19.
Burnett, John J. (2007), *Nonprofit Marketing Best Practices*, John Wiley & Sons, New Jersey.
Cannie, J. K. and Caplin, D (1991),*Keeping Customers for Life*, Chicago: AmericanMarketing Association.
Cao, G.H. and Xia, S.G. (2015), "Study on Key Issues of Green Transportation Planning - Taking Sino-Singapore Ecological Technology Island as an Example," *Shanghai Urban Planning*, 05, 22-24.

Cardello, A. V. and Sawyer, F. M. (1992), "Effects of Disconfirmed Consumer Expectations on Food Acceptability," *Journal of Sensory Studies*, 7(4), 253–277.
Caruana, A. (2002), "Service Loyalty: The Effects of Service Quality and the Mediating Role ofCustomer Satisfaction," *European Journal of Marketing*, 36(7/8), 811–828.
Ceder, A. and Eldar, K. (2002), "Optimal Distance between Two Branches of Uncontrolled Split Intersection," *Transportation Research, Part A: Policy andPractice*, 36(8), 699–724.
Chen, C., Petty, K., Skabardonis, A., and VaraiyaP. (2001), "Freeway PerformanceMeasurement System: Mining Loop Detector Data,"*Transportation Research Record*, 1768, 96-102.
Chen, H., Wakeland, W., and Yu, J. (2012), "A Two-Stage Technology Foresight Model with System Dynamics Simulation and its Application in the Chinese ICT Industry," *Technological Forecasting and Social Change*, 79, 1254–1267.
Chen, K. and Yu, L. (2007), "Microscopic Traffic-Emission Simulation and Case Study for Evaluation of Traffic Control Strategies," *Journal of Transportation System Engineeringand Information Technology*, 7 (1), 93–99.
Chesley, N. (2005), "Blurring Boundaries? Linking Technology Use, Spillover, Individual Distress, and Family Satisfaction," *Journal of Marriage and Family*, 67,1237-1248.
Chhabra, Susheel and Kumar, Muneesh (2009), *Integrating E-Business Models for Government Solutions*, Information Science Reference, Hershey, New York.
Chiou, S.W. (2007), "A Generalized Iterative Scheme for Network Design Problem," *Applied Mathematics and Computation*, 188(2), 1115–1123.
Cho, Yoon C. (2001), "A Hybrid Approach to Customer Satisfaction Measurement that also Accounts for the Realities of E-Commerce,"Working paper.
Cho, Yoon C. (2011), "Analysis of Customer Dissatisfaction toward Perishable Grocery Goods," *Journal of Business Research*, 64, 1245-1250.
Cho, Yoon C. (2013), "Exploring Relationship among Customer Dissatisfaction, Complaints, and Loyalty in the Virtualized Environment: Roles of Advanced Services," *International Business and Economics Research Journal*, 12 (November), 1343-1360.
Cho, Yoon C. (2015), "Justice, Dissatisfaction and Public Confidence in the E-Governance," *Journal of Marketing Thought*, 2(3), 1-12.
Cho, Yoon Jik and Sai, Na (2013), "Does Organizational Justice Matter in the Federal Workplace?"*Review of Public Personnel Administration*, 33 (3), 227-251.
Choi, E. (2007), "Multimodal User Interface for Traffic Incident Management in Control Room," *IETIntelligent Transport Systems*, 1(1), 27-36.
Choi, Sungjoo (2001), "Organizational Justice and Employee Work Attitudes: The Federal Case,"*The American Review of Public Administration*, 41(2), 185-204.
Chu, Wujin, Eitan Gerstner, and James D. Hess (1998), "Managing Dissatisfaction: How to Decrease Customer Opportunism by Partial Refunds," *Journal of Service Research*, 1(2), 140-155.
Chuang, S. H. and Lin, H. N. (2013), "The Roles of Infrastructure Capability and Customer Orientation in Enhancing Customer-Information Quality in CRM Systems: Empirical Evidence from Taiwan," *International Journal of InformationManagement*, 33(2), 271-281.
Church, K. and Smyth, B. (2008), "Understanding Mobile Information Needs," Proceedingsof the10th International Conference on Human Computer Interactionwith Mobile Devices and Services, 493-494.
Church, K. and Smyth, B. (2009),"Understanding the Intent Behind Mobile Information Needs," Proceedings of the 14th International Conference on Intelligent User Interfaces,247-256.
Churchill, Gilbert A. and Suprenant, Carol (1982), "An Investigation into the Determinants

ofCustomer Satisfaction", *Journal of Marketing Research*, 19 (November), 491-504.
Clemmer, E. C. and Schneider, B. (1996), "Fair Service," In T. A. Swartz, D. E.Bowen, & S. W. Brown (Eds.), Advances in services marketing andmanagement Greenwich, CT: JAI Press, 5, 109-126.
Coates, G. (1992), "Program from Invisible Site – a Virtual Sho, a Multiple Performance Work," presented by George Coates Performance Works, (March), San Francisco, CA.
Comegys C. (1976), "Cognitive Dissonance and Entrepreneurial Behavior," *Journal of Small Business Management*, 14, 1-6.
Coninck, H. and De Sagar, A. (2015), "Making Sense of Policy for Climate Technology Development and Transfer Development and Transfer," *Climate Policy*, 15,37–41.
Connole R. J., Benson J. D., and Khera I. P. (1977), "Cognitive Dissonance among Innovators," *Journal of the Academy of Marketing Science*, 5, 9-20.
Cook, Karen S. and David M. Messick (1983), "Psychological and Sociological Perspectives on Distributive Justice: Convergent, Divergent, and Parallel Lines," in Equity Theory: Psychological and Sociological Perspectives, David M. Messick and Karen S. Cook. Eds. New York: Praeger Publisher, 1-12.
Cooke, S. C. (1991), "The Role of Value-added in Benefit/Cost Analysis," *Annals of Regional Science*, 25,145–149.
Cooper J. and Fazio R. (1984), "A New Look at Dissonance Theory," *Advances in Experimental Social Psychology*, 17, 229-266.
Coursey, David and Norris, Donald F. (2008), "Models of E-Government: Are They Correct? An Empirical Assessment,"*Public Administration Review*, May/June, 523-536.
Coyles, S. and Gokey, T. C. (2002), "Customer Retention is not Enough," *The McKinseyQuarterly*,2, 81-89.
Crainic, T.G., Gendreau, M. and Potvin, J.Y. (2009), "Intelligent Freight-Transportation Systems: Assessment and the Contribution of Operations Research," *Transportation Research Part C: EmergingTechnologies*, 17(6), 541-557.
Cronin, J. J., Brady, M. K., and Hult, G. (2000), "Assessing the Effects of Quality, Value, andCustomer Satisfaction on Consumer Behavioral Intentions in Service Environments," *Journal ofRetailing*, 76(2), 193–218.
Cropanzano, R., Rupp, D. E., Mohler, C. J., and Schminke, M. (2001), "ThreeRoads to Organizational Justice," In G. R. Ferris (Ed.), Research in personneland human resources management New York:JAI Press, 20, 1-113.
Crosby, L.A., Evans, K.R. and Cowles, D. (1990), "Relationship Quality in Services Selling:an Interpersonal Influence Perspective," *Journal of Marketing*, 54 (July), 68-81.
Cummings W. H., and Venkatesan M. (1976), "Cognitive Dissonance and Consumer Behavior: A Review of the Evidence," *Journal ofMarketing Research*, 13, 303-308.
Czernich, N., Falck, O., Kretschner, T., and Woesmann, L. (2011), "Broadband Infrastructure and Economic Growth," *The Economics Journal*, 121, 505–532.
Dahwe C., Song, C., Zhang, B., and Humphrey, M. (2004), "Uva Bus. NET: Enhancing User Experiences on Smart Devices through Context-Aware Computing," ConsumerCommunications Network Conference, 511-515.
Davis, F. D. (1989), "Perceived Usefulness, Perceived Ease of Use, and User Acceptance of Information Technology," *MIS Quarterly*, 13(3), 319-340.
Dawes, R., Singer, D. and Lemons, P. (1972), "An Experimental Analysis of the Contrast Effectand its Implications for Intergroup Communication and Indirect Assessment of Attitude," *Journalof Personality and Social Psychology*, 21(3), 281-295.
De Castro, L.N. and Timmis, J.I. (2003), "Artificial Immune Systems as a Novel Soft Computing Paradigm," *Soft Computing Journal*, 7, 671-684.

De Castro, L.N. and Von Zuben, F.J. (2000), "The Clonal Selection Algorithm with Engineering Applications," Workshop Proceeding of GECCO, Workshopon Artificial Immune Systems and their Applications, 36–37.
De Haan, P. and Keller, M. (2000), "Emission Factors For Passenger Cars: Application of Instantaneous Emission Modeling," *Journal of Transportation System Engineering& Information Technology*, 34, 4629–4638.
Debrah, Y.A. (2007), "Promoting the Informal Sector as a Source of Gainful Employment in Developing Countries: Insights from Ghana," *International Journal of Human Resources Management*, 18 (6),1063–1084.
Deliza, R. and MacFie, H. J. H. (1996), "The Generation of Sensory Expectation by External Cues and its Effect on Sensory Perception and Hedonic Ratings: A Review," *Journalof Sensory Studies*, 11(2), 103–128.
Dell'Olio, L., Ibeas, A., and Cecin, P. (2011), "The Quality of Service Desired by Public Transport Users," *Transportation Policy*, 18 (1), 217–227.
Deutsch, Morten (1985), *Distributive Justice*, New Haven, CT: Yale University Press.
Devlin, J. F., Gwynne, A. L., and Ennew, C. T. (2002), "The Antecedents of Service Expectations," *Service Industries Journal*, 22, 117-136.
Dia, H. and Thomas, K. (2011), "Development and Evaluation of Arterial Incident Detection Models Using Fusion of Simulated Probe Vehicle and Loop Detector Data," *Information Fusion*, 12(1), 20-27.
Diab, E.I. and El-Geneidy, A.M. (2012), "Understanding the Impacts of a Combination of Service Improvement Strategies on Bus Running Time and Passenger's Perception," *Transportation Research-Part A Policyand Practice*, 46(3), 614.
Dick, Alan S. and Basu, Kunal (1994), "Customer Loyalty: Toward and Integrated Conceptual Framework,"*Journal of the Academy of Marketing Science*, 22(2), 99-113.
Diener, E., Oishi, S., and Lucas, R. E. (2003), "Personality, Culture, and Subjective Wellbeing: Emotional and Cognitive Evaluations of Life," *Annual Review of Psychology*,54, 403-425.
Dodgson, M. (2000), "Innovation Policies in East Asia," Conceicao, P., Gibson, D.V., Heitor,M., Shariq, S. (Eds.), Science, Technology and Innovation Policy, Quorum 1, Westport,399–416.
Dodgson, M. (2009), "Asia's National Innovation Systems: Institutional Adaptability and Rigidity in the Face of Global Innovation Challenges," *Asia Pacific Journal of Management*, 26 (3), 589–609.
Doney, Patricia M. and Joseph, Cannon P. (1997), "An Examination of the Nature of Trust in Buyer-Seller Relationships,"*Journal of Marketing*, 61 (2), 35-51.
Doyle, S. X. and Roth, G. T. (1992), "Selling and Sales Management inAction: the Use of Insight Coaching to Improve Relationship Selling," *Journalof Personal Selling and Sales Management*, 12 (1), 59-64.
Draycott S. and Dabbs, A. (1998), "Cognitive Dissonance: an Overview of the Literature and its Integration into Theory and Practice in Clinical Psychology," *The British Journal of Clinical Psychology*, 37, 341-53.
Duan, L. R. and Mao, L. Z. (2012), "Total Traffic Reduction: an Important Idea to Deal with the Relationship between the City and Traffic,"*Comprehensive Transportation*, 6, 76-80.
Dwyer, F. R., Schurr, P. H., and Oh, S. (1987), "Developing Buyer-SellerRelationships," *Journal of Marketing*, 51, 11-27.
Dyers, J. S., Fishburn, P. C., Steuer, R. E., Wallenius, J., and Zionts, S. (1992), "Multiple Criteria Decision Making, Multi-attribute Utility Theory: The Next Ten Years," *Management Science*, 38(5),645–654.
Dziekan, K. and Vermeulen, A. (2006), "Psychological Effects of and Design Preferences for

Real-Time Information Displays," *Journal of Public Transportation*, 9 (1), 71-89.
Eboli, L. and Mazzulla, G. (2007), "Service Quality Attributes Affecting Customer Satisfaction for Bus Transit," *Journal of Public Transportation*, 10 (3), 21–34.
Eboli, L. and Mazzulla, G. (2009), "A New Customer Satisfaction Index for Evaluating Transit Service Quality," *Journal of Public Transportation*, 12 (3), 21–37.
Eboli, L. and Mazzulla, G. (2012), "Performance Indicators for an Objective Measure of Public Transport Service Quality," *European Transportation*, 51 (3), 1-21.
Ennew, C. T. and Binks, M. R. (1996), "The Impact of Service Quality and ServiceCharacteristics on Customer Retention: Small Businesses and their Banks in the UK," *British Journal of Management*, 7(1), 219-230.
Eugene, Anderson, W., Fornell, C., and Rust, R. (1997), "Customer Satisfaction, Productivity, and Profitability: Differences between Goods and Services," *Marketing Science*, 16 (2), 129–145.
Faktor, F. (2012), "Intelligent Transport Systems and Protection of Transportation Infrastructure," Proceedings of LOGVD, 23–26.
Fazio R, Zanna M. P. and Cooper J. (1977), "Dissonance and Self-Perception: An Integrative View of Each Theory's Proper Domain of Application," *Journal of Experimental Psychology*, 13, 464-79.
Festinger, L. and Carlsmith, J. M. (1959), "Cognitive Consequences of Forced Compliance," *Journalof Abnormal and Social Psychology*, 58, 203-211.
Festinger, Leon (1957), *A Theory of Cognitive Dissonance*, Stanford, California: Stanford University Press.
Fielding, G. (1995), "Congestion Pricing and the Future of Transit," *Journal of Transport Geography*, 3 (4), 239–246.
Fisk. Raymond P. and Kenneth A. Coney (1982), "Post-choice Evaluation: An Equity Theory Analysis of Consumer Satisfaction/Dissatisfaction with Service Choices," in Conceptual and Empirical Contributions to Consumer Satisfaction and Complaining Behavior, Keith Hunt and Ralph L. Day, eds., Bloomington: Indiana University, 9-16.
Flint, Daniel J., Woodruff, Robert B., and Sarah Fisher Gardial (1997), "Customer Value Change in Industrial Marketing Relationships," *Industrial Marketing Management*, 26, 163-175.
Folger, Robert (1987), "Distributive and Procedural Justice in the Workplace," *Social Justice Research*, 1, 143-160.
Folkes, Valerie S. (1984), "Consumer Reactions to Product Failures: An Attributional Approach," *Journal of Consumer Research*, 10 (March), 398-409.
Fornell, C. (1992), "A National Customer Satisfaction Barometer: The Swedish Experience,"*Journal ofMarketing*, 56(1), 6–21.
Frazier, G. L., Spekman, R. E., and O'Neal, C. (1988), "Just-in-TimeExchange Systems and Industrial Marketing," *Journal of Marketing*, 52, 52-67.
Friman, M. (2004), "Implementing Quality Improvements in Public Transport," *Journal of Public Transportation*, 7 (4), 49–65.
Fujii, S., Garling, T., and Jakobsson, C. (2004), "A Cross-Country Study of Fairness and Infringement on Freedom as Determinants of Car Owners' Acceptance of Road Pricing,"*Transportation*, 31 (3), 285-295.
Galbreath, J. and Rogers, T. (1999), "Customer Relationship Leadership: A Leadership and Motivation Model for the Twenty-First Century Business," *The TQM magazine*,11(3), 161-171.
Ganesan, Shankar (1994), "Determinants of Long-Term Orientation in Buyer-SellerRelationships," *Journal of Marketing*, 58 (April), 1-19.
Gao, H. and Liu, F. (2013), "Estimating Freeway Traffic Measures from Mobile Phone

Location Data," *EuropeanJournal of Operational Research*, 229(1), 252-260.
Garbarino, Ellen and Johnson, Mark S. (1999), "The Different Roles of Satisfaction, Trust, andCommitment in Customer Relationships," *Journal of Marketing*, 63 (2), 70-87.
Garson, G. David (2006), *Public Information Technology and E-Governance: Managing the Virtual State*, Jones and Bartlett Publishers Inc.
Geels, F.W., Hekkert, M.P., and Jacobsson, S. (2008), "The Dynamics of Sustainable Innovation Journeys," *Technology Analysis and Strategic Management*, 20 (5), 521-536.
Geyskens, I., Jan-Benedict Steenkamp, Lisa K. Scheer, and Kumar, Nirmalya (1996), "TheEffects of Trust and Interdependence on Relationship Commitment: A Trans-Atlantic Study,"*International Journal of Research in Marketing*, 13(4), 303-317.
Giannakis-Bompolis, C. and Boutsouki, C. (2014), "Customer Relationship Management in the Era of Social Web and Social Customer: An Investigation of Customer Engagement in the Greek Retail Banking Sector," *Procedia-Social and BehavioralSciences*, 148, 67-78.
Gibbons F. X., Eggleston T. J., and Benthin A. C. (1997), "Cognitive Reactions to Smoking Relapse: The Reciprocal Relation between Dissonance and Self-Esteem," *Journal of Personality and Social Psychology*, 72, 184-95.
Gilliand, Stephen W. (1993), "The Perceived Fairness of Selection Systems: An Organizational Justice Perspective,"*Academy of Management Review*, 18 (4), 694-734.
Goodwin, C. and Ross, I. (1989), "Salient Dimensions of Perceived Fairness in Resolution of Service Complaints," *Journal of Consumer Satisfaction, Dissatisfaction,and Complaining Behavior*, 2, 87-92.
Goodwin, Cathy and Ross, Ivan(1992), "Consumer Responses to Service Failures: Influence of Procedural and Interactional Fairness Perceptions," *Journal of Business Research*, 25, 149–163.
Greenberg, Jerald (1990), "Looking Fair Versus Being Fair: Managing Impressions of Organizational Justice," *Research in Organizational Behavior*, 12, 111-157.
Gro¨ nroos, C. (1994), "From Marketing Mix to Relationship Marketing: Towardsa Paradigm Shift in Marketing," *Management Decision*, 32, 4-20.
Gross, E. F. (2004), "Adolescent Internet Use: What We Expect, What Teens Report,"*Applied Developmental Psychology*, 25, 633-649.
Gummesson, E. (1987), "The New Marketing- A Developing Long-TermInteractive Relationships," *Long Range Planning*, 22, 10-20.
Gundlach, Gregory T., Ravi Achrol, S., and John Mentzer, T. (1995), "The Structure ofCommitment in Exchange," *Journal of Marketing*, 59 (January), 78-92.
Gurbaxani, V. and Whang, S. (1991), "The Impact of Information Systems on Organizations and Markets,"*Communications of the ACM*, 34(1), 59–73.
Gustafsson, Anders (2009), "Customer Satisfaction with Service Recovery," *Journal of Business Research*, 62, 1220-1222.
Hanks J. W., Jr. and Lomax T. J. (2011), "Roadway Congestion in Major Urban Areas 2002 to 2008," Paper No.910376, 90th annual meeting of the Transportation Research Board,Washington, D.C.
Hassan, M.N., Hawas, Y.E., and Ahmed, K. (2013), "A Multi-Dimensional Framework for Evaluating the Transit Service Performance," *Transportation Research Part A*, 50, 47–61.
Hayes, R. H., Wheelwright, S. C., and Clarke, K. B. (1988),*Dynamic Manufacturing*, New York: The Free Press.
Haynes, K. E., Arieira, C. R., Burhans, S., and Pandit, N. (1995), "Fundamentals of Infrastructure Financing with Respect to ITS,"*Built Environment*, 21(4), 246–254.
Haynes, K. E., Bowen,W. M., Arieira, C. R., Burhans, S., Salem, P. L., and Shafie, H. (2000), "Intelligent Transportation Systems Benefit Priorities," *Journal of Transport Geography*,

8(2), 129–139.
Heide, Jan B. and John, George (1992), "Do Norms Matter in Marketing Relationships?"*Journal of Marketing*, 56, April, 32-44.
Heiko, Aydt, Yadong, Xu, Michael, Lees and Alois, Knoll (2013),"A Multi-Threaded Execution Model for the Agent-Based Semsim Traffic Simulation," AsiaSymposium 2013,Springer.
Henk R. H. (1989), "Quantification of Latent Travel Demand on New Urban Facilities in the State of Texas," *ITE Journal*, 59,24-28.
Heron, E. and Dwyer, P. (1999), "Doing the Right Thing: Labor's Attempt to Forge a New Welfare Dealbetween the Individual and the State," *Social Policy and Administration*, 33(1), 91-104.
Hickman, J.S. and Hanowski, R.J. (2011), "Use of a Video Monitoring Approach to Reduce At-Risk Driving Behaviors in Commercial Vehicle Operations,"*Transportation Research Part F:Traffic Psychologyand Behavior*, 14(3), 189-198.
Hilson, G. and Potter, C. (2005), "Structural Adjustment and Subsistence Industry: Artisanal Gold Mining in Ghana," *Development Change*, 36 (1), 103–131.
Hiltz, Roxanne Starr and Turoff, Murray (1993), *The Network Nation (revised edition)*, Cambridge: MIT Press.
Hirschman, A. O. (1970),*Exit, Voice, and Loyalty: Responses to Decline in Firms, Organizations and States*, Cambridge, MA: Harvard University Press.
Ho, A. T. (2002), "Reinventing Local Governments and the E-Government Initiative,"*Public Administration Review*, 62 (4), 434-441.
Hoffman, Donna L. and Novak, Thomas P. (1996), "Marketing in Hypermedia Computer-Mediated Environments: Conceptual Foundations," *Journal of Marketing*, 60, 50-68.
Hoh, B., Gruteser, M., Xiong, H., and Alrabady, A. (2006), "Enhancing Security and Privacy in Traffic-Monitoring Systems," *Pervasive Computing*,45, (October–December), 38–46.
Holmgren, J. (2013), "The Efficiency of Public Transport Operations – An Evaluation Using Stochastic Frontier Analysis," *Research in Transportation Economics*, 39,50–57.
Homans (1961), *Social Behavior: It's Elementary Forms*, New York: Harcourt, Brace & World.
Hovland, C., Harvey, O. and Sherif, M. (1957), "Assimilation and Contrast Effects in Reaction to Communication and Attitude Change," *Journal of Abnormal and Social Psychology*, 55(7), 244-252.
Howard, John A. and Jagdish N. Sheth (1969), *The Theory of Buyer Behavior*, New York, John Wiley and Sons.
Hunt, George, W. and Hoyer, Wayne D. (1976), "CS/D: The Program Planning and Evaluation Perspective," in Beverlee B. Anderson (ed.), Advances in Consumer Research, 3, Cincinnati: Association for Consumer Research, 159-60.
Hunt, H. K. (1977),"CS/D-overview and Future Research Directions," In K. H.Hunt (Ed.), Conceptualization and Measurement of Consumer Satisfactionand Dissatisfaction, Cambridge, MA: Marketing ScienceInstitute, 455-488.
Ichoua, S., Gendreau, M., and Potvin, J.Y. (2000), "Diversion Issues in Real-Time Vehicle Dispatching,"*Transportation Science*, 34 (4), 426–438.
Ioana, V. Mirea and Balescu, C. (2009), "Analysis of Service Quality Management in the Materials Industry using the BCG Matrix Method,"*Amfiteatru Economic Review*, 11(26), 270-276.
Jackson, B. B. (1985),*Winning and Keeping Industrial Customers: The Dynamics ofCustomer Relationships*, Lexington, MA: D.C. Heath.
Jacobsson, Staffan and Eugenia Perez Vico (2010), "Towards a Systemic Framework for Capturing and Explaining the Effects of Academic R&D," *Technology Analysis and*

Strategic Management, 22 (7), 765–787.
Jafari Navimipour, N., Rahmani, A. M., Habibizad Navin, A., and Hosseinzadeh, M.(2015), "Expert Cloud: A Cloud-Based Framework to Share the Knowledge and Skills of Human Resources," *Computers in Human Behavior*, 46, 57-74.
James, T. (2012), "The Importance of Protecting Transport Infrastructure," *Engineering and Technology Magazine*, 7(12), 12-19.
Jarašūnienė, A. (2009), "Research on Advanced Technologies and their Efficiency in the Process of Interactions between Different Transport Modes in the Terminal," *Transport*,24(2), 129–134.
Javed Aslam, Sejoon Lim, and Daniela Rus (2012),"Congestion-Aware Traffic Routing System using Sensor Data," 15th International IEEE Conference on Intelligent Transportation Systems (ITSC), IEEE, 1006–1013.
Ji, J. andGao, X. (2010), "Analysis of People's Satisfaction with Public Transportation in Beijing," *Habitat International*, 34, 464–470.
Josiassen, A., Assaf, A. G., and Cvelbar, L. K. (2014), "CRM and the Bottom Line: Do All CRM Dimensions Affect Firm Performance?" *International Journal of HospitalityManagement*, 36, 130-136.
Kamp, L. (2004), "Notions on Learning Applied to Wind Turbine Development in the Netherlands and Denmark," *Energy Policy*, 32, 1625–1637.
Kaparias, I., Eden, N., Tsakarestos, A., Gal-Tzur, A., Gerstenberger, M., Hoadley, S.,Lefebvre, P., Ledoux, J., and Bell, M. (2012), "Development and Application of an Evaluation Framework for Urban Traffic Management and Intelligent Transport Systems", Procedia—Social Behavioral Science, 48, 3102–3112.
Karakosta, C. and Askounis, D. (2010), "Developing Countries Energy Needs and Priorities under a Sustainable Development Perspective: A Linguistic Decision Support Approach," *Energy Sustainability and Development*, 14, 330–338.
Katz, K., Larson, B., and Larson, R. (1991), "Prescription for the Waiting Time in Line Blues: Entertain, Enlighten, and Engage," *Sloan ManagementReview*, 16, 44-53.
Kavetsos, G. and Koutroumpis, P. (2011), "Technological Affluence and Subjective Wellbeing,"*Journal of Economics and Psychology*, 32, 742–753.
Kendall, J. (2000), "The Mainstreaming of the Third Sector into Public Policy in England: Whys and Wherefores," *Policy and Politics*, 28, 41-59.
Keramati, A., Mehrabi, H., and Mojir, N. (2010), "A Process-Oriented Perspective on Customer Relationship Management and Organizational Performance: An Empirical Investigation," *Industrial Marketing Management*, 39(7), 1170-1185.
Kim, B. C. and Choi, J. P. (2010), "Customer Information Sharing: Strategic Incentives and New Implications," *Journal of Economics & Management Strategy*, 19(2),403-433.
Kim, B.J., Kim, W., and Song, B.H. (2008), "Sequencing and Scheduling Highway Network Expansion using A Discrete Network Design Model," *The Annals of Regional Science*, 42, 621–642.
Kim, Hyun Joon, Lee, Jooho, and Kim, Soonhee (2008), "Making the Connection between Local Electronic-Government Development States and Collaboration Strategy: A Case Study of Gangnam District, Seoul, Korea,"*International Journal of Government Research*, 4 (3), July-September, 36-56.
Kim, J., Schmocker, J.D., and Fujii, S. (2013), "Attitudes towards Road Pricing and Environmental Taxation among US and UKStudents," *Transportation Research Part A: Policy and Practice*, 48, 50-62.
Kim, J.K. (2007), "Efficiency of Critical Incident Management Systems: Instrument Development and Validation," *Decision Support Systems*, 44(1), 235-250.
Kim, Soonhee and Lee, Jooho (2012), "E-Participation, Transparency, and Trust in Local

Government,"*Public Administration Review*, 72(6), 819-828.
Kim, Y., Kim, D., and Wachter, K. (2013), "A Study of Mobile User Engagement (Moen): Engagement Motivations, Perceived Value, Satisfaction, and Continued Engagement Intention," *Decision Support System*, 56, 361-370.
Kirkpatrick, S., Gelatt, C.D., and Vecchi, M.P. (1983), "Optimization by Simulated Annealing," *Science*, 220, 671-680.
Kitamura, R. (1989), "A Causal Analysis of Car Ownership and Transit Use," *Transportation*, 16,155–173.
Kjeldskov, J., Howard, S., Murphy, J., Carroll, J., Vetere, F., and Graham, C. (2003),"DesigningTrammatena Context-Aware Mobile System Supporting Use of Public Transportation," Proceedings of the 2003 Conference on Designing for User Experiences.
Koch, James L. and Steers, Richard M. (1978), "Job Attachment, Satisfaction, and Turnover among Public Sector Employees,"*Journal of Vocational Behavior*, 12, 119 – 128.
Kousoulidou, M., Fontaras, G., Ntziachristos, L., Bonnel, P., Samaras, Z., and Dilara, P. (2013), "Use of Portable Emissions Measurement System (PEMS) for the Development and Validation of Passenger Car Emission Factors," *Journal of Transportation System Engineering &Information Technology*, 64, 329–338.
Koutroumpis, P. (2009), "The Economic Impact of Broadband on Growth: A Simultaneous Approach," *Telecommunication Policy*, 33, 471–485.
Kraut, R., Kiesler, S., Boneva, B., Cummings, J., Helgeson, V., and Crawford, A. (2002), "Internet Paradox Revisited," *Journal of Social Issues*, 58(1), 49-74.
Król, A. (2014), "Application of the Artificial Immune System to Determine the Priorities for the Development of the Transportation Network,"Proceedings of the First International Conference on Engineering and Applied Sciences Optimization.OPT-i, Kos Island, Greece.
Krupnick A. J. (1993), "Vehicle Emissions, Urban Smog and Clean Air Policy," *The Environment of Oil (Gilbert R. J.Edition)*, Kluwer Academic Publishers, Boston.
Kwon Jung, Yoon C. Cho, and Sun Lee (2014), "Online Shoppers' Response to Price Comparison Sites: Moderating Role of Product Type and Price Consciousness on Price and Value Perceptions," *Journal of Business Research*, 67 (October), 2079-2087.
Lapidus, R. S. and Pinkerton, L. (1995), "Customer Complaint Situations: AnEquity Theory Perspective," *Psychology and Marketing*, 12, 105-122.
Lee, J. (2013), "Commercial Vehicle Pre-Clearance Programs: Current Issues and Recommendations for Potential Implementation," *Transport Policy*,27(3), 92-101.
Lemola, T. (2003), "Convergence of National Science and Technology Policy: The Case of Finland," *Resource Policy*, 31, 1481–1490.
Levitt, Theodore (1960), "Marketing Myopia,"*Harvard Business Review*, Republished in July – August 2004, Best of HBR 1960.
Li, C., Yang, H., Zhu, D., and Meng, Q. (2012), "A Global Optimization Method for Continuous Network Design Problems," *Transportation Research PartB (46)*, 1144–1158.
Li, Y., Waterson, B., and McDonald, M. (2009), "Collection and Use of Environmental Data for Transport Management: A View from Local Authorities," *IET Journal ofIntelligent Transportation Systems*, 3 (1), 95–101.
Lim, S., Balakrishnan, H., Gifford, D., Madden, S., and Rus, D. (2009),"Stochastic Motion Planning and Applications to Traffic," Proceeding in Algorithmic Foundation of Robotics VIII,Springer, 483–500.
Lin, Y., Su, H. Y., and Chien, S. (2006), "A Knowledge-Enabled Procedure for Customer Relationship Management," *Industrial Marketing Management*, 35(4), 446-456.
Lind, E. A. and Tyler, T. R. (1988), *TheSocial Psychology of Procedural Justice*, New York: Plenum.

Lindley J. A. (1989), “Urban Freeway Congestion Problems and Solutions: An Update,” *ITE Journal*, 59, 21-23.
Litan, R.E. and Rivlin, A.M. (2001), “Projecting the Economic Impact of the Internet,” *AmericanEconomic Review*, 91, 313–317.
Liu, W. (2001), “Experience and Inspiration of European Urban Transportation,” *Urban Planning*,10, 56-60.
Luathep, P., Sumalee, A., Lam, W.H.K., Li, Z., and Lo, H.K. (2011), “Global Optimization Method for Mixed Transportation Network Design Problem: A Mixed-Integer Linear Programming Approach,” *Transportation Research Part B (45)*, 808–827.
Luo, X. and Homburg, C. (2007), “Neglected Outcomes of Customer Satisfaction,” *Journal ofMarketing*,71 (April), 133–149.
Luong, A. (2005), “Affective Service Display and Customer Mood,” *Journal of ServiceResearch*, 8 (2), 117–130.
Ma¨gi, A. and Julander, C.R. (1996), “Perceived Quality and Customer Satisfaction in a Store Performance Framework,” *Journal of Retailing and Consumer Services*, 3(1), 33–41.
MacKenzie, S.B. and Lutz, R.J. (1989), “An Empirical Examination of the Structural Antecedents of Attitude toward the Ad in an Advertising Pretesting Context,”*Journal of Marketing*, 53 (April), 48–65.
Mahmassani, H.S. and Jayakrishnan, R. (1991), “System Performance and User Response under Real-Time Information in a Congested Traffic Corridor,” *Transportation Research Part A:General*, 25 (5), 293-307.
Malkia, Matti, Anttiroiko, Ari-Veikko, and Savolainen, Reijo (2004), *e-Transformation in Governance*, Idea Group Publishing, Hershey, London.
Marchau, V., Walker, W., and van Duin, R. (2008), “An Adaptive Approach to Implementing Innovative Urban Transport Solutions,” *Transportation Policy*, 15 (6),405–412.
Marco, Cipriani and Antonio, Guarino (2008), “Herd Behavior and Contagion in Financial Markets,” *Journal of Theoretical Economics*, 8 (1), 393-408.
Martin, B.R. and Johnston, R. (1999), “Technology Foresight for Wiring Up the National Innovation System: Experiences in Britain, Australia, and New Zealand,” *Technological Forecasting and Social Change*, 60 (1), 37–54.
Masteron, S. S., Lewis, K., Goldman, B. M., and Taylor, M. S. (2000), “IntegratingJustice and Social Exchange: The Differing Effects of Fair Procedures and Treatment on Work Relationships,” *Academy of ManagementJournal*, 43, 738-748.
Matsumoto, T. and Hidaka, K. (2014),“The Effect of Mobile Information Services on Commuter Trains,” Proceedings of Management of Engineering & Technology (PICMET),2014 Portland International Conference, 358-366.
Matz D. C. and Wood W. (2005), “Cognitive Dissonance in Groups: The Consequences of Disagreement,” *Journal of Personality and SocialPsychology*, 88, 22-37.
Maxham, James G. III and Richard G. Netemeyer (2002), “Modeling Customer Perceptions of Complaint Handling over Time: the Effects of Perceived Justice on Satisfaction and Intent,” *Journal of Retailing*, 78, 239-252.
McCollough, M.A., Berry, L.L., and Yadav, M.S. (2000), “An Empirical Investigation of Customer Satisfaction after Failure and Recovery,” *Journal of Service Research*, 3(2), 121–137.
McKenna, R. (1991),*Relationship Marketing: Successful Strategies for the Age ofthe Customers*, Addison-Wesley.
Mehdi, Khosrow-Pour (2009), *E-Government Diffusion, Policy, and Impact: Advanced Issues and Practices*, Information Science Reference, Hershey, New York.
Mehra, R. (2004), *Getting to Transformation, a Management Handbook*, New Delhi: McMillan India Limited.

Messenger, T. and Ewing, R. (2007), "Transit-Oriented Development in the Sun Belt," *Journal of Transportation Research*, 96, 145–153.
Miller, M. (1995), "Improving Customer Service and Satisfaction at London Underground," *Managing Service Quality*, 5 (1), 26–29.
Ministry of Land, Infrastructure, and Transport, and KDISchool of Public Policy and Management, Republic of Korea (2013), "Establishment of Intelligent Transport Systems (ITS),"*http://www.molit.go.kr/USR/policyData/m_34681/dtl?id=408.*
Montserrat Costa-Font, Jose´ M. Gil, and Bruce TraillW. (2008), "Consumer Acceptance, Valuation of and Attitudes Towards Genetically Modified Food: Review and Implications for Food Policy," *Food Policy*, 33, 99–111.
Moon, Jae M. (2002), "The Evolution of E-Government among Municipalities: Rhetoric or Reality?"*Public Administration Review*, 62 (4), 424-433.
Moorman, Christine, Gerald Zaltman, and Rohit Deshpandé (1992), "Relationships betweenProviders and Users of Market Research: The Dynamics of Trust within and betweenOrganizations," *Journal of Marketing Research*, 29 (August), 314-328.
Morfoulaki, M., Tyrinopoulos, Y.and Aifadopoulou, G. (2007), "Estimation of Satisfied Customers in Public Transport Systems: A New Methodological Approach," *Journal of the Transportation Research Forum*, 46 (1), 63–72.
Morgan, R. M. and Hunt, S. D. (1994), "The Commitment-Trust Theory ofRelationship Marketing," *Journal of Marketing*, 58 (3), 20-38.
Morlacchi, P. and Martin, B. (2009), "Emerging Challenges for Science, Technology and Innovation Policy Research: A Reflective Overview," *Research Policy*, 38, 571–582.
Mulley, C. and Tanner, M. (2009), "The Vehicle Kilometers Travelled (VKT)by Private Car: A Spatial Analysis using Geographically Weighted Regression," 32ndAustralasian Transport Research Forum ATRF 2009, Auckland, New Zealand, 29 September–1 October.
Naidu, G. M., Parvatiyar, A., Sheth, J. N., and Westgate, L. (1999), "DoesRelationship Marketing Pay? An Empirical Investigation of RelationshipMarketing Practices in Hospitals," *Journal of Business Research*, 46 (3), 207-218.
Nakamura, K. and Hayashi, Y. (2013), "Strategies and Instruments for Low-Carbon Urban Transport: An International Review on Trends and Effects," *Transport Policy*, 29,264–274.
Nandan, Shefali (2009), "E-Government: Good Deliverance through Effective Performance Management," published in the chapter of the book, *Integrating E-Business Models for Government Solutions*, Information Science Reference, Hershey, New York.
Nandan, Shefali (2010), "Determinants of Customer Satisfaction on Service Quality: A Study of Railway Platforms in India," *Journal of Public Transportation*, 13 (1), 97-113.
Navimipour, N. J. and Soltani, Z. (2016), "The Impact of Cost, Technology Acceptance and Employees' Satisfaction on the Effectiveness of the Electronic Customer Relationship Management Systems," *Computers in Human Behavior*, 55, 1052-1066.
Nevin, J. R. (1995), "Relationship Marketing and Distribution Channels:Exploring Fundamental Issues," *Journal of the Academy Marketing Sciences*, 22 (2), 327-334.
Nie, W., Shao, C.F., and Yang, L.Y. (2007), "Bi–Level Programming Model for Mixed Transportation Network Design and Genetic Solution Algorithm,"*China Civil Engineering Journal*, 40(8), 90–93.
Nishiuchi, H. and Todoroki, T. (2013),"A Study on Effectiveness of Real Time Congestion Information on Urban Railway Considering Captive Passengers," Proceedingsof OPTIMUM'13.
Norris, Donald (2008), *E-Government Research: Policy and Management*, IGI Publishing, Hershey, New York.

Norris, Donald F. (2003), "Building the Virtual State…or Not?"*Social Science Computer Review*, 21 (4), 417-424.
Nyer, P.U. (1997), "A Study of the Relationship between Cognitive Appraisals and Consumption Emotions," *Journal of the Academy of Marketing Science*, 25 (4),296–304.
O'Neill M. and Palmer A. (2004), "Cognitive Dissonance and the Stability of Service Quality Perceptions," *Journal of Services Marketing*, 18, 433-49.
Oliver H., Yau, M., and Hanming You (1994),*Consumer Behavior in China: Customer Satisfactionand Cultural Values*, Taylor & Francis.
Oliver, R. L. and Swan, J. E. (1989), "Consumer Perceptions of Interpersonal Equity and Satisfaction in Transactions: A Field Survey Approach," *Journalof Marketing*, 53, 21-35.
Oliver, Richard L. (1980), "A Cognitive Model of the Antecedents and Consequences of Satisfaction Decisions,"*Journal of Marketing Research*,17 (November), 460-469.
Oliver, Richard L. (1997), *Satisfaction: A Behavioral Perspective on the Consumer*, Irwin McGraw-Hill.
Oliver, Richard L. and DeSarbo Wayne S. (1988),"Response Determinants in Satisfaction Judgments,"*Journal of Consumer Research*, 14 (March), 495-507.
Oliver, Richard L. and Swan, John E. (1989),"Consumer Perceptions of Interpersonal Equity and Satisfaction in Transactions: A Field Survey Approach,"*Journal of Marketing*, 53 (April), 21-35.
Oliver, Richard L. and Swan, John E. (1989),"Equity and Disconfirmation Perceptions as Influences on Merchant and Product Satisfaction,"*Journal of Consumer Research*, 16 (December), 372-383.
Olsen, S. O. (2002), "Comparative Evaluation of the Relationship between Quality, Satisfaction, and Repurchase Loyalty," *Journal of the Academy ofMarketing Science*, 30, 240-249.
Olson, J. and Dover, P. (1979), "Disconfirmation of Consumer Expectations through Product Trial," *Journal of Applied Psychology*, 64, 179-189.
Oshikawa S. (1969), "Can Cognitive Dissonance Theory Explain Consumer Behavior?" *Journal of Marketing*, 33, 44-49.
Padilla-Pérez, R. and Gaudin, Y. (2014), "Science, Technology and Innovation Policies in Small and Developing Economies: The Case of Central America," *Research Policy*, 43 (4), 749–759.
Parasuraman, A., Valarie Zeithaml, and Leonard Berry (1988), "Servqual: A Multiple-Item Scale for Measuring Consumer Perceptions of Service Quality," *Journal of Retailing*, 64 (1), 12-40
Parvatiyar, A. and Sheth, J. N. (2000), "The Domain and Conceptual Foundations ofRelationship Marketing," In J. N. Sheth and A. Parvatiyar (Eds.), Handbook ofRelationship Marketing Thousand Oaks, CA: Sage Publications, 3-38.
Pathak,D. S., Kucukarslan, S., and Segal, R. (1994), "Explaining Patient Satisfaction/ Dissatisfaction in High Blood Pressure Prescription Drug Market: An Application of Equity Theory and Disconfirmation Paradigm," *Journalof Consumer Satisfaction*, Dissatisfaction, and Complaining Behavior, 7,53-73.
Patterson, P. G., Johnson, L. W., and Spreng, R. A. (1997), "Modeling the Determinants of Customer Satisfaction for Business-To-Business Professional Services," *Journal of the Academy of Marketing Science*, 25,4-17.
Pavitt, Keith (1984), "Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory," *Research Policy*, 13 (6), 343-373
Peil, M. (1996), "Ghana's Universities and their Government: An Ambiguous Relationship,"*Research Policy*, 24 (1), 52–56.
Peng, Y. (2011), "An Incident Information Management Framework Based on Data

Integration, Data Mining and Multi-Criteria Decision Making,"*Decision Support Systems*, 51(2), 316-327.
Peppers, D. and Rogers, M. (1993),*The One to One Future: Building RelationshipsOne Customer at a Time*, New York: Doubleday.
Petri, G., Jensen, J.H., and Polak, J.W. (2009), "Global and Local Information in Traffic Congestion,"*Europhysics Letters*, 88 (2), 710-716.
Peyton, R.M., Pitts, S., and Kamery, H.R. (2003), "Consumer Satisfaction/Dissatisfaction(CS/D): A Review of the Literature Prior to the 1990s," Proceedings of the Academy ofOrganizational Culture, Communication and Conflict, 7(2), 42-64.
Ping, Robert A. Jr. (1993), "The Effects of Satisfaction and Structural Constraints on Retailer Existing, Voice, Loyalty, Opportunism, and Neglect," *Journal of Retailing*, 69 (3), 320-352.
Pinninghoff, M., Contreras, R., and Atkinson, J. (2008), "Using Genetic Algorithms to Model Road Network," *IEEE Computer Society*, 45, 142-154.
Poon, T.C. (2009), "A RFID Case-Based Logistics Resource Management System for Managing Order-Picking Operations in Warehouses," *ExpertSystems with Applications*, 36(4), 8277-8301.
Poorzahedy, H., and Rouhani, O.M. (2007), "Hybrid Meta-Heuristic Algorithms for Solving Network Design Problem," *European Journal of OperationalResearch*, 182(2), 578–596.
Quan, Y.S., Liu, Y., and Chen, J.C. (2007), "Analysis of China's Urban Traffic Problems and Improvement Measures," *City Transportation*, 04, 5-9.
Rath, A. (1990), "Science, Technology, and Policy in the Periphery: A Perspective from the Center," *World Development*, 18 (11), 1429–1443.
Reichheld F. F. (1996),*The Loyalty Effect*, Boston, MA: Harvard Business SchoolPress.
Reichheld, F. F., and Sasser, W. E. (1990), "Zero Defections: Quality Comes to Services,"*HarvardBusiness Review*, 68(5), 105–112.
Rittel, H.W.J. and Webber,M.M. (1973), "Dilemmasina General Theoryof Planning,"*PolicyScience*, 4,155–169.
Rogers, E. M. (1962), *Diffusionof Innovations*, New York: Free Press.
Rosenberg, L. and Czepiel, J. (1984), "A Marketing Approach to CustomerRetention," *Journal of Consumer Marketing*, 7 (9), 45-51.
Rosenberg, N. (1969), "The Direction of Technological Change: Inducement Mechanismsand Focusing Devices," *Economic Development and Cultural Change*, 18 (1), 1-24.
Rothwell, R. (1992), "Industrial Innovation and Government Environmental Regulation: Some Lessons from the Past," *Technovation*, 12 (7), 447–458.
Rothwell, R. and Dodgson, M. (1992), "European Technology Policy Evolution: Convergence Towards SMEs And Regional Technology Transfer," *Technovation*, 12 (4), 223–238.
Rust, R.and Zahorik, A. J. (1993), "Customer Satisfaction, Customer Retention, and MarketShare,"*Journal of Retailing*, 69(2), 193–215.
Scellato, S., Fortuna, L., Frasca, M., Gómez-Garde nes, J., and Latora, V. (2010), "Traffic Optimization in Transport Networks Based on Local Routing," European PhysicalScience Journal, 73 (2), 303–308.
Shani, D. and Chalasani, S. (1992), "Exploiting Niches Using Relationship Marketing,"*Journal of Consumer Marketing*, 9 (3), 33-42.
Shapiro, B. P. and Moriarty, R. T., Jr. (1980),*National Account Management*, Cambridge, MA: Marketing Science Institute.
Shapiro, B. P. and Posner, R. S. (1979) "Making the Major Sale,"*Harvard Business Review*, 57 (4), 68-79.

Sharma, Subhash, Niedrich, Ronald W., and Dobbins, Greg (1999), "A Framework forMonitoring Customer Satisfaction: An Empirical Illustration," Industrial MarketingManagement, 28, 231-243.
Sherif, M., Taub, D., and Hovland, C. I. (1958), "Assimilation and Contrast Effects of Anchoring Stimuli on Judgments," *Journal of Experimental Psychology*, 55(2),150–155.
Sheth, C., Triantis, K., and Teodorovic, D. (2007), "Performance Evaluation of Bus Routes: A Provider and Passenger Perspective," *Transportation Research Part E*, 43,453–478.
Sheth, J. N. and Sisodia, R. S. (1995), "Improving Marketing Productivity," In J.Heilbrunn (Ed.), Encyclopedia of Marketing in the Year 2000. Chicago, IL:American Marketing Association/NTC Publishing.
Sheth, Jagdish N. and Sharma, Arun (1997), "Supplier Relationships: Emerging Issues andChallenges," *Industrial Marketing Management*, 26, 91-100.
Shibata, N., Terauchi, T., Kitani, T., Yasumoto, K., Ito, M.,and Higashishino, T. (2006), "A Method for Sharing Traffic Jam Information using Inter-Vehicle Communication, Mobiquitous," 3rd Annual International Conference on Mobile and Ubiquitous Systems—Workshops, 1–7.
Shladover S. E. (1993), "Potential Contributions of Intelligent Vehicle/Highway Systems (IVHS) to Reducing Transportation's Greenhouse as Production," *Transportation Research*, 27 (A), 207-216.
Siriprasoetsin, P., Tuamsuk, K., and Vongprasert, C. (2011), "Factors Affecting Customer Relationship Management Practices in Thai Academic Libraries," *The InternationalInformation & Library Review*, 43(4), 221-229.
Smith, A. K., Bolton, R. N., and Wagner, J. (1999), "A Model of Customer Satisfaction with Service Encounters Involving Failure and Recovery," *Journalof Marketing Research*, 36, 356-372.
Sohn, T., Li, K.A., Griswold, W.G., and Hollan, J.D. (2008),"A Diary Study of Mobile Information Needs," Proceedings of the SIGCHI Conference on Human Factors inComputing Systems, 433-442.
Spivey, M.Z. and Powell, W.B.(2004), "The Dynamic Assignment Problem," *Transportation Science*, 38(4), 399–419.
Spreng, R. A., and Mackoy, R. D. (1996), "An Empirical Examination of A Model of Perceived Service Quality and Satisfaction," *Journal of Retailing*,72, 201-214.
Stanley, K.John, Hensher, A. David, and Loader, Chris(2011), "Road Transport and Climate Change: Stepping Off the Greenhouse Gas," *Transportation Research Part A: Policy Practice*, 45 (10),1020–1030.
Stead,D. and Banister,D. (2003), "Transport Policy Scenario Building," *Transportation Planning Technology*, 26(6),513–536.
Steuer, Jonathan (1992), "Defining Virtual Reality: Dimensions Determining Telepresence," *Journal of Communication*, 42 (4), 73-93.
Stone J. and Cooper J. (2001), "A Self-Standards Model of Cognitive Dissonance," *Journal of Experimental Social Psychology*, 37, 228-43.
Storbacka, K. (2000), "Customer Profitability: Analysis and Design Issues," In J. N.Sheth and A. Parvatiyar (Eds.), Handbook of Relationship Marketing (565-586), Thousand Oaks, CA: Sage Publications.
Sun, Y., Song, R., He, S., and Chen, Q. (2009), "Mixed Transportation Network Design Based on Immune Clone Annealing Algorithm, *Journal of Transportation Systems Engineering& IT*, 9(3), 103–108.
Swan, J. E. and Oliver, R. L. (1989), "Post-Purchase Communications by Consumers,"*Journal of Retailing*, 65, 516-533.
Sweeney, J. C., Hausknecht, D, and Soutar, G. N. (2000), "Cognitive Dissonance after

Purchase: A Multidimensional Scale," *Psychology &Marketing*, 17, 369-385.
Swimmer, C.R. and Klein, C.C. (2010), "Public Transportation Ridership Levels," *Journal of Economic Education*, 10 (1), 40–46.
Takahashi, N., Takada, T., Kiriishi, M., Tokunaga, R., and Kamiyama, S. (2012),"Subjective andObjective Assessment of Winter Driving Environment Surface," *TransportationWeather*, 44 (II), 521-534.
Tax, Stephan S., Brown, Stephen W., and Chandrashekaran, Murali (1998), "Customer Evaluations of Service Complaint Experiences: Implications for Relationship Marketing," *Journal of Marketing*, 62, 60-76.
Taylor, B.D., Miller, D., Iseki, H., and Fink, C. (2009), "Nature and/or Nurture?Analyzing the Determinants of Transit Ridership across US Urbanized Areas," *Transportation Research Part A*, 43 (1), 60–77.
Taylor, Shirley (1994), "Waiting for Service: The Relationship between Delays and Evaluations of Service,"*Journal of Marketing*, 58, April, 56-69.
Thibaut, J. and Walker, L. (1975),*Procedural Justice: A Psychological Analysis*, Hillsdale, NJ: Lawrence Erlbaum.
Tianze, X., Heng, W., and Zhuan–De, W. (2009), "Study on Continuous Network Design Problem Using Simulated Annealing and Genetic Algorithm,"*Expert Systems with Applications*, 36, 2735–2741.
Treiber, M., Hennecke, A., and Helbing, D. (2000), "Congested Traffic States in Empirical Observations and Microscopic Simulations," *Physical Review*, 62 (2), 1805-1821.
Tyrinopoulos, Y. and Antoniou, C. (2008), "Public Transit User Satisfaction: Variability and Policy Implications," *Transport Policy*, 15, 260–272.
Valkenburg, P. M. and Peter, J. (2007), "Online Communication and Adolescent Wellbeing: Testing the Stimulation versus the Displacement Hypothesis," *Journal ofComputer-Mediated Communication*, 12, 1169-1182.
Vitta, P.B. (1990), "Technology Policy in Sub-Saharan Africa: Why the Dream Remains Unfulfilled," *World Development*, 18 (11), 1471–1480.
Walker, W. (2000), "Entrapment in Large Technology Systems: InstitutionalCommitments and Power Relations", *Research Policy*, 29 (7-8), 833-846.
Walls M. A. (1992), "Differentiated Products and Regulation: The Welfare Costs of Natural Gas Vehicles", Resourcesfor the Future discussion paper, Washington, D.C.
Wang, J. and Wang, H. (2011), "The Predictive Effects of Online Communication on Well-Being among Chinese Adolescents," *Psychology*, 2(4), 359-362.
Wang, X., Wu, D., and Wang, H. (2006), "An Attempt to Calculate Economic Links between Cities," *Urban Studies*, 13(3), 55–59.
Wang, Y. (2012), "Perceptual Control Architecture for Cyber-Physical Systems in Traffic Incident Management," *Journal of Systems Architecture*,46(1), 139-148.
Wanga, S.,Meng, Q., and Yang, H. (2013), "Global Optimization Methods for the Discrete Network Design Problem," *Transportation Research Part B (50)*, 42–60.
Welch, Eric W., Hinnant, Charles, C., and Moon, Jae M. (2004), "Liking Citizen Satisfaction with E-Government and Trust in Government,"*Journal of Public Administration Research and Theory*, 15(3), December, 371-391.
West, Darrell M. (2007), "Global Perspectives on E-Government,"*Governance and Information Technology*, edited by Viktor Mayer-Schonberger and David Lazer.
Westbrook, R. A. (1980), "Intrapersonal Affective Influences on Consumer Satisfaction with Products," *Journal of Consumer Research*, 7, 49-54.
White, Jay(2007), *Managing Information in the Public Sector*, Routledge.
Wilson, David T. (1995), "An Integrated Model of Buyer-Seller Relationships," *Journal ofthe Academy of Marketing Science*, 23 (4), 335-345.

Wind, Y., Mahajan, V., and Gunther, R. E. (2002),*Convergence Marketing:Strategies for Reaching the New Hybrid Consumer*, Upper Saddle River,NJ: Prentice-Hall.
Wright, L. and Fulton, L. (2005), "Climate Change Mitigation and Transport in Developing Nations," *Transport Reviews*, 25 (6), 691–717.
Xie, G. and Hoeft, B. (2012), "Freeway and ArterialSystem of Transportation Dashboard," *Journal of the TransportationResearch Board*, 2271(1), 45-56.
Xu, T., Wei, H., and Huc, G. (2009), "Study on Continuous Network Design Problem Using Simulated Annealing and Genetic Algorithm," *Expert Systemswith Applications*, 36,1322–1328.
Yan, Y. (2012), "Bus Transit Travel Time Reliability Evaluation Based on Automatic Vehicle Location Data,"*Journal of Southeast University*, 28(1), 100-105.
Yi, Y. (1990),"A Critical Review of Consumer Satisfaction," In Valarie A. Zeithaml (ed.), *Review of Marketing*, 68-123. American Marketing Association, Chicago.
Yin, G.T. and Li, Q. (2009), "Planning and Practice of Green Transportation System - Taking Sino-Singapore Tianjin Eco-City as an example,"*City Transportation*, 4, 56-58.
Yu, T., Gu, C., and Li, Z. (2008), "China's Urban Systems in terms of Air Passenger and Cargo Flows since 1995," *Geographical Research*, 27(6), 1407–1418.
Zak, J. (2011), "The Methodology of Multiple Criteria Decision Making/Aiding in Public Transportation," *Journal of Advance Transportation*, 45 (1), 1–20.
Zeithaml, Valerie A. (1988), "Consumer Perceptions of Price, Quality, and Value: A Means-End Model and Synthesis of Evidence," *Journal of Marketing*, 52 (July), 2-22.
Zellner, D. A., Strickhouser, D., and Tornow, C. E. (2004), "Disconfirmed Hedonic Expectations Produce Perceptual Contrast, not Assimilation," *The American Journalof Psychology*, 117, 363–387.
Zhang, G., Lu, J., and Xiang, Q. (2008), "Application of Genetic Algorithm to Network Design Problem," International Conference on IntelligentComputation Technology and Automation, 26–29.
Zhou, J., Yang, L., and Xu, Y. (2007), "The Economic Performance of Transportation Infrastructure: An Empirical Study on the Recent Development of China," *WorldTransactions on Engineering and Technology Education*, 6(1), 193-197.

Appendix A.
Questionnaire

Part 1: Research Questions

i) Do levels of perceived justice (distributive, procedural and interactional) in ITS environment affect levels of satisfaction/dissatisfaction?
ii) Do levels of satisfaction form ITS affect levels of public confidence?
iii) Do levels of dissatisfaction form ITS affect levels of willingness to complain?
iv) Dolevels of dissatisfaction form ITS affect levels of complaining behavior?
v) Do levels of complaining behavior affect levels of satisfaction with complaint handling when the complaints are resolved based on three dimensions (distributive, procedural and interactional)of justice?
vi) Dolevels of willingness to complainin ITS environment affect levels of public confidence?
vii) Do levels of satisfaction with complaint handling in ITS environment affect levels of public confidence?

Part 2: Introduction

Purpose of the study:

Transportation industry, like many industries in the current world, has undergone massive transformation due to the advent of Information Technology (IT). IT enables various components of the transportation system to become intelligent by microchips and sensors and thereby empowering them to communicate with each other through wireless technologies. Such IT applications contribute in significant improvements in the performance of the transformation system, which includes reduction in congestions, less pollution and enhanced safety. Improved performance in the overall transportation system ensures customer satisfaction to the everyday commuters.

The purpose of the study is to investigatesatisfaction and public confidence in the context of Intelligent Transportation System (ITS) (transportation systems that use modern IT applications such as internet and mobile applications) and this study will explore implications to CRM and public policy.

Anonymity

The responses to the survey questionnaire are solely to be used for the research purposes. So all the respondents will remain anonymous during and after this research work.

Voluntary

The responses to the survey questionnaire are voluntary.

Correspondence

If you have any questions, queries or comments, please send an e-mail to rahmananisur@kdis.ac.kr

Please answer the following questions on the basis of your personal experiences from the use of ITS.

Part 3: Basic start-up question

1. Do you use Intelligent Transportation System (ITS) (transportation systems that use IT applications such as internet and mobile applications)?

_____ Yes _____ No (If not, stop here)

2. Have you ever used ITS within last one year?

_____ Yes _____ No (If not, stop here)

3. When did you start using ITS approximately?
( ) Less than one year ( ) More than one – Less than two years
( ) More than two – Less than three years ( ) More than three years
4. How likely do you use ITS?
Very unlikely 1 2 3 4 5 6 7 Highly Likely
5. How much are you dissatisfied with the use of ITS?
Very dissatisfied 1 2 3 4 5 6 7Very satisfied

If the Answer of Question #5 is within the range (5 ~ 7), please go to Section A

If the Answer of Question #5 is within the range (1 ~ 4), please go to Section B

Part 4: Main questions

Section A:

6. Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think that it is convenient to use ITS compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

b. I think thatITS is more easily accessible compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

c. I think that uses of ITS are fair compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

d. I think that use of ITS meets my expectations compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

e. I think that use of ITS is the better method to facilitate commuting compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS are easy to get information compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

b. I think that uses of ITS reduce any inconvenient process compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

c. I think that procedure to use ITS isnot complicated and very clear compared to conventional transportation system.
1 2 3 4 5 6 7 N/A

d. Overall, I think that procedure to use ITS meets my expectation.
1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I prefer not to use conventional transportation system due to availability of information in ITSvia online.

1 2 3 4 5 6 7 N/A

b. I think that use of ITS is more efficient compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that interaction in the use of ITS is satisfactory after adopting advanced information technology compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. I think that information and explanation provided in the use of ITS are enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

e. I think that the overall interaction in the use of ITS meets my expectation compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

7. (Satisfaction) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I am satisfied with the services offered by ITS due to convenient procedure.

1 2 3 4 5 6 7 N/A

b. I am pleased with ITS as I could have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am satisfied with ITS as I have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am satisfied with use of ITS as I am fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am satisfied with the use of ITS as my complaints will be resolved by the service staff.

1 2 3 4 5 6 7 N/A

f. I think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am satisfied with the use of ITS as it meets my expectation.

1 2 3 4 5 6 7 N/A

Please go to Q# 15

Section B:

8. Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think that it is inconvenient to use ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think thatITS isless easily accessible compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that uses of ITS arenot fair compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. I think that use of ITS does meet my expectations compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

e. I think that use of ITS is not the better method to facilitate commuting compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS arenot easy to get information compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that uses of ITS do not reduce any inconvenient process compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that procedure to use ITS is complicated and not very clear compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. Overall, I think that procedure to use ITS does not meet my expectation.

1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I prefer to use conventional transportation system due to direct interaction rather than information via online.

1 2 3 4 5 6 7 N/A

b. I think that use of ITS is less efficient compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that interaction in the use of ITS is not satisfactory even after adopting advanced information technology compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. I think that information and explanation provided in the use of ITS are not enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

e. I think that the overall interaction in the use of ITS does not meet my expectation compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

9. (Dissatisfaction) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I am dissatisfied with the services offered by ITS due to inconvenient procedure.

1 2 3 4 5 6 7 N/A

b. I am not pleased with ITS as I could not have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am dissatisfied with ITS as I do not have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am not so satisfied with use of ITS aa I am not fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am not satisfied with the use of ITS as my complaints will not be resolved due to lack of presence of service staff.

1 2 3 4 5 6 7 N/A

f. I do not think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am dissatisfied with the use of ITS as it does not meet my expectation.

1 2 3 4 5 6 7 N/A

10. Have you ever filed complaints against ITS? ( ) Yes ( ) No (If yes, go to Q# 13)

11. How strong did you have intention to complaint against ITS?

Very unlikely 1 2 3 4 5 6 7 N/A Highly likely

12. (Willingness to complain) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I often felt like complaining against ITS.

1 2 3 4 5 6 7 N/A

b. I was about to complain due to dissatisfaction in using ITS.

1 2 3 4 5 6 7 N/A

c. I regret that I did not complain actually even though I was not satisfied with the use of ITS.

1 2 3 4 5 6 7 N/A

d. I am unwilling to complain against ITS as I do not have strong motivation to do so.

1 2 3 4 5 6 7 N/A

e. I am hesitant to complain against ITS as I do not want to spend money and time.

1 2 3 4 5 6 7 N/A

f. I am reluctant to complain against ITS as I do not want to encounter uncomfortable situation.

1 2 3 4 5 6 7 N/A

g. I am hesitant to complain against ITS since I am not aware of the procedure to complain.

1 2 3 4 5 6 7 N/A

Please go to Q# 15

13. (Complaining Behavior) Please rate your overall opinions about experiences regarding your complaints from using ITS.<u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I actually complained to the organizations that provide ITS as I am not satisfied with it.

1 2 3 4 5 6 7 N/A

b. I expressed my unpleasant feeling to the organizations that provide ITS with the believe that it will not occur again.

1 2 3 4 5 6 7 N/A

c. I expected that my complaints are resolved if I address to the organizations that provide online public service.

1 2 3 4 5 6 7 N/A

14. (Resolution) Please rate your overall opinions about experiences regarding your complaints from using ITS and reactions. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

(Distributive Justice)

a. I think that getting feedback from the organizations that provide ITS on my complaints was convenient.

1 2 3 4 5 6 7 N/A

b. I think that the complaints were fairly treated by the organizations that provide ITS.

1 2 3 4 5 6 7 N/A

c. Overall, distributive services for my complaints offered by the organizations that provide ITS meet my expectations.

1 2 3 4 5 6 7 N/A

(Procedural Justice)

a. It was not so difficult to find the way to how to complain to get resolved.

1 2 3 4 5 6 7 N/A

b. My complaints were well resolved with plausible procedure.

1 2 3 4 5 6 7 N/A

c. Follow-up services to resolve complaints were well-proceeded.

1 2 3 4 5 6 7 N/A

d. I think that the overall procedure to receive feedback on my complaints from the organizations that provide ITS was efficient.

1 2 3 4 5 6 7 N/A

e. Overall, I think the resolution process offered by the organizations that provide ITS meets my expectation.

1 2 3 4 5 6 7 N/A

(Interactive Justice)

a. My complaints were timely resolved due to 24 hours/7 days.

1 2 3 4 5 6 7 N/A

b. I think that I received response about my complaints from the organizations that provide ITS with satisfactory response manner.

1 2 3 4 5 6 7 N/A

c. I think that information and explanation about my complaints were enough from the organizations that provide ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. The way I receive answers/responses from the organizations that provide ITS significantly affect to my decision making to use ITS.

1 2 3 4 5 6 7 N/A

e. Overall, I think that interaction with the organizations that provide ITS while my complaints are resolved, meets my expectation.

1 2 3 4 5 6 7 N/A

15. (Public Confidence) Please rate your overall opinions about experiences regarding your confidence from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. Using ITS increase confidence among the users.

1 2 3 4 5 6 7 N/A

b. By offering ITS, users' confidence level has been increased.

1 2 3 4 5 6 7 N/A

c. Development of ITS help enhance trust among users.

1 2 3 4 5 6 7 N/A

d. Overall, use of ITS will help increase trust among the users.

1 2 3 4 5 6 7 N/A

Part 5: Demographic questions

16. How old are you?

( ) Below 18 ( ) 18 – 25 ( ) 26 – 35 ( ) 36 – 45 ( ) 46 – 55

( ) 56 – 65 ( ) 65 +

17. What is your gender? _____ Male _____ Female

18. What is your education level?

( ) High school or below

( ) Associate degree (completed 2 years of college)

( ) Bachelor degree (completed 4 years of college)

( ) Master degree or higher

19. What is your marital status? _____ Married _____ Single

20. What is your annual income (optional)?

( ) $ 10,000 or less ( ) $ 10,001 - $ 20,000

( ) $ 20,001 - $ 30,000 ( ) $ 30,001 - $ 40,000

( ) $ 40,001 - $ 50,000 ( ) $ 50,001 - $ 60,000

( ) $ 60,001 - $ 70,000 ( ) $ 70,001 or more

21. What is your nationality? _____

22. What is your occupation (optional)?

( ) Student ( ) Own a personal business

( ) Businessman ( ) Public Servant

( ) Housewife ( ) Other (please specify)_____

Part II

Comparing Satisfaction/Dissatisfaction and Public Confidence in the ITS Environment in Public and Private Transportation

Abstract

Though Intelligent Transport Systems (ITS) is widely used both in public and private transportation, the factors that influence satisfaction and public confidence seem to be different in the two modes of transportation. Private transportation users are more interested in having information regarding the existing congestion scenario on their current route, whether there is any occurrence of accidents on the way and the availability of repair or maintenance shop nearby. On the other hand, public transportation users are more concerned about the information regarding the ease of accessibility to the public vehicles, total transit time required to reach the destination, travel speed, frequency of vehicles, behavior of the service personnel and cleanliness of the public vehicles. The purpose of this study is to compare the justice dimensions that influence satisfaction and public confidence in the context of ITS in public and private transportation and to explore implications to Citizen/Customer Relationship Management (CRM) and public policy. This study explores the following research questions: i) Do levels of perceived justice (distributive, procedural and interactional) in ITS environment affect levels of satisfaction/dissatisfactionin both public and private transportation? ii) Do levels of satisfaction form ITS affect levels of public confidence in both public and private transportation? iii) Do levels of dissatisfaction form ITS affect levels of willingness to complain in both public and private transportation? iv) Do levels of dissatisfaction form ITS affect levels of complaining behavior in both public and private transportation? v) Do levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on three dimensions (distributive, procedural and interactional)of justice in both public and private transportation? vi) Do levels of willingness to complain in ITS environment

affect levels of public confidence in both public and private transportation? vii) Do levels of satisfaction with complaint handling in ITS environment affect levels of public confidence in both public and private transportation?

This study finds that in case of public transportation, policy planners should focus on freedom to communicate views and opinions, ease of engaging commuting, adaptability of commuting to reflect individual circumstances, manner and behavior of the service personnel, and provision of caring, individual attention towards the passengers. In case of private transportation, policy planners should focus on manner and behavior of the service personnel, and provision of caring, individual attention towards the passengers.

Table of Contents

I. Introduction

1.1 Perception of ITS Regarding Public and Private Transportation

Commuters expect their travel experience to be fair, and they react negatively if they find that during their travel, they have been subjected to unjust interactions, procedures or outcomes (Hunt, 1977). Therefore, satisfaction response is comprised of an added factor of perceived justice which is not reflected in the expectancy disconfirmation paradigm (Oliver & Swan, 1989).Thus, travelers have a justice motive and judge their relationships with institutions and salespersons providing ITS using fairness as a fundamental base and the affected commuters may experience dissatisfaction and elicit an intention to switch service providers.(Westbrook, 1980).

Table 1 below summarizes perception of ITS(Patterson, Johnson & Spreng, 1997; Cropanzano, Rupp, Mohler, & Schminke, 2001)in the cases of private and public transportation.

	Effects of ITS	Level of Application	
		Private	Public
Types of information required	Congestion	High	Low
	Accident	High	Low
	Repair/maintenance	High	Low
	Accessibility	Low	High
	On-time performance	Low	High
	Travel speed	Low	High
	Service frequency	Low	High
	Personnel/driver behavior	Low	High
	Vehicle tidiness	Low	High
Frequency of use of information	Regular commuting to work place, shopping, and leisure	High	High
	Long drive	High	Low
Perceived utilities	Reduction in travel time	High	High
	Availability of information	High	High
	Reduction in travel cost	High	High

Table1: Perception of ITS: Private vs. Public Transportation Users (Summarized from Patterson, Johnson & Spreng, 1997; Cropanzano, Rupp, Mohler, & Schminke, 2001)

Private transportation users are more interested in having information regarding the existing congestion scenario on their current route, whether there is any occurrence of accidents on the way and the availability of repair or maintenance shop nearby (Ahn & Rakha, 2008). On the other hand, public transportation users are more concerned about the information regarding the ease of accessibility to the public vehicles, total transit time required to reach the destination, travel speed, frequency of vehicles, behavior of the service personnel and cleanliness of the public vehicles (Yan & Mok, 2012).

Public transportation commuters frequently seek for the information regarding their regular commuting to work place, shopping mall, and leisure places (Weber, 2003). Apart from these cases, private transportation users also look for the information about long drive (Hughes, Knittel,&Sperling,2008). Reduction in travel time, availability of information and reduction in travel cost are perceived utilities in case of both public transportation users (Wall& McDonald, 2007) and private transportation users (Poorzahedy & Rouhani,2007).

In terms of distributive justice, private transportation users are concerned about availability of right information (Yang, 1998) while public transportation users are focused on service quality of their journey to the amount of fare they have to pay (Rubio, Aguado, Hontangas, & Hernandez,2007). In the case of procedural justice, private transportation users are motivated about ease of availability of proper travel information (Fernandez, De Cea,Valverde,2009), but public transportation users are attentive on transit time and waiting time during commuting (Al-Enezi, Abbod, & Alsharhan, 2010). For interactional justice, private transportation users are driven about ease of interaction with the information provider (Gubins, Verhoef, & de Graaff, 2012), but public transportation users concentrate on fairness of the

interpersonal treatment they receive from the service staff (Martin, Wrigley, Barnett, & Roderick, 2002).

Table 2 below summarizes the theoretical background on Justice Theory regarding private and public transportation (Oliver & DeSarbo, 1988; Lapidus & Pinkerton, 1995; Katz, Larson, & Larson, 1991; Blodgett, Hill, & Tax, 1997).

		Justice Elements	Private	Public
Justice theory	**Distributive**	Equity Equality Need	Perceptions of justice result from customer evaluations of outcome fairness such as availability of right information.	The customer expects reciprocity in terms of tangible matters (e.g., relating service quality to fare).
	Procedural	Accessibility Timing Flexibility	Ease of availability of information results in users' satisfaction.	Waiting for short time for vehicles and ease of accessibility results in users' satisfaction.
	Interactive	Effort Politeness Empathy	The ease of interaction with the information provider contributes towards users' satisfaction.	The fairness of the interpersonal treatment commuters receive during the travel determines users' satisfaction.

Table2: Theoretical Background on Justice Theory Regarding Private and Public Transportation (Summarized from Oliver &DeSarbo, 1988; Lapidus & Pinkerton, 1995; Katz, Larson, & Larson, 1991; Blodgett, Hill, & Tax, 1997)

1.2Purpose of the Study and Research Questions

Customer satisfaction and loyalty and public confidence have been investigated extensively in the case of private firms. However, few researches have been carried out in the context of public sectors, especially that involving ITS. The purpose of the study is to investigate satisfaction and public confidence in the context of ITS in both public and private transportation and this study will explore implications to Citizen/Customer Relationship Management

(CRM)and public policy. The aforementioned purpose of the current study will be explored with the aid of following research questions:

i) Do levels of perceived justice (distributive, procedural and interactional) in ITS environment affect levels of satisfaction/dissatisfaction in both public and private transportation?

ii) Do levels of satisfaction form ITS affect levels of public confidence in both public and private transportation?

iii) Do levels of dissatisfaction form ITS affect levels of willingness to complain in both public and private transportation?

iv) Do levels of dissatisfaction form ITS affect levels of complaining behavior in both public and private transportation?

v) Do levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on three dimensions (distributive, procedural and interactional)of justice in both public and private transportation?

vi) Do levels of willingness to complain in ITS environment affect levels of public confidence in both public and private transportation?

vii) Do levels of satisfaction with complaint handling in ITS environment affect levels of public confidence in both public and private transportation?

II. Using ITS for Public Transportation

2.1 Factors Affecting Satisfaction of Using ITS for Public Transportation

Providing public transportation services that meet users' travel needs and expectations is crucial in creating an inclusive and attractive urban transport system. At the same time, in an era of deregulation and privatization, it is very important for the transport authority to identify the service quality measurements that really matter for the users (Wu& Li, 1995). Thus, over the past few decades, there has been a surge in the number of studies concerning assessment of public transportation services that were aimed at providing clues to improve users' satisfaction and to make the services more user-oriented(Bouamrane, Tahon, &Beldjilali, 2005).

In the assessment of service quality, investigating feedback from the users about various aspects of service was often conducted (Szetoa & Lob, 2006). Responses stated by the public, in particular from regular passengers, may be used as a proxy of determinants of current performances and therefore can be utilized to improve existing services (Ceder, 2011). Previous studies argued that functional, instrumental, or core service attributes – such as frequency, travel speed, on-time performance – are the most important determinants of travelers' overall satisfaction (Naumann, Suhl, & Kramkowski, 2011).

Traditionally, travel time has been widely regarded as the key performance indicator that would satisfy frequent public transportation users, among other functional factor attributes (Knight & Timmis, 2002). At the same time, some other study (Krasemann, 2012) found that non-instrumental variables, such as cleanliness, privacy, safety, convenience, stress, social interaction and scenery play a significant role in influencing traveler satisfaction with their journey. Other study (Fu, Liu, & Calamai, 2009) highlighted the complexity of the impacts and

users' social and psychological feedback concerning public transportation service quality and travel satisfaction. Nevertheless, despite its complexity, it is argued that providing a satisfactory service is paramount in order to create loyal public transport users (Balbo & Pinson, 2005).

There have been studies discussing the key determinant of travel satisfaction within public transportation and its relation with service quality attributes contributing mainly on two frontiers. First, most of the previous studies examined the relationships between the levels of user satisfaction and users' positive experiences with public transport services, investigating the correlations between users' dissatisfaction and unpleasant experiences with their travel behavior and support of various policy options of public transportation for service improvement (Ezzedine, Trabelsi, &Kolski, 2006). This research objective is in line with the statements that efforts in examining the relationship between travel behavior and human subjective perceptions may provide insights to the operators for service improvement and to policymakers for designing sustainable transportation in urban areas (Deb & Chakroborty, 1998). Second, most of the prior comprehensive studies area not only employed data and cases from developed countries, but also provided elaboration from developing country cases, which is crucial to enrich the body of knowledge regarding public transport improvement strategies in the context of newly emerging economic countries (De Castro &Timmis, 2003).

2.1.1 ITS for Public Transportation in Developing and Developed Countries

Many countries, like in Europe, have more advanced system where the public transport network is extensive and reliable, and the users have the flexibility to change their mode or route, or even their schedule if they are displeased with the service provided (Eberlein, Wilson, &

Bernstein, 2001). In developing countries, however, many of the users are not loyal to public transportation by choice but are rather captive users (Hunt& Cook, 1996).

Unlike in developed countries, it is common for the public transport system in developing countries to be dependent on indigenous paratransit systems, which tend to be loosely regulated and offer a relatively lower level of service and reliability (Guimarães, Palhares, Campelo, & Igarashi, 2007). This low level of service and unreliable conditions intensifies the feeling of uncertainty among users and encourages them to shift to more accessible and reliable travel modes ,for example the motorcycle, whenever possible (King, Russ, Lambert, & Reese, 2001). Thus, it becomes more important not only to understand what really matters for public transportation users in cities in developing countries, but also to understand how their preferences and dissatisfaction regarding the current public transportation services influence their acceptabilityof particular improvement policies (Lo, Yip, & Wan, 2004).

Furthermore, it is also important to understand whether users would be willing to pay more in order to have a service that meets their expectations. Unlike in developed countries where the public transport systems are well supported by tax-payer money, the paratransit system is a bottom-up or grass-roots initiated system, the costs of which are mostly borne by the operators and owners(Nikraz, Caire, &Bahri, 2006). In some developing countries, the local bus and paratransit operators were often faced by financial constraints even just to maintain the existing services (Perelson, Mirmirani, & Oster, 1978). Thus, any efforts to increase the level of service would be likely to increase the cost of the trip. Hence, Sun and Hickman (2005) attempted not only to explore the determinants of users' travel satisfaction, but also the relationship between their preferences and expectations of a particular level of transport service and their support of a set of improvement policy scenarios with its consequences in fare

increment. Wu and Banzhaf (2010) elaborated whether the users' negative experiences, dissatisfaction, and trip-making significantly correlate with such supports.

2.1.2 Users' Experience and the Service Quality of Public Transportation

Service quality evaluation needs to be defined and carried out carefully since this term refers to a complex relationship between tangible and intangible characteristics of supply of service and demand of the users (Yu et al., 2012), which includes travelers' subjective perceptions, expectations, past experience and well-being. Different travelers have different needs and priorities, and these influence their satisfaction and appreciation relating to various quality factors of provided services (Zhao&Davis, 2011). In order to provide a transport service that meets individual travel needs, it is important to understand the factors that underlie travel satisfaction for different groups of individuals (Timmis, Knight, De Castro, & Hart, 2004). In an effort to change the market strategy to attract potential riders on public transportation, Ozcelik and Sukumaran (2011) stressed the importance of collecting feedback on how their satisfaction is related to characteristics of the service. In line with this, Kima, Parkb, and Kweonc (2007) demonstrated that the level of quality of public transportation services is an important variable to explain travel demands o fpublic transportation users.

In many cases, the quality of service is measured based on how well the level of service can satisfy the user expectation, and this should be delivered to users on a regular basis (Gong, Jiao, Zhang, & Dub, 2009). In some cases, the measurement of service quality is indicated by the gap between user expectation of the service and the actual service quality perceived by them (Ceder, Golany, & Tal, 2001). This measurement can be defined as the level of satisfaction with a public transportation service. In other words, satisfaction refers to the extent of overall

excitement based on an accumulation of desires, needs and expectations felt by the users (Dasgupta, Yu, & Nino, 2011). A service can be qualified as high quality when users perceive a pleasant experience when riding public transportation and, therefore, report high satisfaction with various important aspects of the service(Ezzedine, Bonte, Kolski, &Tahon, 2008). In contrast, obtaining a highly negative experience and dissatisfaction with the service may explain a low quality of public transportation service (Chang&Yeh,2012).

2.1.2.1 FactorsUnderlying Users'Experiences

Over the years, a series of comprehensive, multi disciplinary studies have been developed on theoretical and empirical analyses of user satisfaction with public transportation services. These studies reveal that individual travel satisfaction is influenced by a wide range of factors, from built environment factors to quality of service attributes and users' subjective well-being (Fu & Yang, 2002). McKay (1993) highlighted that inappropriate treatment or dissatisfaction caused by operators to customers, such as delay, inadequate information, or poor maintenance of infrastructure, are remembered by users, either consciously or unconsciously, to judge the quality of the service and also to decide whether they will continue utilizing the service or switch to other modes.

However, at the same time, other researchers have found that loyal users can be found among the public transportation users, regardless of their past experiences (Rahal, Rahal, & Chekroun, 2010). This group of individuals consistently utilizes the service as part of their investment for a sustainable environment or simply because they have no option as a result of their socio-economic and demographic constraints (Briggs & Wilson, 2003). In the latter instance, however, users may switch to other modes, for example a motorcycle, when the

constraints disappear (Xuan, Argote, & Daganzo, 2011). Some studies argue that the speed at which one would shift to other modes depends on ones' travel behaviors and attitudes towards public transportation service quality (Uschold&Gruninger, 1996).

While most previous studies have focused on measuring factors that underlie users' positive experiences, it is important not to neglect the reported negative experiences. Passetti, Jin, and De Pencier (2012) argued that dissatisfying or negative incidents have more impact than positive experiences among the riders. For local authorities, finding the sources of negative experiences or dissatisfaction among public transport customers is critical for defining priority areas of intervention to the providers, such as carrot and stick schemes (Lin, Liang, Schonfeld, & Larson, 1995). In the context of human decision-making processes, negative experiences or dissatisfaction are likely then to provide estimation results of future preferences better, since one may consider the losses greater than the gains(Johnson & Thomas, 2000).

2.1.2.2 User Perceptions about Necessity of Service

Another crucial consideration in analyzing public transportation service quality is the construct of importance. Gray (1992) explained that importance refers to user perceptions about how necessary a variable of service is when compared to other variables, and the results vary across users based on mainly personal needs, values and interests. The level of importance indicates the expectation expressed by customers, where user expectations and perceptions are the basis to calculate indicators of service quality (Eberlein, Wilson, & Bernstein, 1999). The level of importance with a specific product indicates buyer's commitment to choose a product, which is also influenced by satisfaction and direct experience with a product (De Castro& Von Zuben, 2000). Great demand to use or purchase a product may suggest that this product has met

user satisfaction based on the level of importance of the product, and, moreover, affected loyalty to reuse this product (Brons, Givoni, & Rietveld, 2009). Improving services based on the level of importance will be a starting point for the service improvement and determinants of usere valuations and behaviors (De Castro &Timmis, 2002).

Davidson et al.(2005) stated that in order to set the right priorities in customer satisfaction management, managers need to know the association between the changes of attribute performance such as satisfaction with the changes of attribute importance, since the level of importance depends on performance. By subtracting the satisfaction rating from the importance rating, a performance gap is determined for an attribute as an indication of how well the institution performs relative to customers'expectations (Darmoul, Pierreval, &Gabouj, 2007). Thus, it can be argued that the reported level of importance can serve as a proxy variable to explain the users' desire to use public transportation services (Dasgupta,Ji, & Gonzalez, 2003). Therefore, in the context of public transportation service assessment, it is suggested that operators improve the services based on user feedback about the level of importance concerning certain aspects of service (Miller, Englisher, Kaplan, & Halvorsen, 2005). Darmoul, Pierreval, & Gabouj (2012) show that different groups of travelers demonstrate unique interactions between importance and satisfaction for different service quality attributes. These interactions evolve differently towards different policy implementations and different internal and external conditions of supply of level of service in the given region and demand for public transportation users(Daganzo, 2009).

There view above indicates that assessments of public transportation service quality have focused on three crucial elements: namely, users' experience, satisfaction, and assessment of service importance. The three elements, together with passengers' travel behaviors and needs,

are likely to relate to users' preferences to support any given policies introduced by the operators aimed at improving public transportation service (Costa Silva, Palhares, &Caminhas, 2012).

However, little knowledge was found in the literature regarding systematic and comprehensive relations across these constructs, particularly in the transportation field based on data from developing countries. A better understanding of the complexity between public transportation users' behavior, attitudes, and policy preferences to improve the service in developing countries will enable us to develop more publicly acceptable strategies (Cortés et al., 2010).Such strategies can help tailor public transportation services to both retain existing passengers and increase the market share by attracting users of other modes of transport in this segment of emerging world economic complexity (Mislevy, 1984). The case of users' behavior in utilizing public transportation in developing countries is critical, since such users may have more resources constraints to perform a mode switch than their counterparts from developed countries (Chen, Adida, & Lin, 2010).

2.2 Improving Service Quality in Public Transportation Systems

Public transport serves the society by providing cheap and fast mobility services. Due to long term experiences over decades, the provided services are highly reliable and affordable (Brentari &Golia, 2008). Traditionally, routes, intervals and vehicles are planned top down based on a priori knowledge about the traveler flows and desired interchanges (Chang& Shih, 2012). Due to the slow changing nature of traveler flows and a huge basis of domain knowledge, this planning process works reasonably well when every actor involved is on time (Dawes, 2008). However, in case of short term interruptions, delays or even cancellations ad hoc dispatching is necessary to counteract the disruption (Chien, Ding, & Wei,2002). In those situations, two

factors limit the service quality. First, the dispatcher only has apriori knowledge about the local situation (Engel-Yan, Rudra, Livett, &Nagorsky, 2014). Thus, it is impossible to make optimal dispatching decisions for all travelers.S econd, the dispatcher's reactions to interruptions are not disseminated efficiently to the affected travelers (Gudmundsson, 2004). This often creates uncertainty, which limits the travel experience and the perceived service quality.

Thus, a beneficiary integration of automated customer feedback is to be investigated. Hadas and Ranjitkar (2012) explained how to integrate and use customer feedback to improve service quality in public transport presenting an overview of related work. Hine and Scott (2000) derived the need for automated information exchange between the transportation company and the traveler. Iseki and Taylor (2010) presented technical constraints and a novel framework to build systems which permit a broad exchange of customer information in a standardized way by pointing out benefits of and possible application scenarios for automated standardized information exchange. By not only focusing on traveler benefits but also on models for transportation companies to improve their service quality, Linacre (2002) discussed the difference between the described approach and the actual situation in public transport.

2.2.1 Processing Journey Information

In former times, it was impossible to gather and process individual journey information for each traveler in a timely manner. However, this has changed due to the wide availability of modern communication systems like smartphones, mobile data plans and high performance servers (Martin, Jordan, & Roderick,2008). Having today's communication and data processing capabilities, it is possible to collect, process, and include in situ information from all travelers within the operational decision processes and to disseminate timetable changes in real time

(Mavoa, Witten, McCreanor, & O'Sullivan, 2012). Informing the traveler about dispatching decisions or timetable changes reduces the uncertainty, increases the consistency and causes a better comprehensibility for the traveler (Olszewski&Wibowo, 2005). This gives the passengers the feeling of being well informed and thus increases the quality of service (Tribby & Zandbergen, 2012). But unfortunately until today, traveler information is not transmitted to transportation companies and their dispatchers in a noteworthy amount nor in a way which permits an automatized processing of this information (Welch & Mishra, 2013).

2.2.2 Integrated Customer Information

Currently, the disruption management cares mainly about timetable adjustment, rolling stock and crew rescheduling (Stradling, Carreno, Rye, & Noble,2007). Customer information sometimes is indirectly integrated by staff reports and is then displayed towards the dispatcher (Sanchez, Shen, &Peng, 2004). The notification of customers in a timely and consistent manner is currently not a highly prioritized aspect in disruption recovery (Reeve&Masse,2007),but taking direct feedback of customers into consideration is not part of the process at all. Humpelet al. (2004) defined a customer oriented dispatching by taking the delays of travelers into consideration though the data is derived from models and simulation are not directly transmitted by the traveler. Currently, the planning phase of disruption management also does not consider data of direct customer feedback (Loukaitou-Sideris, 1999).

In another approach, information derived from travelers is displayed in customer information systems but the information is not transmitted to and not used by traffic operations, though (Guo& Wilson, 2011). A different version of community approach permits passengers to inform other travelers about vehicle occupancy and here as well, the information is solely

provided in passenger information systems but an integration for operational improvement is not documented (Givoni & Rietveld, 2007).

Elias and Shiftan(2012) presented an approach to solve connection conflicts, which postulates the knowledge of origin destination pairs of travelers but even today, this information is generally not available. Therefore, a suitable approach is needed which enhances the service quality in public transport enabling customers to provide this information and the transportation companies to use the information (Dziekan and Kottenhoff,2007).

The use of customer feedback and information, as part of public transport information, planning and dispatching systems, raises challenges on both sides. Based on the definition of service quality, an approach to enhance the service quality has to consider the traveler view and the service provider view as well (Cheng,2010). Traveler aspects and provider aspects have to be equally analyzed and parameters for an increase of service quality have to be identified and the different views on the necessity for automated customer feedback are to be described (Handy & Niemeier, 1997).

2.2.3 Public Transportation and Social Media

In addition, research in the area of public transport and social media is rather focused on services to connect travelers among each other or to provide entertainment for the traveler during the different phases of the trip (Hawkins, Kremer, Swanson, & Fogg, 2014).Actual research concerning traveler feedback directly to the transportation company using social media is relatively rare. Mishra, Welch, and Jha (2012) mentioned the problem of reacting to customer input, via social media, which in generally cannot be processed in an automatized way. Deutsche Bahn, the main railway operator in Germany, uses social media to communicate with its

customers and also reacts to the feedback of the customers (Gabrielli et al., 2014) but this feedback generally cannot be used to influence operations. Social media as well as traditional ways of communication do not allow a transmission of structured information implying that the information cannot be easily evaluated and thus cannot be used to enhance operations(Cheng& Liu,2012).

2.2.4 Firm's Perspective

In addition, service quality in public transport is influenced by several firm related factors. A brief overview regarding important influence factors is given by Chang and Wu (2008) who divided these factors into two categories, namely hard influencing factors such as waiting times at stations, waiting times in trains and missed connections, and soft influencing factors such as tidiness of cars and station's security, good service, friendly staff, comfort of journey and quality of catering.

While hard influencing factors are measurable by the dispatcher, the soft factors are not. Although several studies and concepts such as about the information chain in public transport and the satisfaction of public transportation travelers are known, the overall satisfaction with public transportation islow compared to other transportation sectors (Miranda& Rodrigues da Silva, 2012). Therefore, an approach to improve customer satisfaction by improving the service quality taking into consideration customer feedback is yet to be carved (O'Sullivan, Morrison, & Shearer, 2000).

III. Using ITS for Private Transportation

3.1 Factors Affecting Satisfaction of Using ITS for Private Transportation

The Advanced Traveler Information System (ATIS) field was developed based on the notion that schemes providing exact and online travel time information would efficiently change users' travel behavior (Ben-Elia,Di-Pace,Bifulco,&Shiftan,2013). Research in ATIS investigates the effects of providing usually free information on transportation system users' travel decisions (Bifulco,Simonelli,&Di-Pace,2009),but the emphasis is on providing fuelconsumption and other travel costs information.

3.1.1 Fuel Management Issues

Fuel management issues are another important area of research. Tseng, Knockaert, and Verhoef (2013) proposed a model to properly manage fuel consumption for a vehicle routing problem which showed that users may choose routes involving lower fuel consumption but with longer travel times and even longer travel distances. Yang and Meng (2001) developed a model based on the classical vehicle routing problem by adding a fuel management factor with the objective of minimizing fuel consumption which showed that with the addition of the fuel factor, fuel consumption can be reduced on a capacitated network. However, the vehicle routing problem is intrinsically different from urban transportation modeling problems and cannot be used for system-wide urban transportation planning problems (Watling&Hazelton,2003).

3.1.1.1 Availability of Fuel Cost Information

Fuel consumption and emissions costs have a small effect, if any, on road users' travel choice behavior, partly as a result of the low elasticity of gasoline demand (Bottom,2000). The fundamental reasons for their disinterests are that drivers do not perceive fuel consumption costs

as out-of-pocket costs, and emissions costs are not charged to users(Brouwer,1991). Therefore, implementing a scheme informing road users of fuel and emissions costs would make them more sensitive to costs (Cantarella,1997). On-line information about transportation networks can be used to estimate the real-time fuel cost, emissions cost, and other costs of travel for using each possible route and can be provided to users through radio, roadside banners, GPS devices, or online websites at a relatively low cost (Chorus,Molin,&VanWee,2006).

3.1.1.2 Optimizing Fuel Consumption

Optimizing fuel consumption for individual vehicles has been the subject of many studies, especially in the eco-driving research area(Dell'Orco&Teodorovic,2009). However, fuel consumption costs and emissions costs are important elements in users' travel costs, especially in comparison with time costs and congestion costs, yet they have been given little attention in the context of influencing motorists' travel behavior (Ettema&Timmermans, 2006).In analyzing pricing or planning problems, some researchers have considered gas consumption as one of the factors that users take into account in their mode or route choice decision-making. Khattak,Yim,&Stalker(2003) modeled the morning commute mode choice problem and found that fuel costs, in accordance with different fuel prices, were considered one of the factors driving mode choice decisions. Using a small network, Mahmassani and Liu (1999) investigated the value of perfect information in traffic assignment problems where the information about fuel consumption and vehicle emissions, in addition to time, was included in traffic assignment problems. The study examined this modification in the context of a decision about whether or not to build a highway segment and the research showed the value of the information for transportation planning purposes without focusing on how this information could be provided to

users, and under what conditions the provision of the information could be useful (Mahmassani and Liu, 1999).

Few studies have considered fuel consumption instead of travel time for route choice decision where the conjecture is that on vehicle tools would provide information on gas consumption to users. Schrank, Eisele, and Lomax,(2012) showed that providing real-time traffic information can lead to fuel savings, especially in more congested areas and when real-time traffic distortions are reported while the main assumption of the study was that, instead of travel time, fuel consumption would be used for route choice. Although the results seem promising in terms of reducing fuel consumption, the authors failed to consider that travel time still remains the main travel cost component driving users' behavior and in spite of the correlation between fuel consumption and travel time for some traffic levels, both components are to be used since the relationship is not linear(Schrank,Eisele, and Lomax,2012).

3.1.2 Minimizing Pollutant Emissions

In the context of emissions from transportation networks, a study has developed models to quantify CO_2 and standard pollutant emissions (Yang,1998), but this study has not generally examined the effects of including the emissions costs along with other costs associated with users' travel behavior. Tanaka, Uno, Shiomi,& hn(2014), in one of the few studies analyzing the effects of route choice decisions on fuel and emissions costs, investigated the impacts of route choice on energy consumption and emission rates, taking into consideration vehicle type and using microscopic and macroscopic emission estimation tools, the study showed that the choice of a shorter but slower route can be more energy efficient than choosing a user-preferred longer but faster route. The study recommends using emissions and energy-optimized traffic

assignments without major discussion about how to encourage users to follow the energy-optimized routes (Tanaka, Uno, Shiomi,& Ahn, 2014).

Building on an earlier effort, the study by Paz and Peeta (2009) models and estimates the effects of an Advanced Traveler General Information System (ATGIS) on people's travel choice behavior, similar but not limited to Federal High Way Administration's Applications for Environment Real-time Information Synthesis (AERIS). In this study, they examined several research aspects such as the impact of providing the information in various already pre-perceived information conditions, how effective is the ATGIS compared to a Congestion Pricing (CP) scheme, effects of both peak and off-peak travel demand, fuel price levels, and emissions cost rates have on the success of the policy, and the results of providing emissions costs information to users in addition to fuel cost and travel time information (Paz and Peeta, 2009).

3.1.3 Designof Transportation Network

In modern society, the growth in transportation demand is much faster than the growth of urban transport systems, asthe resources available for expanding system capacity remain limited (Rapoport,Gisches,Daniel,&Lindsey,2014). Therefore, it is necessary to plan and design an effective traffic network. It is, however, a well-known paradox that it is possible to make the network performance worse if traveler behaviors are not considered in the network design (Lo&Szeto,2002), and hence, describing choice behaviors is the basis of network design. Studies have shown that travel time uncertainty and advanced travel information guidance in transportation networks affect travelers' route choice (He,Guan,&Ma,2013). For example, bad weather and traffic incidents lead to road capacity variability and thus cause typical non-recurrent congestion (DePalma,Lindsey,&Picard,2012). Under this condition, traffic information

is an effective technology to make route decisions for drivers, and therefore, it is necessary to establish a new traffic network design model to improve network performance by considering the information and the travel demand uncertainty (Rossi,Gilula,&Allenby, 2001).

3.1.3.1 Network Design Problem

The Network Design Problem (NDP) involves the optimal decision on the expansion of the urban road and highway system in response to rapidly growing travel demand (Cantarella&Cascetta,1995). Generally, this problem has been posed in two different forms: the discrete form dealing with the additions of new road or roadway segments to an existing traffic network; and the continuous form dealing with the optimal capacity expansion of existing urban roads (Emmerink,Axhausen,Nijkamp,&Rietveld,1995). Regardless of the form, the objective of NDP is to optimize a given system performance measure, such as to reduce the total system travel cost (Jha,Madanat,&Peeta,1998). The decisions of the road planner affect the route choice behavior of network users, which are normally described by a network user equilibrium model. Mathematically, bi-level programming is a good way to describe the hierarchical nature of the NDP with an equilibrium constraint: the lower level problem is to characterize the User Equilibrium (UE) traffic flow pattern, while the upper level problem is aimed at minimizing the total system cost (Schrank,Eisele,&Lomax,2012).

Due to the intrinsic complexity of the model formulation, the NDP has been recognized as one of the most difficult but challenging problems in transportation research. In fact, a large number of scholars have investigated the NDP over the pastthree decades (Watling&Hazelton,2003). So far, studies have been overwhelmingly focused on the Continuous Network Design Problem (CNDP)and substantial achievements in algorithmic development have

been made (Lindsey,Daniel,Gisches,&Rapoport,2014). For instance, Avineri and Prashker (2006) proposed a globally convergent algorithm to solve the CNDP. Bifulco,DiPace, andViti (2014) developed a viable global optimization method for the CNDP based on the concepts ofgap function and penalty. An activity-based network design problem was proposed by Hall(1996) using the location routing problem as inspiration without the demand information.

3.1.3.2 The Reliability of the Transportation Network

To provide more effective and reliable transport problem solutions, transport analysts and engineers have to deal with different sources of uncertainty when modeling transportation systems and their main components, such as travel demand, transport supply, interaction between demand and supply and relevant analysis and assessments (Jahn,Mohring,Schulz,&Stier-Moses,2005). Therefore, flow assignments based on stochastic characteristics are both realistic and important and have become a focus of research. Lo and Szeto (2004) considered the effects of stochastic demand on network reliability, which has also been studied by multiple network demon approaches and cooperative game approaches. Oh, Jayakrishnan,Chen, and Yang (2001) studied a multistate network composed of multistate edges to study the relationship between transmission reliability and spare routing. They investigated the various reliability-based traffic equilibria proposed in the literature and the risk-taking behavior of travelers by considering different traveler behaviors. Tsirimpa,Polydoropoulou, and Antoniou (2007) found the maximum amount of flow from an uncertain network.

The need to assess the reliability of the transportation network has caused many researchers to develop various indicators, including travel demand reduction, travel demand satisfaction reliability, capacity reliability, and travel time reliability

(Tyrinopoulos&Antoniou,2008).Chorus et al.(2006) considered the so-called reliable network design problem with stochastic demand. Dia (2002) proposed a reliability index that explicitly considers not only the average traffic flow conditions but also the variability of traffic flow conditions when designing a road network.

3.1.3.3 Factors Affecting the Traveler's Route Choice Behavior

The reliability of route travel time plays an important role in a traveler's route choice behavior. Studies found that reliability-related attributes are among the most important service attributes in a variety of situations (Bifulco, Simonelli, & DiPace,2007). Bogers, Viti, and Hoogendoorn (2006) estimated the value of travel time and of travel time reliability based on the risk-averse driver's route choice behavior.

Moreover, the Advanced Traveler Information System (ATIS) is another important factor affecting travel choice behavior. ATIS is generally believed to be efficient in alleviating traffic congestion and enhancing the performance of road networks, which can improve travelers' route choice decisions by providing them with the road network situation and navigational assistance (Ben-Elia&Avineri,2015). Studies have been conducted to model the effects of ATIS on commuting behaviors and to assess the relevant benefits and risks using laboratory experiments, computer simulation and analytical modeling (Bifulco,Cantarella,&Simonelli, 2014).

Obviously, travelers equipped and unequipped with ATIS will behave differently in terms of their route choices due to different traffic information and variation in perception on travel disutility. In analytical modeling approaches, the three criteria, namely User Equilibrium (UE), System Optimum (SO) and Stochastic User Equilibrium (SUE), are often used to model the commuters' route choice behaviors (Cantarella,2013). A mixed equilibrium formula has also

been developed combining UE and SUE to model the route choice behaviors for equipped and unequipped drivers (Al-Deek,Khattak,&Thananjeyan,1998). Ben-Akiva and Lerman (1985) adopted the logit-based SUE principle to describe the route choice behaviors of all drivers. Their approaches are closer to reality because neither equipped nor unequipped drivers can accurately calculate the route travel disutility. Bifulco, Simonelli, and DiPace (2007) proposed an improved congestion coefficient feedback strategy to an intelligent transportation system.

IV. Hypotheses Development

Customer behavior, loyalty and satisfaction/dissatisfaction have extensively been examined in the background of the private entrepreneurs. But few researches have investigated these topics in the setting of ITS. Researches into negative aspects of satisfaction consider little about the voice and loyalty of the travelers in the context of the transportation sector involving ITS(Chu, Gerstner, & Hess, 1998).

Compared to the usual offline environment, citizen perceptions and attitudes have been affected by the use of IT to provide advanced services at all stages of decision making in their everyday life, such as interaction, transportation, transaction, and transformation flow (White, 2007; Garson, 2006). The application of advanced and integrated services through web-based, electronic, or virtualized environments has its origins in customer relationship management, whereby a citizen-centered management approach is employed to influence public behavior and improve public-sector performance (Cho, 2001; West, 2007). With the development of a customer-centric approach, IT aims to improve quality of life for its citizens and satisfaction with transportation services (Mehra, 2004; Nandan, 2009).

Various studies explored issues on applications of IT in public administration. One study (Welch, Hinnant, & Moon, 2004) addressed citizen trust and satisfaction with e-government by examining transparency and interactivity in electronic transactions. Another study (Kim & Lee,2012) addressed the relationship between electronic participation and trust in local government by focusing on users' satisfaction and different dimensions of the electronic participation process. While the emergence of e-governance has undoubtedly changed governance practices (Malkia,Anttiroiko, &Savolainen, 2004), however, the adoption rate by citizens and their corresponding satisfaction levels remain unclear. The current study explores the relationships between perceived justice, dissatisfaction, willingness to complain, complaining behavior, satisfaction with complaint handing, and public confidence in the context of ITS. The model upon which this study is based was adapted from previous models (Blodgett, Hill, & Tax, 1997; Tax, Brown, &Chandrashekaran, 1988; Oliver, 1980) and is presented in Figure 1. The model describes the proposed relationships between the types of justice experienced, dissatisfaction, and post-dissatisfaction processes (satisfaction with complaint handling and public confidence) in the context of ITS.

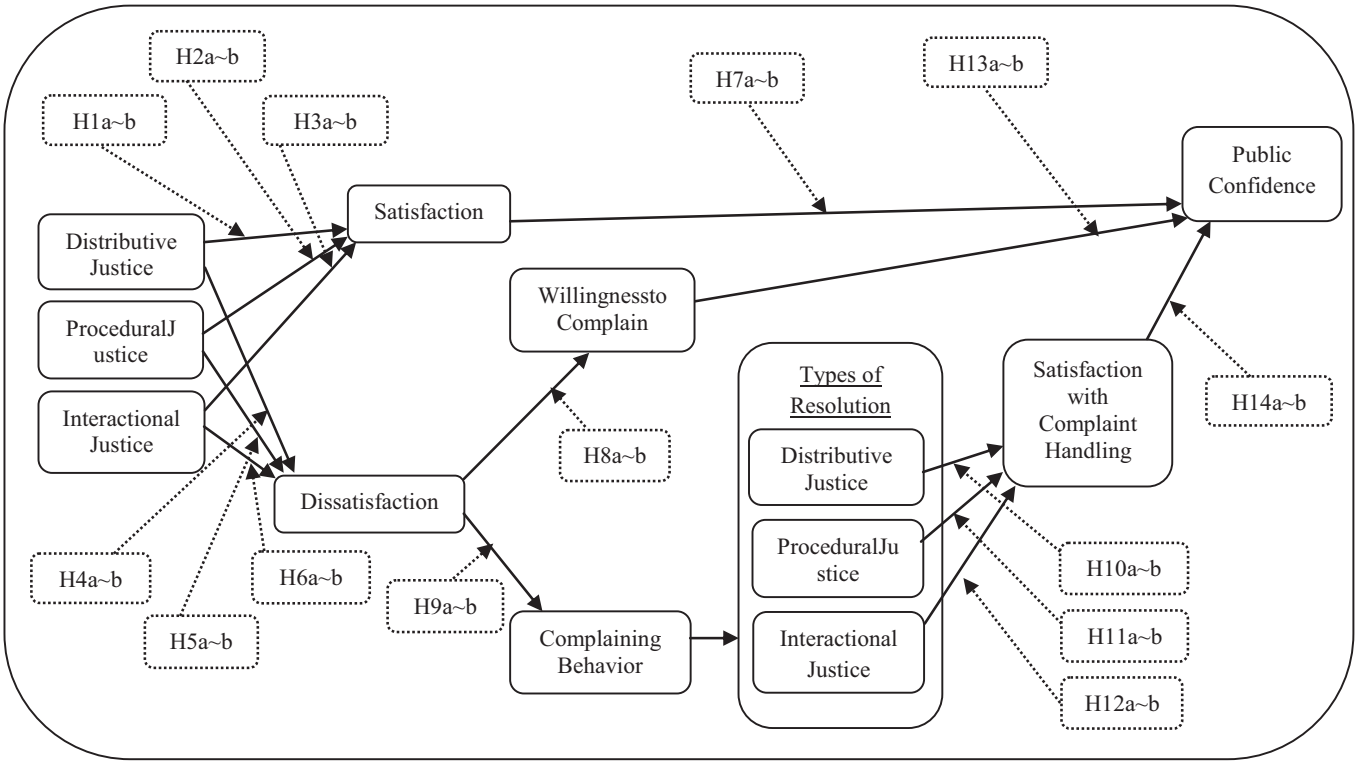

Figure 1. Model of Satisfaction/Dissatisfaction, Complaining Behavior, &Public Confidence: Role of Justice Dimension(Modified from Cho 2015, Blodgett, Hill, and Tax 1997, Tax, Brown, and Chandrashekaran 1988, and Oliver 1980)

4.1 Hypotheses Development for Public Transportation

Varied applications of information technology have been increasingly prevalent in all spheres of citizen lifesince the improvement of digitalized systems, including transportation, infrastructure, and frameworks (Norris, 2008). Governmental agencies face accelerating public demand for electronic services and the internal need to adopt technology to achieve operational efficiency and superior outcomes (Mehdi, 2009). Conventional techniques and tools are being radically reshaping and are evolving into modernize electronic methods for conducting governmental activities (Mehdi, 2009).

4.1.1 Effects of Perceived Justice on Satisfaction/Dissatisfaction

The notion of justice arises from studies of equity that date back to the early of 1960s (Cho &Sai, 2013). Perceived justice, fairness, and equity are valuable frameworks for explaining customer reactions to complaint episodes in organizational behavior and in federal workplace (Blodgett, Hill, &Tax, 1997; Cho &Sai, 2013). In elementary terms, equity refers to fairness, rightness, or deservingness in comparison to other entities (Oliver, 1997). On the contrary, discrepancy, disconfirmation, and inequity imply a negative deficit. Equity and justice are classical experimental paradigms; researchers can manipulate outcome-to-input ratios and observe a direct path between outcome and input combinations and satisfaction that includes fairness in purchasing and consumption(Oliver, 1980; Oliver, 1997).

4.1.1.1 Effects of Distributive Justice on Satisfaction/Dissatisfaction

Theories of distributive justice focus on the allocation of benefits and costs (Deutsch 1985, cited in Tax, Brown, &Chandrashekaran, 1998). Developed from *social exchange theory*, marketing exchanges are an example of benefits and costs that involve consumers (Blodgett, Hill, & Tax, 1997; Deutsch, 1985). Distributive justice explains the expectations of each party regarding the role of the other (Berger, Conner, &Fisek, 1974; Oliver, 1997; Cho, 2013) and its concepts are classified into three dimensions: equity, equality, and need.

Various previous researches studied the effects of distributive justice on users satisfaction/dissatisfaction, while few focused on these effects in the context of ITS. This study hypothesized that the higher expectation of perceived distributive justice from ITS significantly affects satisfaction/dissatisfaction in the context of public transportation.

H1a: Levels of perceived distributive justice from ITS affects levels of satisfaction for public transportation.

H4a: Levels of perceived distributive justice from ITS affects levels of dissatisfaction or public transportation.

4.1.1.2 Effects of Procedural Justice on Satisfaction/Dissatisfaction

Procedural justice relates to the manner in which the outcomes are delivered (Oliver, 1997) and refers to the perceived fairness of the policies, procedures, and criteria used by decision makers in deciding the outcome of a dispute or negotiation (Thibaut & Walker, 1975; Lind &Typer, 1988; cited in Blodgett, Hill, & Tax, 1997). Different preceding researches analyzed the effects of procedural justice on users satisfaction/dissatisfaction, whileonly few focused on these effects in the background of ITS. By considering procedural justice as a cause of dissatisfaction, this study hypothesized that the higher expectations of perceived procedural justice from ITS significantly affects satisfaction/dissatisfaction.

H2a: Levels of perceived procedural justice from ITS affects levels of satisfaction for public transportation.

H5a: Levels of perceived procedural justice from ITS affects levels of dissatisfaction for public transportation.

4.1.1.3 Effects of Interactional Justice on Satisfaction/Dissatisfaction

Interactional justice refers to the manner in which people are treated during the conflict-resolution process (e.g., courtesy, respect, rudeness; Bies& Shapiro, 1987; Blodgett, Hill, & Tax, 1997). As the third dimension of perceived justice, interactional justice refers broadly to the

fairness of the interpersonal treatment that people receive during the enactment of procedures (Bies& Shapiro, 1987; Gilliard, 1993; cited in Tax, Brown, &Chandrashekaran, 1998). Oliver (1997) stated that interactional justice pertains to the person-to-person dealings that are the crucial elements of complaint handling (Maxham&Netemeyer, 2002) and relationship marketing (Tax, Brown, &Chandrashekaran, 1998).

Various studies analyzed the effects of interactional justice on users satisfaction/dissatisfaction, while a few studied these effects in the case of ITS. Based on these considerations, this study hypothesized that the higher expectations of perceived interactional justice from ITS significantly affects satisfaction/dissatisfaction.

H3a: Levels of perceived interactional justice from ITS affect levels of satisfaction for public transportation.

H6a: Levels of perceived interactional justice from ITS affect levels of dissatisfaction for public transportation.

4.1.2Satisfaction/Dissatisfaction, Willingness to Complain, Complaining Behavior, &Public Confidence

This study investigated the effects of justice dimension on satisfaction/dissatisfaction, willingness to complain, and complaining behavior in the context of ITS using the model described above (Figure 1) and the traditional criteria of attitudes and intentions (Oliver, 1980; Bearden & Teel, 1983; Cho, 2013). A previous study (Welch, Hinnant, & Moon, 2004) found that satisfaction in the context of public administration is associated with citizens' perceptions of online service convenience (transactions), information reliability (i.e., transparency), and engaged electronic communication (i.e., interactivity). Various earlier researches studied the

relationships between satisfaction/dissatisfaction, public confidence, willingness to complain, and complaining behavior of the users, while only a few analyzed these relationships in the perspective of ITS. The relationships between satisfaction/dissatisfaction with ITS, public confidence, willingness to complain, and complaining behavior are described in the current study in the following hypotheses:

H7a: Levels of satisfaction from ITS affects levels of public confidence for public transportation.

H8a: Levels of dissatisfaction from ITS affects levels of willingness to complain for public transportation.

H9a: Levels of dissatisfaction from ITS affects levels of complaining behavior for public transportation.

4.1.3Justice, Dissatisfaction, Complaint Handing, & Public Confidence

In addition to satisfaction/dissatisfaction and complaint behaviors, this study investigates the events that follow complaints, specifically satisfaction with complaint handling and public confidence. Previous research (Tax, Brown, &Chandrashekaran, 1998) suggested that satisfaction with complaint handling is the central mediator that links perceptions of the fairness to post-complaint attitudes and behavior. Complaint handling can be viewed as a sequence of events whereby a procedure, beginning with communication of the complaint, generates a process of interaction from which a decision is made, resulting in a specific outcome (Tax, Brown, &Chandrashekaran, 1998).

Previous studies have addressed the relationships between satisfaction with the handling of complaints and perceived justice, including distributive justice (dealing with decision outcomes),

procedural justice (dealing with decision-making procedures), and interactional justice (dealing with interpersonal behavior in the enactment of procedures and delivery of outcomes; Tax, Brown, &Chandrashekaran, 1998; Cho, 2013). Complaint handling is addressed by defensive marketing strategies that are designed to handle complaints by dissatisfaction customers (Chu, Gerstner, & Hess, 1998) and to manage the long-term relationships by examining structural constraints (Ping, 1993; cited in Cho, 2013). This study explored how the handling of complaints in the context of ITS affects citizen confidence and overall perceptions of ITS.

Several former researches studied the effects of resolution of complaints on the basis of three types of perceived justice on level of satisfaction, while few focused on these effects in the setting of ITS. This study examines how complaint handling on the basis of three components of perceived justiceaffects overall satisfaction in the context of ITS. The effects of complaining behavior on overall satisfaction in the case of resolved cases are based on the three types of perceived justice: distributive, procedural, and interactional. Accordingly, this study developed the following hypotheses:

H10a: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on distributive justice for public transportation.

H11a: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on procedural justice for public transportation.

H12a: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on interactional justice for public transportation.

Different previous researches studied the effects of willingness to complain and complaint behavior on public confidence, while few focused on these effects in the framework of ITS. This study examines how willingness to complain and complaint behavior affect public confidencein the case of ITS. Accordingly, this study also developed hypotheses regarding the relationship between willingness to complain, overall satisfaction, and public confidence.

H13a: Levels of willingness to complain in ITS environment affects levels of public confidence for public transportation.

H14a: Levels of satisfaction with complaint handling in ITS environment affects levels public confidence for public transportation.

4.2 Hypotheses Development for Private Transportation

Since the improvement of digitalized systems in the 1980s, diverse applications of IT have been increasingly prevalent in all spheres of citizen life, including transportation, infrastructure, and frameworks (Norris, 2008). The virtual state of the central public administration is as a portal that provides cross-agency services in a citizen-oriented way (Garson, 2006). Governmental agencies face accelerating public demand for electronic services and the internal need to adopt technology to achieve operational efficiency and superior outcomes (Mehdi, 2009). Conventional techniques and tools are being radically reshaping and are evolving into modernize electronic methods for conducting governmental activities (Mehdi, 2009).

4.2.1 Effects of Perceived Justice on Satisfaction/Dissatisfaction

Studies across several contexts such as legal, organizational, and buyer-seller relationship have found the concept of justice valuable for explaining reactions to conflict situations (Gilliand, 1993; Goodwin &Ross, 1992; Lind &Tyler, 1988; cited in Tax, Brown, &Chandrashekaran, 1998). The concept of perceived justice to and examination of the causes of complaints, repeat purchase intention, and loyalty has been applied in private sector (Cho, 2013). Perceived justice is a broad, multifaceted construct that encompasses three dimensions: distributive justice, interactional justice, and procedural justice (Bies& Shapiro, 1987; Clemmer& Schneider, 1996). The present study explored the effects of each justice dimension on dissatisfaction, handling complaints, and confidence in the context of ITS.

4.2.1.1 Effects of Distributive Justice on Satisfaction/Dissatisfaction

Equity is defined as the provision of outcomes that are proportional to the inputs to an exchange (Goodwin &Roos, 1992; Oliver &DeSarbo, 1988; Oliver, 1997), equality is defined as equal outcomes regardless of the contributions to an exchange (Greenberg, 1990, Deutsch, 1985), and need is defined as outcome based on requirements, regardless of contributions (Deutsch, 1985, as cited in Tax, Brown, &Chandrashekaran, 1998). In the context of consumer complaints, distributive justice encompasses the perceived fairness of policies and procedures used by the seller (Blodgett, Hill, & Tax, 1997, as cited in Cho, 2013). The notion of fairness is almost synonymous with equity in that it explicitly implies a form of distributive justice whereby individuals get what they deserve based on their inputs (Oliver, 1997).

Different previous researches studied the effects of distributive justice on users satisfaction/dissatisfaction. But few focused on these effects in the context of ITS. This study

hypothesized that the higher expectation of perceived distributive justice from ITS significantly affects satisfaction/dissatisfaction in the context of private transportation.

H1b: Levels of perceived distributive justice from ITS affects levels of dissatisfaction for private transportation.

H4b: Levels of perceived distributive justice from ITS affects levels of satisfaction for private transportation.

4.2.1.2 Effects of Procedural Justice on Satisfaction/Dissatisfaction

The concepts of procedural justice are defined and classified according to the following dimensions: i) process control, which is freedom to communicate views on a decision process (Goodwin & Ross, 1992; Lynd & Tyler, 1988), ii) decision control, which includes the extent to which a person is free to accept or reject a decision outcome (Brett, 1986, Heide& John, 1992), iii) accessibility which is defined as the ease of engaging in a process (Bitner, Booms, &Tetreault, 1990), iv) timing, or speed, which refers to the perceived amount of time taken to complete a procedure (Fisk & Coney, 1982, Taylor, 1994), and iv) flexibility, which is defined as the adaptability of procedures to reflect individual circumstances (Tax, Brown, &Chandrashekaran, 1998). Prior studies (Folger, 1987; Greenberg, 1990) have shown that procedural justice is meaningful because it aims to resolve conflicts in ways that encourage the continuation of a productive relationship between disputants, even when outcomes are unsatisfactory to one or both parties.

Several preceding researches examined the effects of procedural justice on users satisfaction/dissatisfaction, thoughonly few focused on these effects in the background of ITS. By considering procedural justice as a cause of dissatisfaction, this study hypothesized that the

higher expectations of perceived procedural justice from ITS significantly affects satisfaction/dissatisfaction.

H2b: Levels of perceived procedural justice from ITS affects levels of satisfaction for private transportation.

H5b: Levels of perceived procedural justice from ITS affects levels of dissatisfaction for private transportation.

4.2.1.3 Effects of Interactional Justice on Satisfaction/Dissatisfaction

As studied in Tax, Brown, and Chandrashekaran (1998), the concepts of interactional justice are defined and classified according to the following dimensions: i) provision of reason for failure that is related to the attributions for failure, satisfaction, and fairness (Bies& Shapiro, 1987; Bitner, Booms, &Tetreault, 1990), ii) honesty, which includes the perceived veracity of information provided (Goodwin & Ross, 1989), iii) politeness, including well-mannered and courteous behavior (Blodgett, Hill, & Tax, 1997; Goodwin &Roos, 1989), iv) effort, or the amount of positive energy put into resolving a problem (Folkes, 1984), and v) empathy, including provision of caring, individual attention (Parasuraman, Zeithaml, & Berry, 1988).

Numerous studies evaluated the effects of interactional justice on users satisfaction/dissatisfaction, whilea few studied these effects in the case of ITS. Based on these considerations, this study hypothesized that the higher expectations of perceived interactional justice from ITS significantly affects satisfaction/dissatisfaction.

H3b: Levels of perceived interactional justice from ITS affect levels of satisfaction for private transportation.

H6b: Levels of perceived interactional justice from ITS affect levels of dissatisfaction for private transportation.

4.2.2Satisfaction/Dissatisfaction, Willingness to Complain, Complaining Behavior, &Public Confidence

Current study investigated the effects of justice dimension on satisfaction/dissatisfaction, willingness to complain, and complaining behavior in the context of ITS using the model described above (Figure 1) and the traditional criteria of attitudes and intentions (Oliver, 1980; Bearden & Teel, 1983; Cho, 2013). A previous study (Welch, Hinnant, & Moon, 2004) found that satisfaction in the context of public administration is associated with citizens' perceptions of online service convenience (transactions), information reliability (i.e., transparency), and engaged electronic communication (i.e., interactivity). Various earlier researches studied the relationships between satisfaction/dissatisfaction, public confidence, willingness to complain, and complaining behavior of the users, while only a few analyzed these relationships in the perspective of ITS. The relationships between satisfaction/dissatisfaction with ITS, public confidence, willingness to complain, and complaining behavior are described in the current study in the following hypotheses:

H7b: Levels of satisfaction from ITS affects levels of public confidence for private transportation.

H8b: Levels of dissatisfaction from ITS affects levels of willingness to complain for private transportation.

H9b: Levels of dissatisfaction from ITS affects levels of complaining behavior for private transportation.

4.2.3Justice, Dissatisfaction, Complaint Handing, & Public Confidence

Multiplicative expectancy value models that incorporate a confidence component have consistently related confidence to attitudes and behavior (Bennett & Harrell, 1975, as cited in Dick &Basu, 1994). Confidence refers to the overall confidence of buyers (i.e., the degree of certainty) and the ability to judge or evaluate attributes (Bennett & Harrell, 1975; Howard &Sheth, 1969). A decline of public trust in government implies the loss of public confidence in political and administrative performance as well as dissatisfaction with public services (Welch, Hinnant, & Moon, 2004).

Several former researches studied the effects of resolution of complaints on the basis of three types of perceived justice on level of satisfaction, while few focused on these effects in the setting of ITS. This study examines how complaint handling on the basis of three components of perceived justice affects overall satisfaction in the context of ITS. The effects of complaining behavior on overall satisfaction in the case of resolved cases are based on the three types of perceived justice: distributive, procedural, and interactional. Accordingly, this study developed the following hypotheses:

H10b: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on distributive justice for private transportation.

H11b: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on procedural justice for private transportation.

H12b: Levels of complaining behavior in ITS environment affect levels of satisfaction with complaint handling when the complaints are resolved based on interactional justice for private transportation.

Different previous researches studied the effects of willingness to complain and complaint behavior on public confidence, while few focused on these effects in the framework of ITS. This study examines how willingness to complain and complaint behavior affect public confidence in the case of ITS. Accordingly, this study also developed hypotheses regarding the relationship between willingness to complain, overall satisfaction, and public confidence.

H13a: Levels of willingness to complain in ITS environment affects levels of public confidence for private transportation.

H14a: Levels of satisfaction with complaint handling in ITS environment affects levels public confidence for private transportation.

V.Methodology

This study examined the effects of justice dimensions on users' satisfaction/dissatisfaction, willingness to complain, and complaining behavior in the context of ITS. This study conducted both online and offline surveys to collect data from the respondents. A total of 507 respondents completed the survey, yielding a response rate of 6.1% for online and 85.2% for offline survey. Out of a total of 507 respondents, 51 respondents used only private transportation, 229 respondents used only public transportation and the remaining 227respondents used both private transportation and public transportation for their commuting. Respondents include employees in both public and private sector and students from universities. Multi-item scales were used to

measure each of the constructs that served as the basis for the questionnaire items. The survey employed a 7-point Likert scale where 1 = strongly disagree and 7 = strongly agree.

A sample of 507 respondents participated in the survey. They were asked whether they used public transportation or private transportation or both. Depending on their answer, their data were stored either in the group of public transportation, or private transportation or both. Then the data stored in the group of public transportation were used to perform the regression for public transportation. And the data stored in the group of private transportation were used to perform the regression for private transportation.

The items developed for this survey were based on scales from previous studies (Cho, 2013; Oliver, 1997, 1980; Blodgett, Hill, & Tax, 1997; Blodgett, Granbois, & Walters, 1993) and were modified to serve the objectives of this study. Specifically, this study developed questionnaire items for the concept of distributive justice by considering qualitative measures (fairness, accessibility, and subjective invisible perception) and quantitative measures (time and cost). This study applied the concepts of efficiency and effectiveness to items for procedural and interactional justice, and considered entry, execution, and results for procedural justice. Survey items for measuring justice followed the dimensions outlined by Tax, Brown, and Chandrashekaran (1998). The following criteria were applied to each category: i) equity, equality, and need for distributive justice; ii) process control, decision control, accessibility, timing/speed, and flexibility for procedural justice; and iii) explanation/causal account, honesty, politeness, effort, and empathy for interactional justice (Tax, Brown, &Chandrashekaran, 1998). Items for measuring confidence included the concepts of public trust in general and in the government.

5.1 Construct Reliability for Public Transportation

Cronbach's alpha was applied for each major construct to test the construct reliability for multi-item scale in cases of public transportation. For public transportation users, in the case of satisfaction, Cronbach's alpha values were 0.90 for distributive justice, 0.91 for procedural justice, 0.82 for interactional justice, and 0.89 for satisfaction .In the case of dissatisfaction, Cronbach's alpha values were 0.87 for distributive justice, 0.83 for procedural justice, 0.88 for interactional justice, 0.91 for dissatisfaction, 0.85 for willingness to complain, and 0.91 for complaining behavior. In regard to the handling of complaints, Cronbach's alpha values were 0.81 for distributive justice, 0.83 for procedural justice, and 0.91 for interactional justice. Finally, the Cronbach's alpha for public confidence was 0.92.

5.2 Construct Reliability for Private Transportation

Cronbach's alpha was applied for each major construct to test the construct reliability for multi-item scale in cases of private transportation. For private transportation users, in the case of satisfaction, Cronbach's alpha values were 0.87 for distributive justice, 0.88 for procedural justice, 0.86 for interactional justice, and 0.92 for satisfaction. In the case of dissatisfaction, Cronbach's alpha values were 0.81 for distributive justice, 0.87 for procedural justice, 0.86 for interactional justice, 0.82 for dissatisfaction, 0.91 for willingness to complain, and 0.83 for complaining behavior. In regard to the handling of complaints, Cronbach's alpha values were 0.84 for distributive justice, 0.87 for procedural justice, and 0.81 for interactional justice. Finally, the Cronbach's alpha for public confidence was 0.88.

VI.Data Analysis

6.1 Demographics

Of the 507 respondents, 47.2% were female and 52.8% were male, 41.2% were18-25 years old, 39.1% were26-35 years old, 12.6% were 36-45 years old, and 7.1% were 46-55 years old. In regard to highest education level, 15.6% were undergraduate students, 69.2% were Masters students, and 15.2% were Ph.D. students. In terms of income, 29.7% of respondents had an annual household income of less than $10,000, 26.4% had annual incomes between $10,000 and $20,000, 30.1% had annual incomes between $20,000 and $30,000, and13.8% had annual incomes above $30,000.

6.2 Hypotheses Testing for Public Transportation

The results of factor analysis for public transportation are as follows:

Items		Components		
Factors	**Scale Items**	**1**	**2**	**3**
DISTRIBUTIVE 3	I think that uses of ITS are fair compared to conventional transportation system.	.901		
DISTRIBUTIVE 1	I think that it is convenient to use ITS compared to conventional transportation system.	.872		
DISTRIBUTIVE 2	I think that ITS is more easily accessible compared to conventional transportation system.	.756		
PROCEDURAL 2	I think that uses of ITS reduce any inconvenient process compared to conventional transportation system.		.684	
PROCEDURAL 4	Overall, I think that procedure to use ITS meets my expectation.		.762	
PROCEDURAL 1	I think that the services offered by ITS are easy to get information compared to conventional transportation system.		.919	
INTERACTIONAL 3	I think that interaction in the use of ITS is satisfactory after adopting advanced information technology compared to conventional transportation system.			.801
INTERACTIONAL 2	I think that use of ITS is more efficient compared to conventional transportation system.			.762
INTERACTIONAL 4	I think that information and explanation provided in the use of ITS are enough compared to conventional transportation system.			.782

Table 3.Results of Factor Analysis for Justice Dimensions on Satisfaction

Items		Components		
Factors	**Scale Items**	**1**	**2**	**3**
DISTRIBUTIVE 5	I think that it is inconvenient to use ITS compared to conventional transportation system.	.637		
DISTRIBUTIVE 2	I think that ITS is less easily accessible compared to conventional transportation system.	.867		
DISTRIBUTIVE 4	I think that uses of ITS are not fair compared to conventionaltransportation system.	.764		
PROCEDURAL 4	I think that uses of ITS do not reduce any inconvenient process compared to conventional transportation system.		.712	
PROCEDURAL 1	I think that the services offered by ITS are not easy to get information compared to conventional transportation system.		.647	
PROCEDURAL 3	I think that procedure to use ITS is complicated and not very clear compared to conventional transportation system.		.837	
INTERACTIONAL 4	I think that use of ITS is less efficient compared to conventional transportation system.			.698
INTERACTIONAL 1	I prefer to use conventional transportation system due to direct interaction rather than information via online.			.864
INTERACTIONAL 5	I think that the overall interaction in the use of ITS does not meet my expectation compared to conventional transportation system.			.792

Table 4.Results of Factor Analysis for Justice Dimensions on Dissatisfaction

Using principal components analyses as the extraction method and Varimax rotation methods with Kaiser Normalization, the most relevant data emerged. The results of factor analyses show that successfully represented the major constructs, with Eigen values greater than 1.00. Table 3 and 4 summarizes the result of factor analysis for justice dimension on satisfaction and dissatisfaction respectively.

Table 5 provides the results of multiple regression analysis for the effects of three justice dimension on satisfaction and dissatisfaction. In the case of satisfaction, the results of the ANOVA indicated that the models were significant at the 0.01 level with $F = 587.384$ (*r-square* = 0.812). Based on these findings, hypotheses 1c and 1e were accepted, but hypothesis 1a was rejected. In the case of dissatisfaction, the results of the ANOVA indicated that the models were significant at the 0.01 level with $F = 604.873$ (*r-square* = 0.782). Based on these findings, hypotheses 1d and 1f were accepted, but hypothesis 1b was rejected.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)	Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Distributive Justice->Satisfaction (H1a)	0.055 (0.997)	Distributive Justice-> Dissatisfaction (H1b)	0.081 (1.087)
Procedural Justice ->Satisfaction (H1c)	0.297 (7.894***)	Procedural Justice -> Dissatisfaction(H1d)	0.374 (9.073***)
Interactional Justice ->Satisfaction (H1e)	0.476 (15.108***)	Interactional Justice -> Dissatisfaction(H1f)	0.604 (21.076***)

*** Significant at 0.01 level (2-tailed).

Table 5. Effects of Justice Dimension on Satisfaction/Dissatisfaction

This study examined the effects of satisfaction from ITS on public confidence and the results are shown in Table 6. Overall, the results of the ANOVA find the models significant at the 0.01 level with $F = 69.795$ (*r-square* = 0.317).Based on these findings, hypothesis H2 was accepted.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Satisfaction ->Public Confidence (H2)	0.438 (6.384***)

*** Significant at 0.01 level (2-tailed).

Table 6. Effects of Satisfaction on Public Confidence

This study conducted factor and regression analysis for willingness to complain and actual complaining behavior and the results are shown in Table 7. Overall, the results of the ANOVA find the models significant at the 0.01 level with $F = 576.672$ (*r-square* = 0.701) and $F = 147.038$ (*r-square* = 0.286).Based on these findings, hypotheses H3 and H4 were accepted.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Dissatisfaction ->Willingness to Complain(H3)	0.764 (15.973***)
Dissatisfaction ->Complaining Behavior (H4)	0.396 (9.765***)

*** Significant at 0.01 level (2-tailed).

Table 7. Effects of Dissatisfaction on Willingness to Complain and Actual Complaining Behavior

This study also examined the effects of justice dimension on overall satisfaction with complaint handling. Additional factor analyses were applied to valid constructs for three justice dimension on resolution and satisfaction with complaint handling. The results of multiple regression analyses are shown in Table 8. Overall, the results of ANOVA indicated that the models were significant at the 0.01 level with $F = 57.937$ (*r-square* = 0.349).Hypotheses 5a & 5c were accepted, and hypothesis 5b was rejected. Thus, the effects distributive and interactional justice dimensions, but not procedural justice, on satisfaction with complaint handling were significant.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Distributive Justice->Satisfaction with Complaint Handling(H5a)	0.463 (10.064***)
Procedural Justice ->Satisfaction with Complaint Handling(H5b)	0.235 (0.415)
Interactional Justice ->Satisfaction with Complaint Handling(H5c)	0.397 (8.168***)

*** Significant at 0.01 level (2-tailed).

Table 8. Effects of Justice Dimension on Satisfaction with Complaint Handling

This study also examined the effects of willingness to complain and satisfaction with complaint handling on public confidence. The results of regression analyses are shown in Table 9. Overall, the results of the ANOVA find the models significant at the 0.01 level with $F = 34.782$(*r-square* = 0.208) and with $F = 91.676$ (*r-square* = 0.217). Therefore, hypotheses 6 and

7were accepted. In other words, higher levels of willingness to complain were associated with lower levels of public confidence, and higher levels of satisfaction with complaint handling were associated with higher levels of public confidence.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Willingness to Complain->Public Confidence (H6)	-0.199 (-6.176***)
Satisfaction with Complaint Handling ->Public Confidence (H7)	0.602(9.634***)

*** Significant at 0.01 level (2-tailed).

Table 9. Effects of Willingness to Complain and Satisfaction with Complaint Handling on Public Confidence

6.3 Hypotheses Testing for Private Transportation

The results of factor analysis for private transportation are as follows:

Items		Components		
Factors	**Scale Items**	**1**	**2**	**3**
DISTRIBUTIVE 3	I think that uses of ITS are fair compared to conventional transportation system.	.712		
DISTRIBUTIVE 1	I think that it is convenient to use ITS compared to conventional transportation system.	.801		
DISTRIBUTIVE 2	I think that ITS is more easily accessible compared to conventional transportation system.	.698		
PROCEDURAL 2	I think that uses of ITS reduce any inconvenient process compared to conventional transportation system.		.792	
PROCEDURAL 4	Overall, I think that procedure to use ITS meets my expectation.		.867	
PROCEDURAL 1	I think that the services offered by ITS are easy to get information compared to conventional transportation system.		.647	
INTERACTIONAL 3	I think that interaction in the use of ITS is satisfactory after adopting advanced information technology compared to conventional transportation system.			.764
INTERACTIONAL 2	I think that use of ITS is more efficient compared to conventional transportation system.			.756
INTERACTIONAL 4	I think that information and explanation provided in the use of ITS are enough compared to conventional transportation system.			.837

Table 10.Results of Factor Analysis for Justice Dimensions on Satisfaction

Items		Components		
Factors	**Scale Items**	**1**	**2**	**3**
DISTRIBUTIVE 5	I think that it is inconvenient to use ITS compared to conventional transportation system.	.864		
DISTRIBUTIVE 2	I think that ITS is less easily accessible compared to conventional transportation system.	.684		
DISTRIBUTIVE 4	I think that uses of ITS are not fair compared to conventional transportation system.	.782		
PROCEDURAL 4	I think that uses of ITS do not reduce any inconvenient process compared to conventional transportation system.		.901	
PROCEDURAL 1	I think that the services offered by ITS are not easy to get information compared to conventional transportation system.		.762	
PROCEDURAL 3	I think that procedure to use ITS is complicated and not very clear compared to conventional transportation system.		.919	
INTERACTIONAL 4	I think that use of ITS is less efficient compared to conventional transportation system.			.762
INTERACTIONAL 1	I prefer to use conventional transportation system due to direct interaction rather than information via online.			.872
INTERACTIONAL 5	I think that the overall interaction in the use of ITS does not meet my expectation compared to conventional transportation system.			.637

Table 11.Results of Factor Analysis for Justice Dimensions on Dissatisfaction

Using principal components analyses as the extraction method and Varimax rotation methods with Kaiser Normalization, the most relevant data emerged. The results of factor analyses show that successfully represented the major constructs, with Eigen values greater than 1.00. Table 10 and 11 summarizes the result of factor analysis for justice dimension on satisfaction and dissatisfaction respectively.

Table 12 provides the results of multiple regression analysis for the effects of three justice dimension on satisfaction and dissatisfaction. In the case of satisfaction, the results of the ANOVA indicated that the models were significant at the 0.01 level with $F = 602.734$ (*r-square* = 0.795). Based on these findings, hypotheses 1c and 1e were accepted, but hypothesis 1a was rejected. In the case of dissatisfaction, the results of the ANOVA indicated that the models were significant at the 0.01 level with $F = 563.017$ (*r-square* = 0.804). Based on these findings, hypotheses 1d and 1f were accepted, but hypothesis 1b was rejected.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)	Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Distributive Justice->Satisfaction (H1a)	0.049 (1.034)	Distributive Justice-> Dissatisfaction (H1b)	0.073 (1.005)
Procedural Justice ->Satisfaction (H1c)	0.306 (1.181)	Procedural Justice -> Dissatisfaction(H1d)	0.314 (0.997)
Interactional Justice ->Satisfaction (H1e)	0.501 (18.004***)	Interactional Justice -> Dissatisfaction(H1f)	0.597 (19.346***)

*** Significant at 0.01 level (2-tailed).

Table 12. Effects of Justice Dimension on Satisfaction/Dissatisfaction

This study examined the effects of satisfaction from ITS on public confidence and the results are shown in Table 16. Overall, the results of the ANOVA find the models significant at the 0.01 level with F = 71.673 (*r-square* = 0.276).Based on these findings, hypothesis H2 was accepted.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Satisfaction ->Public Confidence (H2)	0.401 (5.607***)

*** Significant at 0.01 level (2-tailed).

Table 13. Effects of Satisfactionon Public Confidence

This study conducted factor and regression analysis for willingness to complain and actual complaining behavior and the results are shown in Table 14. Overall, the results of the ANOVA find the models significant at the 0.01 level with F = 608.975 (*r-square* = 0.676) and F = 132.486 (*r-square* = 0.308).Based on these findings, hypotheses H3 and H4 were accepted.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Dissatisfaction ->Willingness to Complain(H3)	0.801 (17.762***)
Dissatisfaction ->Complaining Behavior (H4)	0.429 (15.687***)

*** Significant at 0.01 level (2-tailed).

Table 14. Effects of Dissatisfaction on Willingness to Complain and Actual Complaining Behavior

This study also examined the effects of justice dimension on overall satisfaction with complaint handling. Additional factor analyses were applied to valid constructs for three justice dimension on resolution and satisfaction with complaint handling. The results of multiple regression analyses are shown in Table 15. Overall, the results of ANOVA indicated that the

models were significant at the 0.01 level with $F = 60.046$ (*r-square* = 0.368).Hypotheses 5a & 5c were accepted, and hypothesis 5b was rejected. Thus, the effects distributive and interactional justice dimensions, but not procedural justice, on satisfaction with complaint handlingwere significant.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Distributive Justice->Satisfaction with Complaint Handling(H5a)	0.487 (1.273)
Procedural Justice ->Satisfaction with Complaint Handling(H5b)	0.204 (0.387)
Interactional Justice ->Satisfaction with Complaint Handling(H5c)	0.416 (6.384***)

*** Significant at 0.01 level (2-tailed).

Table 15. Effects of Justice Dimension on Satisfaction with Complaint Handling

This study also examined the effects of willingness to complain and satisfaction with complaint handling on public confidence. The results of regression analyses are shown in Table 16. Overall, the results of the ANOVA find the models significant at the 0.01 level with $F = 29.087$ (*r-square* = 0.195) and with $F = 87.549$ (*r-square* = 0.258). Therefore, hypotheses 6 and 7 were accepted. In other words, higher levels of willingness to complain were associated with lower levels of public confidence, and higher levels of satisfaction with complaint handling were associated with higher levels of public confidence.

Variable (Independent ->Dependent)	Standardized Coefficient (t-value-Sig)
Willingness to Complain->Public Confidence (H6)	-0.204 (-5.684***)
Satisfaction with Complaint Handling ->Public Confidence (H7)	0.548(8.035***)

*** Significant at 0.01 level (2-tailed).

Table 16. Effects of Willingness to Complain and Satisfaction with Complaint Handling on Public Confidence

7.Conclusions

7.1 Findings

7.1.1Findings for Public Transportation

Overall, procedural and interactional justice, but not distributive justice,had significant effects on satisfaction/dissatisfaction, and the effects of interactional justice on satisfaction/dissatisfaction were stronger than those of procedural justice.In the case of public confidence, satisfaction of the users of ITS has positive effect on public confidence. In the instance of willingness to complaint and complaining behavior, dissatisfaction of the ITS users has positive effect on both willingness to complaint and complaining behavior. In regard to satisfaction with complaint handling, the effects of distributive and interactional justice, but not procedural justice,were significant, and the effects of distributive justice were stronger than those of interactional justice. These findings imply that ITS users are more importantly perceive to equity and equality issues, or distributive justice. The results also showed that willingness to complain was negatively associated with public confidence, while satisfaction with complaint handling was positively associated with public confidence. These findings implythatthe employment of ITS should not be limited to the technical aspects of ITS for public transportation, but should focus more attention on the subjective domain of justice. The results of ANCOVA suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction.

During the implementation of ITS in public transportation, factors affecting procedural justice such as process control, decision control, accessibility, timing, speed, and flexibility and factors affecting interactional justice such as explanation, honesty, politeness, effort, and

empathy are to be focused on. In regard to satisfaction with complaint handling, factors affecting distributive justice such as equity, equality and need and factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be emphasized.

Willingness to complain would reduce public confidence, but if complaint handling can be done satisfying distributive, procedural and interactive justice, public confidence can be restored. Since the results suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction, there is no importance of extra measure to address the special need of any particular age group or gender.

7.1.2 Findings for Private Transportation

Overall, interactional justice, but not distributive and procedural justice, had significant effects on satisfaction/dissatisfaction. In the case of public confidence, satisfaction of the users of ITS has positive effect on public confidence. In the instance of willingness to complaint and complaining behavior, dissatisfaction of the ITS users has positive effect on both willingness to complaint and complaining behavior. In regard to satisfaction with complaint handling, the effects of interactional justice, but not distributive and procedural justice, was significant. These findings imply that ITS users are more importantly perceive to politeness and empathy, or interactional justice. The results also showed that willingness to complain was negatively associated with public confidence, while satisfaction with complaint handling was positively associated with public confidence. These findings imply that the employment of ITS should not be limited to the technical aspects of ITS for private transportation, but should focus more attention on the subjective domain of justice. The results of ANCOVA suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction.

During the implementation of ITS in private transportation, factors affecting factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be focused on. In regard to satisfaction with complaint handling, factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be emphasized.

Willingness to complain would reduce public confidence, but if complaint handling can be done satisfying distributive, procedural and interactive justice, public confidence can be restored. Since the results suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction, there is no importance of extra measure to address the special need of any particular age group or gender.

7.2 Policy Implications

7.2.1 Policy Implications for Public Transportation

This study provides implications for policy makers and future research. Previous studies rarely examined the negative side of satisfaction in ITS in the context of public transportation. In particular, few previous studies have investigated the effects of complaint handling on public confidence in the case of public transportation. Theoretically, this study applied customer satisfaction theories that are often applied in private sector, in the case of ITSin the context of public transportation to measure users' satisfaction. This study also applied justice theory to classify causes and remedies for complaints. By applying the three dimensions of justice, this study contributes information about the post-stage of dissatisfaction and its effects on public confidence. The results of this study also have important implications for public complaint handling in terms of increasing public satisfaction with ITS, which is crucial for CRM. The importance of the successful management of dissatisfaction for stability and profitable growth

and the determination of how comprehensive a complaint response strategy must be to satisfy the public and gain their confidence has not been well addressed in the context of ITS. By addressing dissatisfaction, complaint handling, and confidence from ITS, the present study provides information for ITS that can be used to improve user-centered management in ITS.

Policy planners should focus on freedom to communicate views and opinions, ease of engaging commuting, adaptability of commuting to reflect individual circumstances, manner and behavior of the service personnel, and provision of caring, individual attention towards the passengers.

7.2.2 Policy Implications for Private Transportation

Preceding studies rarely examined the factors that influence the satisfaction of commuters using ITS in the context of private transportation. Current study delivers suggestions for policy planners in that respect. Present study utilized satisfaction theories in the use of ITS in the case of private transportation to measure commuters' satisfaction. Only few previous studies have examined the influence of complaint handling on public confidence. This study also applied justice theory to categorize the potential sources and possible remedies for complaints. Utilizing the three dimensions of justice, this study contributes about the post-stage of dissatisfaction and its effects on public confidence. The results of this study also have important implications for public complaint handling n terms of increasing public satisfaction with ITS in the context of private transportation, which is very vital for CRM. By analyzing the sources of dissatisfaction, complaint handling, and confidence from ITS in the background of private transportation, the present study provides useful information for ITS in the background of private transportation.

Policy planners should focus on manner and behavior of the service personnel, and provision of caring, individual attention towards the passengers.

The following table summarizes the findingsand policy implications for public and private transportation.

	Public Transportation	Private Transportation
Findings	i)Procedural and interactional justice cause satisfaction/dissatisfaction ii) Satisfaction causespublic confidence iii) Dissatisfaction causeswillingness to complain and complaining behavior iv) Distributive and interactional justice lead to satisfaction with complaint handling v) Willingness to complainreduces public confidence vi) Satisfaction with complaint handlingincreasespublic confidence	i) Interactional Justice cause Satisfaction/ Dissatisfaction ii) Satisfaction causespublic confidence iii) Dissatisfaction causeswillingness to complain and complaining behavior iv) Interactional justice lead to satisfaction with complaint handling v) Willingness to complainreduces public confidence vi) Satisfaction with complaint handlingincreasespublic confidence
Policy Implications	Policy planners should focus on freedom to communicate views and opinions, ease of engaging commuting, adaptability of commuting to reflect individual circumstances, manner and behavior of the service personnel, and provision of caring, individual attention towards the passengers.	Policy planners should focus on manner and behavior of the service personnel, and provision of caring, individual attention towards the passengers.

Table 17.Summary of Findingsand Policy Implications for Public vs. Private Transportation

7.3 Managerial Implications: Public vs. Private Transportation

Managers in the ITS sector should be capable of managing the information technology to disseminate the proper information to the commuters. They must be proficient in dealing with social networking sites to reach the commuters. They should also be prompt in responding the necessities of the commuters. They should regularly conduct satisfaction surveys to understand the level of satisfaction of the passengers. From the survey, they should sort out the factors that are responsible to contribute towards commuters' satisfaction and dissatisfaction. They should exert efforts to improve the factors that lead to commuters' satisfaction. At the same time, they should try to reduce or eliminate the factors that cause commuters' dissatisfaction.

Therefore, the managers of ITS should keep in mind the following points:

i) Managers should be proficient in dealing with information technology and social networking sites,

ii) They should regularly conduct satisfaction survey among the commuters, and

iii) Based on the findings in survey, they should try to modify the parameters that increase the satisfaction and reduce the dissatisfaction of the commuters.

7.4 Limitations and Future Studies

This study has limitations. The response rate for online survey was relatively low. Future studies should consider higher response rate and a cross-cultural environment for comparison and generalizability. Future studies should include more respondents having diverse background including experts on ITS. Future studies should include Big Data, Data Mining, Fourth Industrialization and Internet-of-Things (IoT) to analyze the possibilities of integration of vehicles using ITS with service providers.

References

Ahn, K. and Rakha, H. (2008), "The Effects of Route Choice Decisions on Vehicle EnergyConsumption and Emissions," *Transportation Research Part D*, 13 (3), 151−167.

AlDeek,H.M.,Khattak,A.J., and Thananjeyan,P. (1998), "ACombined Traveler Behavior and System Performance Model with Advanced Traveler Information Systems,"*TransportationResearchPartA*, 32(7),479–493.

Al-Enezi, J.R.,Abbod, M.F.,and Alsharhan, S.(2010), "Artificial Immune Systems Models,Algorithms and Applications," *International Journal of Research and Reviews in Applied Sciences*, 3 (2), 118–120.

Avineri,E. and Prashker,J.N. (2006), "TheImpact of Travel Time Information on Travelers' Learning under Uncertainty,"*Transportation*, 33(4),393–408.

Balbo, F. and Pinson, S.(2005), "Dynamic Modeling of a Disturbance in a Multi-Agent System for Traffic Regulation," *Decision Support Systems*, 41 (1), 131–146.

Ben-Akiva,M. and Lerman,S.R. (1985), *DiscreteChoiceAnalysis*, MITPress,Cambridge,MA(USA).

Ben-Elia,E. and Avineri,E. (2015), "Response to TravelInformation: A Behavioral Review,"*TransportReviews*, 35(3),352–377.

Ben-Elia,E.,DiPace,R.,Bifulco,G.N., and Shiftan,Y. (2013), "TheImpact of Travel Information's Accuracy on Route-Choice,"*TransportationResearchPartC*, 26,146–159.

Bifulco,G.N.,Cantarella,G.E., and Simonelli,F. (2014), "Design of Signal Setting and Advanced Traveler Information Systems,"*JournalofIntelligentTransportationSystems*, 18(1),30–40.

Bifulco,G.N.,DiPace,R., and Viti,F. (2014), "Evaluatingthe Effects of Information Reliability on Travelers' Route Choice,"*EuropeanTransportResearchReview*, 6(1),61–70.

Bifulco,G.N.,Simonelli,F., and DiPace,R. (2007), "EndogenousDriver Compliance and Network Performances Under ATIS,"IEEEIntelligentTransportationSystemsConference,1028–1033.

Bifulco,G.N.,Simonelli,F., and DiPace,R. (2009), "TheRole of the Uncertainty in ATISApplications,"*AdvancesinSoftComputing*, 52,230–239.

Bogers,E.,Viti,F., and Hoogendoorn,S. (2006), "JointModeling of Advanced Travel Information Service, Habit and Learning Impacts on Route Choice by Laboratory Simulator Experiments,"*TransportationResearchRecord*, 1926,189–197.

Bottom,J.A. (2000), "ConsistentAnticipatoryRouteGuidance,"DepartmentofCivilandEnvironmentalEngineering, MIT, Ph.D. thesis.

Bouamrane, K.,Tahon, C., andBeldjilali, B.(2005), "Decision Making System for Regulation of a Bimodal Urban Transportation System, Associating Classical and Multi-Agent Approaches," *Informatica*, 16 (3), 1–30.

Brentari, E. andGolia, S. (2008), "Measuring Job Satisfaction in the Social Services Sector with the Rasch Model," *Journal of Applied Measurement*, 9 (1), 45.

Briggs, D.C. and Wilson, M. (2003), "An Introduction to Multidimensional Measurement," *Journal of Applied Measurement*, 4 (1), 87–100.

Brons, M., Givoni, M., and Rietveld, P. (2009), "Access to Railway Stations and its Potential in Increasing Rail Use," *Transportation Research Part A: Policy Practice*, 43 (2),136–149.

Brouwer,L.E.J. (1991), "Periodic Solutions of Differential Equations with a General Piecewise Constant Argument and Applications,"*MathematischeAnnalen*, 71(1),97–115.

Cantarella,G.E. (1997), “Fixed-Point Stability and Bifurcation in Dynamic Processes for Traffic Assignment,”Morabito,F.C.(Ed.),AdvancesinIntelligentSystems, IOS-Press,Amsterdam(NL),254–261.

Cantarella,G.E. (2013), “Day-to-Day Dynamic Models for IntelligentTransportationSystemDesign and Appraisal,”*TransportationResearchPartC*, 29,117–130.

Cantarella,G.E. and Cascetta,E. (1995), “DynamicProcess and Equilibrium in Transportation Networks: Towards a Unifying Theory,”*TransportationScience*, 31,107–128.

Ceder, A. (2011), “Public-Transport Vehicle Scheduling with Multi Vehicle Type,”*Transportation Research Part C: Emerging Technologies*, 19 (3), 485–497.

Ceder,A.,Golany, B., and Tal, O.(2001), “Creating Bus Timetables with Maximal Synchronization,” *Transportation Research Part A*, 35 (10), 913–928.

Chang, H.L. and Shih, C.K. (2012), “Using a Multidimensional Rasch Model Approach to Measure the Police’s Perceived Ability to Detect, Detain and Intercept DWIVehicles when Conducting Sobriety Checkpoints,” *Accident Analysis & Prevention*, 48 (2012), 505–517.

Chang, H.L. and Wu, S.C. (2008), “Exploring the Vehicle Dependence Behind Mode Choice: Evidence of Motorcycle Dependence in Taipei,” *Transportation Research Part A*, 42 (2),307–320.

Chang, S. Y. and Yeh, T. Y. (2012), “An Artificial Immune Classifier for Credit Scoring Analysis,”*Applied SoftComputing*, 12 (2), 611–618.

Chen, Q.,Adida, E.,and Lin, J. (2010), “An Investigation in Real-Time Bus Holding Policy,” Proceedings of the 15th Hong Kong Society for Transportation Studies(HKSTS), December 2010.

Cheng, Y.H. (2010), “Exploring Passenger Anxiety Associated with Train Travel,” *Transportation*, 37 (6), 875–896.

Cheng, Y.H. and Liu, K.C. (2012), “Evaluating Bicycle-Transit Users’ Perceptions of Intermodal Inconvenience,” *Transportation Research Part A: Policy Practice*, 46 (10),1690–1706.

Chien, S.I.J., Ding, Y., and Wei, C. (2002), “Dynamic Bus Arrival Time Prediction with Artificial Neural Networks,” *Journal of Transportation Engineering, Part A: Systems*, 128 (5), 429–438.

Chorus,C.G.,Arentze,T.A.,Molin,E.J.E.,Timmermans,H.J.P., and VanMee,B. (2006), “TheValue of Travel Information: DecisionStrategy-Specific Conceptualizations and Numerical Examples,”*TransportationResearchPartB*, 40(6),504–519.

Chorus,C.G.,Molin,E.J.E., and VanWee,B. (2006), “Useand Effects of Advanced Traveler Information Services (ATIS): AReview of the Literature,”*TransportReviews*, 26(2),127–149.

Cortés, C.E.,Milla, Sáez D.F.,Núñez, A., andRiquelme, M. (2010), “Hybrid Predictive Control for Real-Time Optimization of Public Transport Systems’ Operations Based on Evolutionary Multi-Objective Optimization,” *Transportation Research Part C: Emerging Technologies*, 18 (5), 757–769.

Costa Silva, C.G.,Palhares, R.M., and Caminhas, W.M. (2012), “Immune Inspired Fault Detection and Diagnosis: A Fuzzy-Based Approach of the Negative Selection Algorithm and Participatory Clustering,” *Expert Systems with Applications*, 39 (16), 12474–12486.

Cox, T., Houdmont, J., and Griffiths, A. (2006) “Rail Passenger Crowding, Stress, Health and Safety in Britain,” *Transportation Research Part A*, 40 (3), 244–258.

Daganzo, C.F. (2009), “A Headway-Based Approach to Eliminate Bus Bunching: Systematic

Analysis and Comparisons," *Transportation Research Part B: Methodological*, 43(10), 913–921.
Darmoul, S.,Pierreval, H., andGabouj, S.H. (2007), "Scheduling Using Artificial Immune System Metaphors: A Review," International Conference on Service Systemsand Service Management, October 2007.
Darmoul, S.,Pierreval, H., andGabouj, S.H. (2012), "Handling Disruptions in Manufacturing Systems: An Immune Perspective," *Engineering Applications of Artificial Intelligence*, 110–121.
Dasgupta, D.,Ji, Z. and Gonzalez, F. (2003), "Artificial Immune System (AIS) Research in the Last Five Years,"The Congress on Evolutionary Computation (CEC '03), 1, 123–130.
Dasgupta, D., Yu, S., and Nino, F. (2011), "Recent Advances in Artificial Immune Systems: Models and Applications," *Applied Soft Computing*, 11 (2), 1574–1587.
Davidsson, P.,Henesey, L.,Ramstedt, L.,Törnquist, J., andWernstedt, F. (2005), "An Analysis of Agent-Based Approaches to Transport Logistics," *Transportation Research Part C*, 13, 255–271.
Dawes, J. (2008), "Do Data Characteristics Change According to the Number of Scale Points Used?" *International Journal of Market Research*, 50 (1), 61–77.
De Castro, L.N.and Timmis, J.I. (2002), *Artificial Immune Systems: A New ComputationalIntelligence Approach*, Springer-Verlag, Berlin.
De Castro, L.N. andTimmis, J.I. (2003), "Artificial Immune Systems as a Novel Soft Computing Paradigm," *Soft Computing*, 7 (8), 526–544.
De Castro, L.N. and Von Zuben, F.J. (2000), "The Clonal Selection Algorithm with Engineering Application,"Proceedings of GECCO00 Workshop, 36–37.
DePalma,A.,Lindsey,R., and Picard,N. (2012), "Aversion, the Value of the Information, and Traffic Equilibrium,"*TransportationScience*, 46(1),1–26.
Deb, K. and Chakroborty, P. (1998), "Time Scheduling of Transit Systems with Transfer Considerations Using Genetic Algorithms," *Evolutionary Computation*, 6 (1), 1–24.
Dell'Orco,M. and Teodorovic,D. (2009), "DataFusion for Updating Information in Modelling Drivers' Choice Behavior,"*Transportmetrica*, 5(2),107–123.
Dia,H. (2002), "AnAgent-Based Approach to Modelling Driver Route Choice Behavior under the Influence of Real-Time Information,"*TransportationResearchPartC*, 10(5-6),331–349.
Dziekan, K. andKottenhoff, K. (2007), "Dynamic At-Stop Real-Time Information Displays for Public Transport: Effects on Customers," *Transportation Research Part A: PolicyPractice*, 41 (6), 489–501.
Eberlein, X.J., Wilson, N.H.M.,and Bernstein, D. (1999), "Modeling Real-Time Control Strategies in Public Transit Operations," N.H.M. Wilson (Ed.), Lecture Notesin Economics and Mathematical Systems: Computer-Aided Scheduling,Springer-Verlag, 325–346.
Eberlein, X.J., Wilson, N.H.M.,and Bernstein, D. (2001), "The Holding Problem with Real-Time Information Available," *Transportation Science*, 35, 1–18.
Elias, W. andShiftan, Y. (2012), "The Influence of Individual's Risk Perception and Attitudes on Travel Behavior," *Transportation Research Part A: Policy Practice*, 46 (8),1241–1251.
Emmerink,R.H.M.,Axhausen,K.W.,Nijkamp,P., and Rietveld,P. (1995), "ThePotential of Information Provision in a Simulated Road Transport Network with Non-Recurrent Congestion,"*TransportationResearchPart C*, 3(5),293–309.
Engel-Yan, J., Rudra, M., Livett, C., and Nagorsky, R. (2014), "Strategic Station Access Planning for Commuter Rail," *Transportation Research Record:Journalof Transportation*

Research Board, 2419 (1), 82–91.
Ettema,D. and Timmermans,H. (2006), "Cost of Travel Time Uncertainty and Benefit of Travel Time Information: Conceptual Model and Numerical Examples,"*TransportationResearchPartC*, 14(5),335–350.
Ezzedine, H.,Bonte, T.,Kolski, C., andTahon, C. (2008), "Integration of Traffic Management and Traveler Information Systems: Basic Principles and Case Study in Intermodal Transport System Management," *International Journal of Computers Communications & Control(IJCCC)*, 3 (3), 281–294.
Ezzedine, H.,Trabelsi, A., andKolski, C. (2006), "Modeling of an Interactive System with an Agent-Based Architecture Using Petri Nets, Application of the Method to the Supervision of a Transport System," *Mathematics and Computers in Simulation*, 70, 358–376.
Fernandez, L.J.E., De Cea, C., and Valverde, G.G. (2009), "Effect of Advanced Traveler Information Systems and Road Pricing in a Network with Non-Recurrent Congestion,"*Transportation Research Part A*, 43 (5), 481−499.
Fu, L. and Yang, X. (2002), "Design and Implementation of Bus-Holding Control Strategies with Real-Time Information," *Transportation Research Record*, 1791, 6–12.
Fu, L.P., Liu, Q. and Calamai, P. (2009), "Real-Time Optimization Model for Dynamic Scheduling of Transit Operations," *Transportation Research Record*, 48–55.
Gabrielli S., Forbes P., Jylhä A., Wells S., Sirén M., Hemminki S., Nurmi P., Maimone R.,Masthoff J., and Jacucci G. (2014), "Design Challenges in Motivating Change for Sustainable Urban Mobility,"*Computers in Human Behavior*, 41, 416-423.
Givoni, M. and Rietveld, P. (2007), "The Access Journey to the Railway Station and its Role in Passengers' Satisfaction with Rail Travel," *Transport Policy*, 14 (5), 357–365.
Gong, M., Jiao, L., Zhang, L., and Dub, H. (2009), "Immune Secondary Response and Clonal Selection Inspired Optimizers," *Progress in Natural Science*, 19, 237–253.
Gray, D.(1992), "The Dynamics of Immunological Memory," *Seminars in Immunology*, 4, 29–34.
Gubins, S., Verhoef, E.T., and de Graaff, T. (2012), "Welfare Effects of Road Pricing and Traffic Information under Alternative Ownership Regimes," *TransportationResearchPart A*, 46 (8), 1304−1317.
Gudmundsson, H. (2004), "Sustainable Transport and Performance Indicators," Hester, R.E., Harrison, R.M. (Eds.), Transport and the Environment—Issues inEnvironmental Science and Technology, Royal Society of Chemistry, Cambridge-UK, 20, 35–63.
Guimarães, F.G.,Palhares, R.M.,Campelo, F., and Igarashi, H.(2007), "Design of Mixed H2/H1Control Systems Using Algorithms Inspired by the Immune System," *Information Sciences*, 177, 4368–4386.
Guo, Z. and Wilson, N.H.M. (2011), "Assessing the Cost of Transfer Inconvenience in Public Transport Systems: A Case Study of the London Underground," *Transportation Research Part A: Policy Practice*, 45 (2), 91–104.
Hadas, Y. andRanjitkar, P. (2012), "Modeling Public-Transit Connectivity with Spatial Quality-of-Transfer Measurements," *Journal of Transport Geography*, 22, 137–147.
Hall,R.W. (1996), "RouteChoice and Advanced Traveler Information Systems on a Capacitated and Dynamic Network,"*TransportationResearchPartC*, 4(5),289–306.
Handy, S.L. andNiemeier, D.A. (1997), "Measuring Accessibility: An Exploration of Issues,"Harrison, R.M. (Ed.), Transport and the Environment—Issues in Environmental Science and Technology, Royal Society of Chemistry, Cambridge, UK, 20, 35–63.
Hawkins, R.J., Kremer, M.J., Swanson, B., and Fogg, L. (2014), "Use of the Rasch Model for

Initial Testing of Fit Statistics and Rating Scale Diagnosis for a General Anesthesia Satisfaction Questionnaire," *Journal of Nursing Measurement*, 22 (3), 381–403.

He,Z.,Guan,W., and Ma,S. (2013), "ATraffic-Condition-Based Route Guidance Strategy for a Single Destination Road Network,"*TransportationResearchPartC*, 32,89–102.

Hine, J. and Scott, J. (2000), "Seamless, Accessible Travel: Users' Views of the Public Transport Journey and Interchange,"*Transport Policy*, 7 (3), 217–226.

Hughes, J.E., Knittel, C.R., and Sperling, D. (2008), "Evidence of A Shift in the Short-Run Price Elasticity of Gasoline Demand," *The Energy Journal, International Association for EnergyEconomics*, 29 (1),113−134.

Humpel, N., Owen, N., Iverson, D., Leslie, E., and Bauman, A. (2004), "Perceived Environment Attributes, Residential Location, and Walking for Particular Purposes,"*American Journal of Preventive Medicine*, 26 (2), 119–125.

Hunt, J. and Cook, D. (1996), "Learning Using an Artificial Immune System," *Journal of Network and Computer Applications: Special Issue Intelligent System Design Application*, 19, 189–212.

Iseki, H. and Taylor, B.D. (2010), "Style versus Service? An Analysis of User Perceptions of Transit Stops and Stations," *Journal of Public Transportation*, 13 (3), 23–48.

Jahn,O.,Mohring,R.H.,Schulz,A.S., and Stier-Moses,N.E. (2005), "System-Optimal Routing of Traffic Flows with User Constraints in Networks with Congestion,"*OperationsResearch*, 53(4),600–616.

Jha,M.,Madanat,S., and Peeta,S. (1998), "PerceptionUpdating and Day-to-Day Travel Choice Dynamics in Traffic Networks within Formation Provision,"*TransportationResearchPartC*, 6(3),189–212.

Johnson, C.M. and Thomas, E.L. (2000), "Automatic Vehicle Location Successful Transit Applications: A Cross-Cutting Study: Improving Service and Safety," Joint Program Office for Intelligent Transportation Systems, FTA, 2000.

Khattak,A.,Yim,Y., and Stalker,L. (2003), "Willingnessto Pay for Travel Information,"*TransportationResearchPartC*, 11(2),137–159.

Kima, K.S.,Parkb, S.J., andKweonc, Y.J. (2007), "Highway Traffic Noise Effects on Land Price in an Urban Area," *Transportation Research Part D: Transportation Environment*, 12 (4), 275–280.

King, R., Russ, S.H., Lambert, A. and Reese, D. (2001), "An Artificial Immune System Model for Intelligent Agents," *Future Generation Computer Systems*, 17, 335–343.

Knight, T. andTimmis, J. (2002), "A Multi Layered Immune Inspired Approach to Data Mining,"Proceedings of the 4th International Conference on RecentAdvances in Soft Computing.

Krasemann, J.T. (2012), "Design of an Effective Algorithm for Fast Response to the Rescheduling of Railway Traffic During Disturbances," *Transportation Research Part C:Emerging Technologies*, 20 (1), 62–78.

Lin, G., Liang, P.,Schonfeld, P., and Larson, R. (1995), "Adaptive Control of Transit Operations,"Final Report for Project MD-26-7002, University of Maryland.

Linacre, J.M. (2002), "Optimizing Rating Scale Category Effectiveness," *Journal of Applied Measurement*, 3 (1), 85–106.

Lindsey,R.,Daniel,T.,Gisches,E., and Rapoport,A. (2014), "Pre-Trip Information and Route-Choice Decision with Stochastic Travel Conditions: Theory,"*TransportationResearchPartB*, 67(3),187–207.

Lo,H.K. and Szeto,W.Y. (2002), "AMethodology for Sustainable Traveler Information Services,"*TransportationResearchPartB*, 36(3),113–130.
Lo,H.K. and Szeto,W.Y. (2004), "ModelingAdvanced Traveler Information Services: Static Versus Dynamic Paradigms,"*TransportationResearchPartB*, 38(6),495–515.
Lo, H.K., Yip, C.W., and Wan, Q.K. (2004), "Modeling Competitive Multi-Modal Transit Services: A Nested Logic Approach," *Transportation Research Part C: Emerging Technologies*, 12(3–4), 251–272.
Loukaitou-Sideris, A. (1999), "Hot Spots of Bus Stop Crime: The Importance of Environmental Attributes," *Journal of the American Planning Association*, 65 (4), 395–411.
Mahmassani,H. and Liu,Y. (1999), "Dynamics of Commuting Decision Behavior under Advanced Traveler Information Systems,"*TransportationResearchPartC*, 2(2-3),91–107.
Martin, D., Jordan, H., and Roderick, P. (2008), "Taking the Bus: Incorporating Public Transport Timetable Data into Health Care Accessibility Modelling," *Environment and Planning A*, 40 (10), 2510.
Martin, D., Wrigley, H., Barnett, S., and Roderick, P. (2002), "Increasing the Sophistication of Access Measurement in A Rural Healthcare Study," *Health Place*, 8 (1),3–13.
Mavoa, S., Witten, K., McCreanor, T., and O'Sullivan, D. (2012), "GIS Based Destination Accessibility via Public Transit And Walking in Auckland, New Zealand," *Journal of Transport Geography*, 20 (1), 15–22.
McKay, C.R. (1993), "Immunological Memory," Advances in Immunology, 53, 217–265.
Miller, M.A., Englisher, L., Kaplan, B., and Halvorsen, R. (2005), "Transit Service Integration Practices: A Survey of US Experiences," *Transportation Research Record: Journal of Transportation Research Board*, 1927 (1), 101–111.
Miranda, H.D.F. and Rodrigues da Silva, A.N. (2012), "Benchmarking Sustainable Urban Mobility: The Case of Curitiba, Brazil," *Transport Policy*, 21, 141–151.
Mishra, S., Welch, T.F., and Jha, M.K. (2012), "Performance Indicators for Public Transit Connectivity in Multi-Modal Transportation Networks," *Transportation Research Part A:Policy Practice*, 46 (7), 1066–1085.
Mislevy, R.J. (1984), "Estimating Latent Distributions," *Psychometrika*, 49 (3), 359–381.
Naumann, M., Suhl, L., andKramkowski S. (2011), "A Stochastic Programming Approach for Robust Vehicle Scheduling in Public Bus Transport," *Procedia - Social and Behavioral Sciences*, 20, 826–835.
Nikraz, M.,Caire, G., andBahri, P.A. (2006), "A Methodology for the Analysis and Design of Multi-Agent Systems using JADE," *International Journal of Computer Systems Science and Engineering*, 21(2),203-234.
O'Sullivan, D., Morrison, A., and Shearer, J. (2000), "Using Desktop GIS for the Investigation of Accessibility by Public Transport: An Isochrones Approach," *International Journal of Geographical Information Science*, 14 (1), 85–104.
Oh,J.,Jayakrishnan,R.,Chen,A., and Yang,H. (2001), "ParametricEvaluation for Route Guidance Systems with Analysis of Sustainable Driver Compliance,"*TransportationResearchRecord*, 1771,18–27.
Olszewski, P. andWibowo, S.S. (2005), "Using Equivalent Walking Distance to Assess Pedestrian Accessibility to Transit Stations in Singapore," *Transportation Research Record: Journal of Transportation Research Board*, 1927 (1), 38–45.
Ozcelik, S. andSukumaran, S.(2011), "Implementation of an Artificial Immune System on a Mobile Robot," *Procedia- Computer Science*, 6, 317–322.

Passetti, K.,Jin, L. and De Pencier, D. (2012), "Deriving Vehicle Travel Speed/Dwell TimeUsing Automatic Passenger Counter (APC)," Technical Report, FloridaDepartment of Transportation Transit Office.

Paz,A. and Peeta,S. (2009), "On-Line Calibration of Behavior Parameters for Behavior-Consistent Route Guidance,"*TransportationResearchPartB*, 43(4),403–421.

Perelson, A.S.,Mirmirani, M., and Oster, G.F.(1978), "Optimal Strategies In Immunology II. BMemory Cell Production," *Journal of Mathematical Biology*, 5, 213–256.

Poorzahedy, H. and Rouhani, O.M. (2007), "Hybrid Meta-Heuristic Algorithms for Solving Transportation Network Design," *European Journal of Operational Research*, 182 (2), 578−596.

Rahal, D.D., Rahal, F., andChekroun, M.R. (2010), "Multi-Agent System for Modeling Transport Systems," *European Journal of Scientific Research*, 46 (1), 80–89.

Rapoport,A.,Gisches,E.J.,Daniel,T., and Lindsey,R. (2014), "Pre-Trip Information and Route-Choice Decisions with Stochastic Travel Conditions: Experiment,"*TransportationResearchPartB*, 68,154–172.

Reeve, B.B. and Masse, L.C. (2007), "Psychometric Evaluation and Calibration of Health-Related Quality of Life Item Banks: Plans for the Patient-Reported Outcomes Measurement Information System," *Medical Care*, 45 (5), S22–S31.

Rossi, P.E., Gilula, Z., andAllenby, G.M. (2001), "Overcoming Scale Usage Heterogeneity: A Bayesian Hierarchical Approach,"*Journal of the American Statistical Association*, 96 (453), 20–31.

Rubio, V.J., Aguado, D., Hontangas, P.M., and Hernandez, J.M. (2007), "Psychometric Properties of an Emotional Adjustment Measure: An Application of the GradedResponse Model,"*European Journal of Psychological Assessment*, 23 (1), 39–46.

Sanchez, T.W., Shen, Q., and Peng, Z.R. (2004), "Transit Mobility, Jobs Access and Low Income Labor Participation in US Metropolitan Areas," *Urban Studies*, 41 (7),1313–1331.

Schrank,D.,Eisele,B., and Lomax,T. (2012), "The2012UrbanMobilityReport,PoweredbyINRIXTrafficData,"TexasTransportationInstitute ,TexasA&MUniversity,CollegeStationDecember, http://s3.documentcloud.org/documents/566377/2012-urban-mobility-report.pdf.

Stradling, S., Carreno, M., Rye, T., and Noble, A. (2007), "Passenger Perceptions and the Ideal Urban Bus Journey Experience,"*Transport Policy*, 14 (4), 283–292.

Sun, A. and Hickman, M. (2005), "The Real-Time Stop-Skipping Problem," *Journal of Intelligent Transportation Systems*, 9 (2), 91–109.

Szetoa, W.Y. and Lob, H.K. (2006), "Transportation System Improvement and Tolling Strategies: The Issue of Intergeneration Equity," *Transportation Research Part A: Policy and Practice*, 40 (3), 227–243.

Tanaka,M.,Uno,N.,Shiomi,Y., and Ahn,Y. (2014), "ExperimentalStudy of Effects of Travel Time Distribution Information on Dynamic Route Choice Behavior,"*JournalofIntelligentTransportationSystems*, 18(2),215–226.

Timmis, J., Knight, T., De Castro, L.N., and Hart, E. (2004), "An Overview of Artificial Immune Systems," *National Computing Service*, 51–86.

Tribby, C.P. andZandbergen, P.A. (2012), "High-Resolution Spatio-Temporal Modeling of Public Transit Accessibility," *Applied Geography*, 34, 345–355.

Tseng,Y.,Knockaert,J., and Verhoef,E.T. (2013), "ARevealed-Preference Study of Behavioral Impacts of Real-Time Traffic Information,"*TransportationResearchPart C*, 30,196–209.

Tsirimpa,A.,Polydoropoulou,A., and Antoniou,C. (2007), "Development of a Mixed Multinomial Logit Model to Capture the Impact of Information Systems on Traveler's Switching Behavior,"*JournalofIntelligentTransportationSystems*, 11(2),79–89.
Tyrinopoulos, Y. and Antoniou, C. (2008), "Public Transit User Satisfaction: Variability and Policy Implications," *Transport Policy*, 15 (4), 260–272.
Uschold, M. and Gruninger, M. (1996), "Ontologies: Principles, Methods and Applications,"*The Knowledge Engineering Review*, 11 (2), 93–155.
Wall, G. and McDonald, M. (2007), "Improving Bus Service Quality and Information in Winchester," *Transport Policy*, 14 (2), 165–179.
Watling,D. and Hazelton,M.L. (2003), "TheDynamics and Equilibria of Day-to-Day Assignment Models,"*NetworkandSpatialEconomics*, 3,349–370.
Weber, J. (2003), "Individual Accessibility and Distance From Major Employment Centers: An Examination Using Space-Time Measures," *Journal of Geographical Systems*, 5 (1),51–70.
Welch, T.F. and Mishra, S. (2013), "A Measure of Equity for Public Transit Connectivity," *Journal of Transport Geography*, 33 (December), 29–41.
Wu, H.H. and Li, R.K. (1995), "A New Rescheduling Method for Computer Based Scheduling Systems," *International Journal of Production Research*, 33 (8), 2097–2110.
Wu, S.X. andBanzhaf, W. (2010), "The Use of Computational Intelligence in Intrusion Detection Systems: A Review," *Applied Soft Computing*, 10 (1), 1–35.
Xuan, Y.,Argote, J., andDaganzo, C.F. (2011), "A Dynamic Holding Strategy to Improve Bus Schedule, Reliability and Commercial Speed," *Transportation Research Part B: Methodological*, 45 (10), 1831–1845.
Yan, Z. andMok, M.M.C. (2012), "Validating the Coping Scale for Chinese Athletes using Multidimensional Rasch Analysis," *Psychology of Sport and Exercise*, 13 (3), 271–279.
Yang,H. (1998), "MultipleEquilibrium Behaviors and Advanced Traveler Information Systems with Endogenous Market Penetration,"*TransportationResearchPartB*, 32(3),205–218.
Yang, H. (1998), "Multiple Equilibrium Behaviors and Advanced Traveler Information Systems with Endogenous Market Penetration," *Transportation Research Part B*, 32 (3),205−218.
Yang,H. and Meng,Q. (2001), "ModelingUser Adoption of Advanced Traveler Information Systems: Dynamic Evolution and Stationary Equilibrium,"*TransportationResearchPartA*, 35,895–912.
Yu, B., Wu, S., Yao, B., Yang, Z. and Sun, J.(2012), "Dynamic Vehicle Dispatching at a Transfer Station in Public Transportation System," *Journal of Transportation Engineering*, 138 (2), 191–201.
Zhao, W. and Davis, C.E. (2011), "A Modified Artificial Immune System Based Pattern Recognition Approach – An Application to Clinical Diagnostics," *Artificial Intelligence in Medicine*, 52 (1), 1–9.

Appendix A.
Questionnaire

Part 1: Research Questions

i) Do levels of perceived justice (distributive, procedural and interactional) in ITS environment affect levels of satisfaction/dissatisfaction?
ii) Do levels of satisfaction form ITS affect levels of public confidence?
iii) Do levels of dissatisfaction form ITS affect levels of willingness to complain?
iv) Dolevels of dissatisfaction form ITS affect levels of complaining behavior?
v) Do levels of complaining behavior affect levels of satisfaction with complaint handling when the complaints are resolved based on three dimensions (distributive, procedural and interactional)of justice?
vi) Dolevels of willingness to complainin ITS environment affect levels of public confidence?
vii) Do levels of satisfaction with complaint handling in ITS environment affect levels of public confidence?

Part 2: Introduction

Purpose of the study:

Transportation industry, like many industries in the current world, has undergone massive transformation due to the advent of Information Technology (IT). IT enables various components of the transportation system to become intelligent by microchips and sensors and thereby empowering them to communicate with each other through wireless technologies. Such IT applications contribute in significant improvements in the performance of the transformation system, which includes reduction in congestions, less pollution and enhanced safety. Improved performance in the overall transportation system ensures customer satisfaction to the everyday commuters.

The purpose of the study is to investigatesatisfaction and public confidence in the context of Intelligent Transportation System (ITS) (transportation systems that use modern IT applications such as internet and mobile applications) and this study will explore implications to CRM and public policy.

Anonymity

The responses to the survey questionnaire are solely to be used for the research purposes. So all the respondents will remain anonymous during and after this research work.

Voluntary

The responses to the survey questionnaire are voluntary.

Correspondence

If you have any questions, queries or comments, please send an e-mail to rahmananisur@kdis.ac.kr

Please answer the following questions on the basis of your personal experiences from the use of ITS.

Part 3: Basic start-up question

1. Do you use Intelligent Transportation System (ITS) (transportation systems that use IT applications such as internet and mobile applications)?

_____ Yes _____ No (If not, stop here)

2. Have you ever used ITS within last one year?

_____ Yes _____ No (If not, stop here)

3. When did you start using ITS approximately?

( ) Less than one year ( ) More than one – Less than two years

( ) More than two – Less than three years ( ) More than three years

4. How likely do you use ITS?

Very unlikely 1 2 3 4 5 6 7 Highly Likely

5. How much are you dissatisfied with the use of ITS?

Very dissatisfied 1 2 3 4 5 6 7Very satisfied

If the Answer of Question #5 is within the range (5 ~ 7), please go to Section A

If the Answer of Question #5 is within the range (1 ~ 4), please go to Section B

Part 4: Main questions

Section A:

6. Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think thatITS is more easily accessible compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that use of ITS meets my expectations compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that use of ITS is the better method to facilitate commuting compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS are easy to get information compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that procedure to use ITS isnot complicated and very clear compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. Overall, I think that procedure to use ITS meets my expectation.

1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I prefer not to use conventional transportation system due to availability of information in ITSvia online.

1 2 3 4 5 6 7 N/A

b. I think that information and explanation provided in the use of ITS are enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that the overall interaction in the use of ITS meets my expectation compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

7. (Satisfaction) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I am satisfied with the services offered by ITS due to convenient procedure.

1 2 3 4 5 6 7 N/A

b. I am pleased with ITS as I could have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am satisfied with ITS as I have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am satisfied with use of ITS as I am fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am satisfied with the use of ITS as my complaints will be resolved by the service staff.

1 2 3 4 5 6 7 N/A

f. I think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am satisfied with the use of ITS as it meets my expectation.

1 2 3 4 5 6 7 N/A

Please go to Q# 15

Section B:

8. Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think that it is inconvenient to use ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think thatITS isless easily accessible compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that uses of ITS arenot fair compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS arenot easy to get information compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that uses of ITS do not reduce any inconvenient process compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. Overall, I think that procedure to use ITS does not meet my expectation.

1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I think that use of ITS is less efficient compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that interaction in the use of ITS is not satisfactory even after adopting advanced information technology compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that information and explanation provided in the use of ITS are not enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

9. (Dissatisfaction) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I am dissatisfied with the services offered by ITS due to inconvenient procedure.

1 2 3 4 5 6 7 N/A

b. I am not pleased with ITS as I could not have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am dissatisfied with ITS as I do not have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am not so satisfied with use of ITS aa I am not fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am not satisfied with the use of ITS as my complaints will not be resolved due to lack of presence of service staff.

1 2 3 4 5 6 7 N/A

f. I do not think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am dissatisfied with the use of ITS as it does not meet my expectation.

1 2 3 4 5 6 7 N/A

10. Have you ever filed complaints against ITS? ( ) Yes ( ) No (If yes, go to Q# 13)

11. How strong did you have intention to complaint against ITS?

Very unlikely 1 2 3 4 5 6 7 N/A Highly likely

12. (Willingness to complain) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I often felt like complaining against ITS.

1 2 3 4 5 6 7 N/A

b. I was about to complain due to dissatisfaction in using ITS.

1 2 3 4 5 6 7 N/A

c. I regret that I did not complain actually even though I was not satisfied with the use of ITS.

1 2 3 4 5 6 7 N/A

d. I am unwilling to complain against ITS as I do not have strong motivation to do so.

1 2 3 4 5 6 7 N/A

e. I am hesitant to complain against ITS as I do not want to spend money and time.

1 2 3 4 5 6 7 N/A

f. I am reluctant to complain against ITS as I do not want to encounter uncomfortable situation.

1 2 3 4 5 6 7 N/A

g. I am hesitant to complain against ITS since I am not aware of the procedure to complain.

1 2 3 4 5 6 7 N/A

Please go to Q# 15

13. (Complaining Behavior) Please rate your overall opinions about experiences regarding your complaints from using ITS.<u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I actually complained to the organizations that provide ITS as I am not satisfied with it.

1 2 3 4 5 6 7 N/A

b. I expressed my unpleasant feeling to the organizations that provide ITS with the believe that it will not occur again.

1 2 3 4 5 6 7 N/A

c. I expected that my complaints are resolved if I address to the organizations that provide online public service.

1 2 3 4 5 6 7 N/A

14. (Resolution) Please rate your overall opinions about experiences regarding your complaints from using ITS and reactions. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

(Distributive Justice)

a. I think that getting feedback from the organizations that provide ITS on my complaints was convenient.

1 2 3 4 5 6 7 N/A

b. I think that the complaints were fairly treated by the organizations that provide ITS.

1 2 3 4 5 6 7 N/A

c. Overall, distributive services for my complaints offered by the organizations that provide ITS meet my expectations.

1 2 3 4 5 6 7 N/A

(Procedural Justice)

a. It was not so difficult to find the way to how to complain to get resolved.

1 2 3 4 5 6 7 N/A

b. My complaints were well resolved with plausible procedure.

1 2 3 4 5 6 7 N/A

c. Follow-up services to resolve complaints were well-proceeded.

1 2 3 4 5 6 7 N/A

d. I think that the overall procedure to receive feedback on my complaints from the organizations that provide ITS was efficient.

1 2 3 4 5 6 7 N/A

e. Overall, I think the resolution process offered by the organizations that provide ITS meets my expectation.

1 2 3 4 5 6 7 N/A

(Interactive Justice)

a. My complaints were timely resolved due to 24 hours/7 days.

1 2 3 4 5 6 7 N/A

b. I think that I received response about my complaints from the organizations that provide ITS with satisfactory response manner.

1 2 3 4 5 6 7 N/A

c. I think that information and explanation about my complaints were enough from the organizations that provide ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. The way I receive answers/responses from the organizations that provide ITS significantly affect to my decision making to use ITS.

1 2 3 4 5 6 7 N/A

e. Overall, I think that interaction with the organizations that provide ITS while my complaints are resolved, meets my expectation.

1 2 3 4 5 6 7 N/A

15. (Public Confidence) Please rate your overall opinions about experiences regarding your confidence from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. Using ITS increase confidence among the users.

1 2 3 4 5 6 7 N/A

b. By offering ITS, users' confidence level has been increased.

1 2 3 4 5 6 7 N/A

c. Development of ITS help enhance trust among users.

1 2 3 4 5 6 7 N/A

d. Overall, use of ITS will help increase trust among the users.

1 2 3 4 5 6 7 N/A

16. Do you use Intelligent Transportation System (ITS) (transportation systems that use IT applications such as internet and mobile applications) for personal auto driving or for mass transit?

only personal auto driving only mass transit

1 2 3 4 5 6 7 N/A

If the Answer of Question #16 is (7), please go to Q# 27

_____ Yes _____ No (If not, please go to Q# 27)

Personal auto driving (use of smartphone to receive important information such as time ofdeparture, route to take to destinations, congested and non-congested routes, location,

operating hours, and availability of food, lodging, parking, auto repair, hospitals, gas stations and police facilities):

17. Please rate your overall opinions about experiences from using ITS. (You may choose N/A if it is not applicable).

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think thatITS is more easily accessible compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that use of ITS meets my expectations compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that use of ITS is the better method to facilitate commuting compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS are easy to get information compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that procedure to use ITS isnot complicated and very clear compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. Overall, I think that procedure to use ITS meets my expectation.

1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I prefer not to use conventional transportation system due to availability of information in ITSvia online.

1 2 3 4 5 6 7 N/A

b. I think that information and explanation provided in the use of ITS are enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that the overall interaction in the use of ITS meets my expectation compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

18. (Satisfaction) Please rate your overall opinions about experiences from using ITS. (You may choose N/A if it is not applicable).

Strongly Disagree Strongly Agree

a. I am satisfied with the services offered by ITS due to convenient procedure.

1 2 3 4 5 6 7 N/A

b. I am pleased with ITS as I could have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am satisfied with ITS as I have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am satisfied with use of ITS as I am fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am satisfied with the use of ITS as my complaints will be resolved by the service staff.

1 2 3 4 5 6 7 N/A

f. I think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am satisfied with the use of ITS as it meets my expectation.

1 2 3 4 5 6 7 N/A

Please go to Q# 26

19. Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think that it is inconvenient to use ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think thatITS isless easily accessible compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that uses of ITS arenot fair compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS arenot easy to get information compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that uses of ITS do not reduce any inconvenient process compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. Overall, I think that procedure to use ITS does not meet my expectation.

1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I think that use of ITS is less efficient compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that interaction in the use of ITS is not satisfactory even after adopting advanced information technology compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that information and explanation provided in the use of ITS are not enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

20. (Dissatisfaction) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I am dissatisfied with the services offered by ITS due to inconvenient procedure.

1 2 3 4 5 6 7 N/A

b. I am not pleased with ITS as I could not have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am dissatisfied with ITS as I do not have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am not so satisfied with use of ITS as I am not fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am not satisfied with the use of ITS as my complaints will not be resolved due to lack of presence of service staff.

1 2 3 4 5 6 7 N/A

f. I do not think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am dissatisfied with the use of ITS as it does not meet my expectation.

1 2 3 4 5 6 7 N/A

21. Have you ever filed complaints against ITS? ( ) Yes ( ) No (If yes, go to Q# 24)

22. How strong did you have intention to complaint against ITS?

Very unlikely 1 2 3 4 5 6 7 N/A Highly likely

23. (Willingness to complain) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I often felt like complaining against ITS.

1 2 3 4 5 6 7 N/A

b. I was about to complain due to dissatisfaction in using ITS.

1 2 3 4 5 6 7 N/A

c. I regret that I did not complain actually even though I was not satisfied with the use of ITS.

1 2 3 4 5 6 7 N/A

d. I am unwilling to complain against ITS as I do not have strong motivation to do so.

1 2 3 4 5 6 7 N/A

e. I am hesitant to complain against ITS as I do not want to spend money and time.

1 2 3 4 5 6 7 N/A

f. I am reluctant to complain against ITS as I do not want to encounter uncomfortable situation.

1 2 3 4 5 6 7 N/A

g. I am hesitant to complain against ITS since I am not aware of the procedure to complain.

1 2 3 4 5 6 7 N/A

Please go to Q# 26

24. (Complaining Behavior) Please rate your overall opinions about experiences regarding your complaints from using ITS.<u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I actually complained to the organizations that provide ITS as I am not satisfied with it.

1 2 3 4 5 6 7 N/A

b. I expressed my unpleasant feeling to the organizations that provide ITS with the believe that it will not occur again.

1 2 3 4 5 6 7 N/A

c. I expected that my complaints are resolved if I address to the organizations that provide online public service.

1 2 3 4 5 6 7 N/A

25. (Resolution) Please rate your overall opinions about experiences regarding your complaints from using ITS and reactions. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

(Distributive Justice)

a. I think that getting feedback from the organizations that provide ITS on my complaints was convenient.

1 2 3 4 5 6 7 N/A

b. I think that the complaints were fairly treated by the organizations that provide ITS.

1 2 3 4 5 6 7 N/A

c. Overall, distributive services for my complaints offered by the organizations that provide ITS meet my expectations.

1 2 3 4 5 6 7 N/A

(Procedural Justice)

a. It was not so difficult to find the way to how to complain to get resolved.

1 2 3 4 5 6 7 N/A

b. My complaints were well resolved with plausible procedure.

1 2 3 4 5 6 7 N/A

c. Follow-up services to resolve complaints were well-proceeded.

1 2 3 4 5 6 7 N/A

d. I think that the overall procedure to receive feedback on my complaints from the organizations that provide ITS was efficient.

1 2 3 4 5 6 7 N/A

e. Overall, I think the resolution process offered by the organizations that provide ITS meets my expectation.

1 2 3 4 5 6 7 N/A

(Interactive Justice)

a. My complaints were timely resolved due to 24 hours/7 days.

1 2 3 4 5 6 7 N/A

b. I think that I received response about my complaints from the organizations that provide ITS with satisfactory response manner.

1 2 3 4 5 6 7 N/A

c. I think that information and explanation about my complaints were enough from the organizations that provide ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. The way I receive answers/responses from the organizations that provide ITS significantly affect to my decision making to use ITS.

1 2 3 4 5 6 7 N/A

e. Overall, I think that interaction with the organizations that provide ITS while my complaints are resolved, meets my expectation.

1 2 3 4 5 6 7 N/A

26. (Public Confidence) Please rate your overall opinions about experiences regarding your confidence from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. Using ITS increase confidence among the users.

1 2 3 4 5 6 7 N/A

b. By offering ITS, users' confidence level has been increased.

1 2 3 4 5 6 7 N/A

c. Development of ITS help enhance trust among users.

1 2 3 4 5 6 7 N/A

d. Overall, use of ITS will help increase trust among the users.

1 2 3 4 5 6 7 N/A

If the Answer of Question #16 is (1), please go to Q# 38

27. Do you use Intelligent Transportation System (ITS) (transportation systems that use IT applications such as internet and mobile applications) for mass transit?

_____ Yes _____ No (If not, Go to Q# 38)

Mass transit (real-time, accurate transit service information on-board the vehicle, at transit stationsand bus stops and use of smartphone to receive important information such as expected arrival times of vehicles, transfers,and connections to travelers):

28. Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think thatITS is more easily accessible compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that use of ITS meets my expectations compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that use of ITS is the better method to facilitate commuting compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS are easy to get information compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that procedure to use ITS isnot complicated and very clear compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. Overall, I think that procedure to use ITS meets my expectation.

1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I prefer not to use conventional transportation system due to availability of information in ITSvia online.

1 2 3 4 5 6 7 N/A

b. I think that information and explanation provided in the use of ITS are enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that the overall interaction in the use of ITS meets my expectation compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

29. (Satisfaction) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I am satisfied with the services offered by ITS due to convenient procedure.

1 2 3 4 5 6 7 N/A

b. I am pleased with ITS as I could have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am satisfied with ITS as I have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am satisfied with use of ITS as I am fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am satisfied with the use of ITS as my complaints will be resolved by the service staff.

1 2 3 4 5 6 7 N/A

f. I think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am satisfied with the use of ITS as it meets my expectation.

1 2 3 4 5 6 7 N/A

Please go to Q# 37

Section B:

30. Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

I. (Distributive Justice)

a. I think that it is inconvenient to use ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think thatITS isless easily accessible compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that uses of ITS arenot fair compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

II. (Procedural Justice)

a.I think that the services offered by ITS arenot easy to get information compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that uses of ITS do not reduce any inconvenient process compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. Overall, I think that procedure to use ITS does not meet my expectation.

1 2 3 4 5 6 7 N/A

III. (Interactive Justice)

a. I think that use of ITS is less efficient compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

b. I think that interaction in the use of ITS is not satisfactory even after adopting advanced information technology compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I think that information and explanation provided in the use of ITS are not enough compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

31. (Dissatisfaction) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I am dissatisfied with the services offered by ITS due to inconvenient procedure.

1 2 3 4 5 6 7 N/A

b. I am not pleased with ITS as I could not have comfort feeling that I used to have from using conventional transportation system.

1 2 3 4 5 6 7 N/A

c. I am dissatisfied with ITS as I do not have the services exactly I want.

1 2 3 4 5 6 7 N/A

d. I am not so satisfied with use of ITS aa I am not fully accustomed to it.

1 2 3 4 5 6 7 N/A

e. I am not satisfied with the use of ITS as my complaints will not be resolved due to lack of presence of service staff.

1 2 3 4 5 6 7 N/A

f. I do not think that I receive my required information in using ITS on time and in pleasant manner.

1 2 3 4 5 6 7 N/A

g. Overall, I am dissatisfied with the use of ITS as it does not meet my expectation.

1 2 3 4 5 6 7 N/A

32. Have you ever filed complaints against ITS? ( ) Yes ( ) No (If yes, go to Q# 35)

33. How strong did you have intention to complaint against ITS?

Very unlikely 1 2 3 4 5 6 7 N/A Highly likely

34. (Willingness to complain) Please rate your overall opinions about experiences from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I often felt like complaining against ITS.

1 2 3 4 5 6 7 N/A

b. I was about to complain due to dissatisfaction in using ITS.

1 2 3 4 5 6 7 N/A

c. I regret that I did not complain actually even though I was not satisfied with the use of ITS.

1 2 3 4 5 6 7 N/A

d. I am unwilling to complain against ITS as I do not have strong motivation to do so.

1 2 3 4 5 6 7 N/A

e. I am hesitant to complain against ITS as I do not want to spend money and time.

1 2 3 4 5 6 7 N/A

f. I am reluctant to complain against ITS as I do not want to encounter uncomfortable situation.

1 2 3 4 5 6 7 N/A

g. I am hesitant to complain against ITS since I am not aware of the procedure to complain.

1 2 3 4 5 6 7 N/A

Please go to Q# 37

35. (Complaining Behavior) Please rate your overall opinions about experiences regarding your complaints from using ITS.<u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. I actually complained to the organizations that provide ITS as I am not satisfied with it.

1 2 3 4 5 6 7 N/A

b. I expressed my unpleasant feeling to the organizations that provide ITS with the believe that it will not occur again.

1 2 3 4 5 6 7 N/A

c. I expected that my complaints are resolved if I address to the organizations that provide online public service.

1 2 3 4 5 6 7 N/A

36. (Resolution) Please rate your overall opinions about experiences regarding your complaints from using ITS and reactions. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

(Distributive Justice)

a. I think that getting feedback from the organizations that provide ITS on my complaints was convenient.

1 2 3 4 5 6 7 N/A

b. I think that the complaints were fairly treated by the organizations that provide ITS.

1 2 3 4 5 6 7 N/A

c. Overall, distributive services for my complaints offered by the organizations that provide ITS meet my expectations.

1 2 3 4 5 6 7 N/A

(Procedural Justice)

a. It was not so difficult to find the way to how to complain to get resolved.

1 2 3 4 5 6 7 N/A

b. My complaints were well resolved with plausible procedure.

1 2 3 4 5 6 7 N/A

c. Follow-up services to resolve complaints were well-proceeded.

1 2 3 4 5 6 7 N/A

d. I think that the overall procedure to receive feedback on my complaints from the organizations that provide ITS was efficient.

1 2 3 4 5 6 7 N/A

e. Overall, I think the resolution process offered by the organizations that provide ITS meets my expectation.

1 2 3 4 5 6 7 N/A

(Interactive Justice)

a. My complaints were timely resolved due to 24 hours/7 days.

1 2 3 4 5 6 7 N/A

b. I think that I received response about my complaints from the organizations that provide ITS with satisfactory response manner.

1 2 3 4 5 6 7 N/A

c. I think that information and explanation about my complaints were enough from the organizations that provide ITS compared to conventional transportation system.

1 2 3 4 5 6 7 N/A

d. The way I receive answers/responses from the organizations that provide ITS significantly affect to my decision making to use ITS.

1 2 3 4 5 6 7 N/A

e. Overall, I think that interaction with the organizations that provide ITS while my complaints are resolved, meets my expectation.

1 2 3 4 5 6 7 N/A

37. (Public Confidence) Please rate your overall opinions about experiences regarding your confidence from using ITS. <u>(You may choose N/A if it is not applicable).</u>

Strongly Disagree Strongly Agree

a. Using ITS increase confidence among the users.

1 2 3 4 5 6 7 N/A

b. By offering ITS, users' confidence level has been increased.

1 2 3 4 5 6 7 N/A

c. Development of ITS help enhance trust among users.

1 2 3 4 5 6 7 N/A

d. Overall, use of ITS will help increase trust among the users.

1 2 3 4 5 6 7 N/A

Part 5: Demographic questions

38. How old are you?

( ) Below 18 ( ) 18 – 25 ( ) 26 – 35 ( ) 36 – 45 ( ) 46 – 55

( ) 56 – 65 ( ) 65 +

39. What is your gender? _____ Male _____ Female

40. What is your education level?

( ) High school or below

( ) Associate degree (completed 2 years of college)

( ) Bachelor degree (completed 4 years of college)

( ) Master degree or higher

41. What is your marital status? _____ Married _____ Single

42. What is your annual income (optional)?

( ) $ 10,000 or less
( ) $ 10,001 - $ 20,000
( ) $ 20,001 - $ 30,000
( ) $ 30,001 - $ 40,000
( ) $ 40,001 - $ 50,000
( ) $ 50,001 - $ 60,000
( ) $ 60,001 - $ 70,000
( ) $ 70,001 or more

43. What is your nationality? _____

44. What is your occupation (optional)?

( ) Student
( ) Own a personal business
( ) Businessman
( ) Public Servant
( ) Housewife
( ) Other (please specify)_____

Part III

Implementation Strategies of ITS in Developing Countries

Abstract

From the experience of developed countries, ITS seems to have immense potential to better manage urban traffic in developing countries as well. But only few small scale ITS projects had been introduced in some countries in the developing world for toll collection, parking information, and web based traveler information. Apart from these application which had been deployed, there are more ITS concepts which will be useful for the scenario prevailing in the countries of the developing world like emergency management, congestion management, advanced traffic management systems, advanced traveler information system, commercial vehicle operations, and advanced vehicle control systems. The purpose of this study is to investigate the strategies and steps to introduce ITS in the context of developing countries.

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I. Introduction

1.1 Problems of Introducing ITS

The economy of the countries in the developing world as compared to those in the developed world is rapidly increasing, thereby increasing the use of automobiles on urban roads. Only few small scale ITS projects had been introduced in some countries in the developing world for toll collection, parking information, and web based traveler information (Wang, Liao,& Hua, 2013). Apart from these application which had been deployed, there are more ITS concepts which will be useful for the scenario prevailing in the countries of the developing world like emergency management, congestion management, advanced traffic management systems, advanced traveler information system, commercial vehicle operations, and advanced vehicle control systems (Eriksson et al., 2008).

The existing applications show an initial potential for the deployment of ITS, but there are also some challenges in the deployment of ITS in developing countries (Roy et al., 2011). ITS implementation cannot be carried out by reproducing what is already been done in the developed countries because of the range of cultural, lifestyle and physical differences among them (Angin, Bhargava, & Helal, 2010). In developing countries, the diverse range of vehicular velocities such as pedestrian, bicycle, Light Motor Vehicles, Heavy Motor Vehicles, animal drawn carts, wide variety of vehicles including pedestrian traffic and poor lane discipline, partially resulting from the first two factors and partially due to cultural reasons, and very high population density makes adoption of Western ITS standards and architecture difficult (Thiagarajan et al., 2009).

Some of the actions needed to be taken to meet the challenges of ITS in developing countries include the settings up the fully functional Traffic Management Centre, developing national ITS data archive, developing models and algorithms for ITS, evolving national ITS

standard for different ITS applications and organize interaction between academia, industries and governmental agencies to generate more interest (Hunter et al., 2011) which can be achieved through the improvement of technology, infrastructure and government initiatives.

1.1.1 Inadequacy of Infrastructure

In the immediate post-WWII decades, increasing the size and number of roads including flyovers and tunnels was a commonly-used approach for addressing congestion and other urban travel issues(Deqi, Xiumin, & Zhe, 2012). In more recent years an understanding has emerged that increasing capacity can lead to greater demand as a result of induced travel(He& Zhang,2009). Induced travel is due to diversion of travel from other lower volume hours of the day to more peak hour use of improved facilities, parallel commuting routes and public transportation(Logi& Ritchie,2001) and the consequence is that congestion levels are soon restored to almost pre-expansion levels and little travel time savings are realized.

Road investments also have adverse long-term effects on traffic congestion. They spawn new trips due to the land-use development and sprawl, which improved car access induces(Kumar, Singh, & Reddy,1999) and moreover, road construction itself is disruptive for densely-built urban areas. In many cases, the demolition of buildings and open space is necessary(Peng, 1997).While induced demand claims have elicited strong reactions and polarized political factions, studies have confirmed the induced travel demand(Singh, & Gupta, 2013). While the travel demand elasticity and the circumstances in which induced travel occurs remain a matter of debate, it is obvious that road improvements prompt traffic increases and provide little congestion relief(Wang, Xiao, & Gu,2008). Since this is the case in developed cities with saturated or nearly saturated car ownership markets, it follows that

the findings would certainly apply to developing cities, in which incomes and car ownership are still growing(Zhian, & Han, 2010).

The prospect of induced travel lends acceptance to a transportation policy based on alternative modes. Policy makers in Europe have been sensitive to claims of induced demand and have taken steps to abandon the traditional forecast and provide policy of trying to accommodate traffic growth(Singh,Gupta, & Suman,2014). In North America, funding incentives and political inertia have made major change difficult(Molina,2005). In developing countries, where new road construction is often seen as a yardstick of modernization, governments have often allocated public expenditures in favor of new road construction at the expense of other urban transport investments and the maintenance of existing infrastructure(Ganeshkumar& Ramesh,2010).

In terms of road investment, evidence to date suggests that developing cities need to focus their resources on existing road maintenance rather than new road construction. Estimates suggest that $45 billion worth of road infrastructure in urban, interurban, and rural areas was lost in 85 developing countries in Asia, Africa, and Latin America between 1970 and 1990 due to inadequate maintenance which could have been averted with preventive maintenance costing less than $12 billion(Faghri& Hamad,2002). There are multiple reasons why the problem is widespread that include economic adversity and mistaken investment choices as well as institutional failures(Hasnat, Haque, & Khan, 2006). Without corrective action, poor roads as well as inadequate road-based public and private transport can become a challenging obstacle to the economic recovery and growth of developing cities(Hatem& Habib,2009). Current evidence suggests that, in developing cities, maintenance expenditures have a positive effect on economic output whereas the construction of new highly-visible road infrastructure is less beneficial for economic development(Kejun,Yong,& Xiangwu,2008).

II. Potentials of Introducing ITS

2.1 Focus on Different Modes

Increased investments in all types of public transport promise to help boost the urban economy of developing countries. In the post-WWII era, the Japanese government played a key role in urban transport by adopting public policies that discouraged automobile use and channeled investment into public transport(Feizhou,Xuejun,& Dongkai,2008). This urban transportation system contributed to rapid economic growth by minimizing aggregate transportation costs, constraining the consumption of private automobiles, and encouraging savings, although with a decided lack of attention to passenger comfort(Campbell,Carney,& Kantowitz,2003).It is debatable whether rail-based or road-based public transport should be emphasized in developing cities. Mobility patterns are influenced by both population size and population density(Balaji & Srinivasan, 2011). Urban sprawl has a significant effect on travel distances and hinders public transport supply and in urban areas with a small but dispersed population, the provision of either rail or road-based public transport might not be economically viable(Hernandez,Ossowski,& Garcya-Serrano, 2002).

2.1.1 Focus on Rail-based Transport

In particular, rail should have a definite advantage over road-based systems to justify implementation in smaller and dispersed cities, since new rail systems are very expensive to construct and operate and a full cost-benefit analysis of both options should guide decision-making(Thapar,1999).

Light Rail Transit (LRT)ranges from the historical tramways, trolleys, and streetcars of Eastern Europe, which run along other traffic in urban streets, to the sophisticated elevated and completely segregated systems of Singapore(Molina,2005). LRT vehicles can be developed on urban streets and run alongside urban traffic because they are fed electricity

from overhead wires(Mulay et al., 2013). This is an advantage over metro systems, which require fully segregated rights of way because they have an electrified third rail that increases speeds but is fatal on contact(Ossowski et al., 2005). LRT is expanding rapidly in developed cities with low corridor volumes, sometimes feeding heavy rail systems but in developing countries, LRTs exist only in larger cities (Kumar,Jain,& Singh, 2002). The cost of building and operating LRT varies widely but it is considerably higher than the cost of alternative public transport forms, such as busways(Ramachandran & Devi,2011).

If LRT operates at grade without priority or protection from obstruction by other traffic, it has little or no performance advantage over busways(Shumin, Zhaosheng, & Maolei,2010), but in the past, LRT advantages over busways were the lower local air pollution impact and possibly smother rides for urban travelers. Older LRT vehicles generally had higher carrying capacity than most buses(Singh,& Kumar,2011). Electric buses have minimized the differences between bus and rail in terms emissions, capacity, and comfort, however, LRT is generally more appealing to middle class passengers, and investment in this mode is seen as a signal of a more permanent commitment to public transport on a government's part(Wu et al., 2003). A preference only arises when one mode offers a higher quality service such as fewer transfers and higher frequency(Zhenlin, Peng, & Shulin, 2012).

In view of the evidence, investments in new LRT systems in developing cities may have limited economic and practical value. Due their high costs, developing cities often can only construct such systems over a few kilometers in a few limited corridors, which do not meet the broader transport needs of the population(Zhang, Liaoa,Arentzea,& Timmermansaa, 2011). Nevertheless, the public sector may end up with a long-term debt that can affect investment in more pressing policy areas(Ramesh, Ezhilarasu, Ravichandran, & Prathibha,2012). In many developing cities, power shortages are common which means that a public transport system which relies on grid electricity may not always be a feasible or

desirable option (King, 1999). At the same time, full reliance on fossil fuels for public transport is also controversial, especially in countries which lack oil resources(Purushothaman, Arunachalam, Srinivasan,& Suresh,2011).

Metro systems are usually the most expensive form of public transport in terms of construction and operation, but, as fully segregated systems, have the best performance. Since most metros are designed for capacities around 30,000 to 40,000 passengers per hour in the peak direction, usually, only cities with a population of 2–3 million have at least one corridor, which requires this type of facility(Balaji & Srinivasan, 2011). In the developing world, only some of the larger cities, such as Beijing, Mexico City, Bombay, and Cairo have metro or suburban rail systems (Mousavi &Nikdel, 2014).As with LRT, the capital costs of building metro systems can vary substantially between cities, between metro systems, and between metro lines within the same city and system(Mouskos &Greenfeld, 1999). However, they are taxing even for developed nations, $50–$150 million per kilometer, with cost over-runs being the rule rather than the exception (Jain & Kumar, 1998). The reasons for high cost variations include differences between projects in terms of the ratio of underground to above-ground construction, ground conditions, station spacing, type of rolling stock, environmental and safety constraints, and labor costs (Li & Kurt, 2000).

Underground metro systems cannot be easily integrated into existing urban physical structures, without disrupting building foundations and utility lines (King, 1999). In addition to high capital costs, metro systems have high operating costs and usually require operating subsidies (Ortiz, Amin, &Wootton,1995), otherwise the price of the tickets would be prohibitive even in developed cities. While in principle public transport operations do not need to be profitable, given the valuable service that they provide to society, the high capital and operation cost of metros makes them less economically viable in developing cities (Adler & Blue,1998).

With capacities comparable to small or medium-sized tramways on rail tracks and with moderate costs, ropeways have evolved to become a reasonable and attractive proposition for mainstream urban public transport in a number of citiesin the developing countries (Bernhard,2000), including Algiers and Oran in Algeria, Medellin in Colombia, and Caracas in Venezuela. They can provide suitable urban transport in hilly terrains, and over rivers, harbors, motorways, as well as over dense housing and historic buildings, and can complement other public transport options (Wu, Miller, & Hung, 2001).

2.1.2 Focus on Road-based Transport

Effective road-based public transport is central to economic growth of developing cities. For the majority of residents, road-based public transport such as bus and paratransit is the only means to access employment, education, and public services (Coifman & Cassidy, 2002). In medium and large developing cities, such destinations are beyond viable walking and cycling distances while vast numbers of individuals have limited access to automobiles (Jain, Sharma,&Subramanian, 2011).

Unfortunately, the current state of road-based public transport services in many developing cities does not serve the mobility needs of the population adequately (Yoon, Noble,&Liu, 2007). Formal bus services are often unreliable, inconvenient, uncomfortable, or even dangerous. Informal paratransit services, while providing benefits including on-demand mobility for the transit-dependent, jobs for low-skilled workers, and service coverage in areas devoid of formal transit supply, carry major costs, such as increased traffic congestion, air and noise pollution, traffic accidents, and even violence among route cartels (Biagioni, Gerlich, Merrifield,&Eriksson, 2011). In addition to regulating paratransit systems through measures in between the extremes of acceptance and outright prohibition, several options are

available to cities in developing countries that wish to improve the quality of formal bus services (Ratan, Thies & Davis, 2011).

In recent decades, the creation of bus lanes on existing roads by painting of a lane in a different color from the rest of the asphalt has been a common low-cost strategy for improving the quality of bus systems throughout the world (Yin, Han, &Yu, 2007). In some cases, they are shared with high-occupancy vehicles, taxis, and non-motorized vehicles, and even with vehicles near turning points (Tie &Tan, 2013). New technologies allow vehicles in bus lanes to gain priority at intersections, with lights automatically turning red for cars and green for buses whenever the later approach shared intersections (Pasternack & Roth, 2010).

Despite their advantages, unsegregated bus lanes alone, particularly those situated in the curb lane, do little to enhance the effectiveness of public transport (Kusdogan, 2001). Temporary parking by taxis and delivery vehicles, low levels of respect for traffic rules, the unavoidable conflicts with turning vehicles, and limitations in narrow street configurations degrade the usefulness of bus lanes in these contexts (Pattara-attikom & Peachavanish, 2007). Here, a more effective intervention in favor of public transport is the construction of busways that are physically segregated from other traffic by means of barriers, cones, or other well defined physical features (Guha et al.,2010). Located on the curb or in the median of a roadway, they are permanently and exclusively for the use of public transport vehicles-although emergency vehicles are often allowed to use the lane (Gaonkaret al., 2008).

Bus Rapid Transit (BRT) is a recently developed bus-based mass transit which emulates the performance and amenities of rail transit. BRT is often more appropriate for large cities as it can transport up to 45,000 passengers per hour per direction, surpassing the capacity of many rail systems (Ganti et al., 2010). To date, BRT has been developed only in a few large cities including Bogotá, Curitiba,and Guangzhou with very high levels of political

commitment and charismatic political leadership in support of quality public transport (Le et al., 2011). More standard forms of BRT include segregated busways over the majority of the length of the system's trunk or city center corridors and at least two of the full BRT characteristics which serve up to around 13,000 passengers per hour per direction, and may be more suitable for medium-sized cities (Dua,Bulusu,Feng, &Hu, 2009).

Prior experience indicates that the best BRT results are achieved when private sector competition is combined with strong public sector oversight (Dong, Berti-Equille, &Srivastava, 2009). This type of business plan is generally desirable for public transport in developing cities, even those without BRT systems, because in these contexts both fully regulated sectors and completely deregulated sectors have failed (Ratan, Thies,&Davis, 2011). Mainline services can be complemented by existing conventional bus and paratransit systems, which can provide feeder connections and serve remote areas (Jurdak, Corke, Dharman, & Salagnac, 2010). To avoid overreliance on fossil fuels, BRT vehicles can run on natural gas, electricity, or biofuels (Borriello, Thies, Chaudhri, & Foneastra, 2010). Once a developing city has secured the right of way for a BRT system, it can later upgrade to light rail should funding become available andto date, more than 150 cities worldwide, at least 70 in Asia, Africa, and Latin America, have implemented BRT systems (Hoh et al., 2008).

Comparative assessments of BRTs throughout the world have found that most systems have greatly improved their local travel conditions and the quality and performance of public transport, especially in travel time savings and enhanced reliability (Bhoraskar, Vankadhara,Raman, & Kulkarni, 2012). BRT systems have also reduced energy consumption and emissions andthey have generally been well-received by the users leading to massive bus ridership increases (Rana et al.,2010).

BRT can be developed at substantially lower costs than rail transit. BRT systems typically cost between $1 m and $8 m per kilometer depending on the complexity and size of the project, the need for overpasses or underpasses and the need for property acquisition (Thiagarajan et al., 2011). Even in developed cities with higher labor costs, BRT costs less than $10 m per kilometer (Anderson et al., 2009). If property designed, BRT can operate at affordable fares ($1/ride) without subsidies (Lin & Zeng, 1999). Rapid implementation times (1–5 years) and flexibility to adapt to spatially-constrained historical centers and business districts with narrow roadway segments are other attractive features (Dailey, Maclean, Cathey, &Wall, 2001).

Despite the advantages, BRT systems in various developing countries suffer from a range of problems. These include rushed implementation e.g., several components incomplete at the time of commissioning, very tight financial planning as systems usually do not receive operational subsidies, excessive occupancy levels; early deterioration of infrastructure, fare collection systems requiring very tight supervision, and insufficient user education for initial implementation and system changes (Mohan, Padmanabhan, & Ramjee, 2008). While many of these problems are associated with financial restrictions and institutional constraints, they are not intrinsic BRT issues (Sasaki,Ukyo,&Novák, 2013). Nevertheless, these difficulties affect public perception which means that BRT is often regarded as a second-best mode compared to rail, and that politicians frequently offer rail alternatives as part of their electoral proposals (Koukoumidis, Peh, &Martonosi, 2011).

2.2 Effect of Road Tax and Parking Price on Auto Ownership

Even in contexts where drivers are well aware of the adverse impacts of car driving in urban areas, the choice of mode is distorted in favor of road transport, particularly private cars, if drivers are not charged the full costs of motorization (Armelius& Hultkrantz, 2006).

The availability of free or underpriced parking also increases car ownership and use and increases search for parking traffic (Borins, 1988). Keeping fuel prices artificially low through price control, export or quantity restrictions, or political pressure put on oil companies produces another set of adverse effects, particularly in developing countries (Chin, 1996). These include flourishing black markets, smuggling, fuel adulteration, illegal diversion of subsidy funds, large financial losses suffered by fuel suppliers, deteriorating refining and other infrastructure, and acute fuel shortages causing economy-wide damage (Harsman& Quigley, 2010).

The idea of financially penalizing drivers by using coercive pricing mechanisms has long been proposed by transport economists as an effective mechanism to contain car use in urban areas (Daniel& Bekka, 2000). Notwithstanding their theoretical value, all realworld pricing schemes have limitations and there is no guarantee that their benefits will exceed their setup and operating costs (Eliasson, 2009). For example, while fuel taxes are administratively simple and discourage the utilization of vehicles in the short-run, in the long run they alter consumers' purchasing behavior, thereby causing them to switch to more fuel-efficient methods such as smaller vehicles, which ultimately do little to alleviate congestion and can increase safety risk (Ison& Rye. 2005). Even in the short-term, most studies find that fuel taxes lead to welfare loss among lower-income drivers, who lack alternative travel options in a city where the public transport system is weak (Kockelman& Kalmanje, 2005).

Cordon pricing and direct road charges, which outside the developed world have only seen application in Singapore, employ cameras or other electronic devices that observe the license plates of vehicles entering or moving within the cordon, and charge the driver remotely (May, Shepherd, Sumalee, & Koh, 2008). While cordon pricing has positive impacts on peak-congestion delays, air pollution, and accidents in city centers, it often has few effects on the overall amount of commuter traffic (Newbery, 1990).

While megacities with large numbers of private vehicles and severe congestion problems may prefer congestion charges, smaller developing cities might consider fuel taxes (Parry, 2009). Generally, in developing countries and cities with low administrative capacities, instruments with smaller or no monitoring costs e.g., fuel taxes and emission-based vehicle taxes are more effective than those requiring large monitoring or administrative and compliance costs (Parry, Walls, & Harrington, 2007), but no single policy fits all conditions. The policy options can be enacted at the local, regional, or national level, depending on the governance arrangements that are already in place (Mitchell, Namdeo, &Milne, 2005).

The major barriers to charging drivers the full cost of car use are often related to public acceptability and political feasibility (Kottenhoff & Freij, 2009). Even the most sophisticated, equitable, efficient, and sensitive policy designs will create losers and generate opposition (Leape, 2006). This necessitates approaches that can increase public acceptance while maintaining efficiency (Johansson, 1997). For example, earmarking revenues for local public transportation, and possibly for infrastructure for pedestrians and bicyclists and public space improvements, has public support more than placing revenues in general funds (Graham, Glaister, Quddus, & Wadud, 2009). These revenues can then be used to reduce other taxes or could be returned uniformly to adult residents or owners of registered vehicles in a designated area (Daunfelt, Rudholm, & Ra¨mne, 2009). Overall, studies indicate that attitudes toward road pricing improve after programs are implemented once residents experience their benefits (Eliasson, Hultkrantz, Nerhagen, &Smidfelt-Rosqvist, 2009).

Pricing mechanisms also include subsidies for public transport fares e.g., limited to vulnerable groups, tax subsidies or exemptions for the purchase of clean vehicles, and incentives for scrapping old vehicles (Hensher, 2006). They have all been implemented in various developing cities but in a limited way due to their cost (Johansson-Stenman, 2006).

2.3 Private Vehicle Access Restrictions

Several developing countries attempted to restrict private auto in different ways such as restraining all newly registered cars to use solely in off-peak hours, allowing only locally registered motorcycles to circulate, and by limiting the operation of commercial vehicles in terms of days, hours, and localities (Thackeray,Wolverton,&Isaacs, 2012).

Pricing mechanisms are generally considered to be more effective than regulatory approaches because they offer car users more choice, raise revenues, and can be adjusted according to different conditions (Bureau& Glachant, 2008). However, command and control policies have a role to play as well and laws and regulations related to driving include limits on car use based on certain criteria, such as emission levels, noise levels, vehicle weight, fuel consumption, occupancy i.e., bans of single-occupancy vehicles, days of the week, time of the day, area which is usually a city center, and license plate number in pollution-emergency days or permanently, and quotas for distance travelled or number of motorized trips within a given urban area (Beevers&Carslaw. 2005). Other regulatory options include parking restrictions and speed limits (Karlstro¨m&Franklin, 2009).

Several developing cities have experimented with selective car rationing or banning, often reaching for higher achievement than developed cities (Lin&Yu, 2008). These measures are considered politically easier to implement than pricing mechanisms because of the perception that all sections of the population are treated equally (Mayeres&Proost, 2001). Bangkok made efforts to restrict all newly registered cars to use exclusively in non-rush hours and in Guangzhou only locally registered motorcycles are allowed to circulate (Olszewski&Xie, 2005). Many other Chinese cities have limited the operation of commercial vehicles in unprecedentedly detailed ways in terms of days, hours, and localities (Parry& Timilsina, 2010). During the 2008 Olympics, the City of Beijing imposed a temporary

restriction on car owners based on license plate numbers (Rotaris, Danielis,Marcucci, & Massiani, 2010).

In Latin America, larger cities including Mexico City, Santiago, São Paulo, and Bogotá have attempted the same approach for some time (Santos& Rojey, 2004). While there are no reported examples of large scale car restrictions implemented in smaller developing cities, many examples of small scale schemes to facilitate pedestrians in historic or commercial centers can be found, especially in some parts of Latin America and Asia (Steimetz, 2008).

In the past, some vehicle restriction measures have had unintended consequences. In Mexico City, for example, a vehicle restriction backfired when more than one fifth of the households (the higher income ones) purchased additional cars with alternating plates, usually cheaper, older, and more polluting, in order to circumvent the restriction (Van Goeverden, Rietveld, Koelemeijer, &Peeters, 2006). In Santiago, the car ban schedule is changed every few months to prevent this possibility, while in Bogotá, the high price of used cars prevented the problem from arising (Yang & Huang, 1998).

While traffic restrictions have received public support in Latin America, they have faced opposition from the auto industry and vehicle owners (Winslott-Hiselius, Brundell-Freij, Vagland, & Bystro¨m, 2009). To be successful, these types of command and control measures must be reinforced by other complementary transport policies and promotional measures (Verhoef& Small, 2004). Some types of car restrictions, such as speed limits, are not effective without the traffic law enforcement resources to ensure that limits are followed (Small& Parry, 2005).An indirect way to alleviate peak-hour congestion through regulations is to mandate employers to implement telecommuting, flexible work, and staggered work shift programs, so that employees shift their commute at different times of the

day(Prud'homme& Bocarejo, 2005). Reviews that recount the experience of developing cities with work-related policies and their impact on urban travel are still to be assembled (Proost&Van Dender, 2008). In developed countries, the evidence suggests that, without supportive policies, telecommuting is unlikely to be enough to affect employee commuting patterns (Parry& Small, 2009).

2.4 Technological Solutions

The main urban transport-related technological solutions that cities worldwide are currently pursuing, with North American and West European cities leading the way, include alternative-fuel vehicles in ITS. New technologies may help to tackle certain transport-related problems, such as air and noise pollution and oil dependency (Sen, Raman, &Sharma, 2010) andtheir applicability in developing cities is growing gradually.

The sustainability of these types of technological solutions is subject to three caveats. First, transport technology improvements cannot help tackle reduced physical activity due to car dependence (Cheung et al., 2004). Second, in most developing countries, where car ownership is growing, the benefits of technological advances will often be offset by the rapid increase in the amount of car travel (Quinn & Nakibuule, 2010). Third, many new technologies are outside the financial reach of many residents of developing cities (Thiagarajan et al., 2009). Consequently, the pursuit of technology-based measures alone is not cost-effective in these contexts. Nonetheless, technological optimism prevails in both developed and developing countries, which may be seen as an expression of people's reluctance to more fundamental changes in lifestyle (Singh et al., 2012).

A wide range of ITS vehicles can run on alternative fuels including natural gas, electricity, and biofuels. These fuels, which can be produced from any primary energy source, including biomass, wind and solar energy, nuclear energy and decarbonized fossil fuels,

constitute a cleaner alternative to diesel and gasoline (Lin, Kansal, Lymberopoulos, & Zhao, 2010). Biodiesel can be used in any diesel engine without modification while ethanol, gas, hydrogen, and electricity can be used only in specially-produced or modified vehicles(Eriksson et al., 2008).

In some countries, especially in South America, the availability of natural gas resources and existing pipeline and delivery infrastructure are incentives to encourage compressed natural gas and liquefied petroleum gas use for transport (Mathur et al., 2010). Brazil and Argentina combined have more than half of the world's total natural gas vehicles, but several Asian countries, notably India, China, and Pakistan, have also had significant natural gas vehicle growth beginning in the late 1990s (Doucette&McCulloch, 2011). In other countries, the adoption of natural gas for urban transport requires the co-existence of fuel supply, refueling stations, and appropriate vehicles (Balan, Khoa, & Lingxiao, 2011).

Some governments in developing countries specifically mandate the use of natural gas for transport in highly polluted areas such as for buses in Buenos Aires, and more recently for buses in Beijing (Jain, Sharma, & Subramanian, 2011). Other developing country governments offer financial incentives to consumers of natural gas fuels and vehicles and to equipment suppliers of alternative fuel vehicles (Itou&Ukyo, 2005). A pump price of at least 40%–60% below the gasoline price–attributed to government incentives such as favorable taxation, tax breaks for natural gas, or higher taxes on gasoline and diesel fuel–is common in most countries that have had successful natural gas vehicle penetration (Magrini et al., 2011). Experiences in Argentina, Brazil, China, India, and Pakistan indicate that marketing and subsidy programs must be sustained for long periods before diffusion crosses the tipping pointdue to the long life of a vehicle fleet and social and economic penetration barriers (McShane, Roesss, & Prassas, 1998).

Electric buses equipped with fuel-cell, battery, or plug-ins have a low range such as 100 km on a full charge in city traffic conditions, and are therefore attractive for use in small and medium-sized urban areas (Sen, Siriah, & Raman, 2011). However, their widespread adoption in developing countries faces a range of barriers and the capital costs of electric vehicles are significantly higher than the costs of conventional vehicles (Roy et al.,2011). In order to amortize the acquisition costs through energy savings, an electric bus has to be used to travel significant distances, typically more than 20,000 km a year (Kastrinaki, Zervakis, & Kalaitzakis, 2003). While some estimates indicate that in a few decades capital costs could drop significantly, conventional buses will remain cheaper. In terms of fuel costs, accurate predictions are not possible (Thiagarajan, Biagioni, Gerlich, & Eriksson, 2010).

Another significant challenge is the bulkiness and cost of batteries or hydrogen tanks. In the recent past, recharging battery-powered vehicles was very time-consuming but fast-charging stations are now becoming available (Singh et al., 2011). While electric vehicles are non-polluting at the point of use, their overall environmental impact depends on the way in which electricity is generated, stored, and distributed and the problems associated with recycling expired batteries (Cornelius et al., 2008). The availability of lithium in the case of batteries and the availability of platinum in the case of fuel cells constitute barriers as well (Rodriguez&Emadi, 2007).

Overall, the market penetration of electric vehicles in developing cities is far from favorable, at least in the short term. For example, modelling estimates for Colombia predict that, even by 2050, electricity will not have surpassed gasoline in the Colombian passenger vehicle fleet (Amjadi&Williamson, 2010). India aims to have 100,000 electric vehicles on the roads by 2020-a small share considering its population size-while China's modest target is for the annual sales of new energy vehicles such as electric, hybrid, etc. to reach 5% in the short term (Jeanneret,Trigui,Badin,&Harel, 1999.)

Biofuels such as ethanol, biodiesel, and blends could provide a significant reduction in urban greenhouse-gas emissions, particulate matter, and volatile organic chemicals (Mikalsen&Roskilly, 2007). They are attractive to many developing countries where surplus land as well as marginal land can be used for biofuel production (Wang et al., 2007). Brazil, China, and India are world leaders in ethanol production, surpassed only by the USA(Chang&Xu, 2008). Warm-climate countries such as Argentina, Colombia, Indonesia, India, Malaysia, Thailand, and the Philippines which produce large amounts of palm, coconut, soybean, and jatropha oil show promise for the adoption of biodiesel (Ren&Chang, 2011).

Biofuels present various challenges depending on the type of feedstock. For corn-based biofuel, in particular, life-cycle assessment studies have highlighted a low or negative net contribution to emission reductions (Ren&Ma, 2012). Biofuels, especially biodiesel, generate up to 70% higher emissions depending on feedstock (Sharma&Bhatti, 2010). Moreover, the greenhouse-gas savings potential may disappear once the full impacts of fuel production are taken into account such as the release of carbon stored in forests or grasslands during land conversion to crop production, the frequent burning of cleared vegetation for biofuel production, and the fugitive emission of methane from palm-oil production (Ren&Chang, 2011).

Another keyconcern is the close link between biofuels and food consumption. A switch to second-generation biofuels manufactured from non-food feedstock might alleviate these concerns (Chinnaiyan, Jerome,&Karpagam, 2006). However, second-generation biofuels still compete with food supply through land-use and are currently constrained by many technical and economic barriers (Chan, 2007).

In addition to alternative fuels, ITS have the potential to address urban transport problems in a variety of applications but in the industrialized world, ITS have only been

adopted at a moderate pace and, in developing countries, adoption has been even slower(Amrhein &Krein, 2005). In East Asia, Eastern Europe, and Latin America, the most common forms of ITS that have been introduced to date include traffic signal systems, traffic surveillance systems using CCTV, commercial vehicle tracking systems using GPS, electronic ticketing services, electronic toll collection and fare payment systems, bus management systems, and traveler information systems (Anstrom,Zile,&Smith, 2005). Further ITS deployment is needed in these settings to improve road safety conditions and mitigate traffic congestion, especially in large, polluted, and congested cities and in harsh climates with hazardous driving scenarios (Morandi et al.,2012).

Although developing cities are often at a disadvantage in applying ITS relative to developed cities, they also have some advantages. For example, some developing cities can install electronic infrastructure at the same time that physical infrastructure is being constructed, which is far less expensive than retrofitting existing physical infrastructure (Hall& Bain, 2008). Developing cities are also not generally burdened with outdated IT infrastructure that has to be updated and they can take advantage of ITS products and applications, which have already been tested and deployed in developed cities and which are now mature and stable (Daud, Mohamed,&Hannan, 2012).

In theory, they can then advance to an ITS-enabled transportation infrastructure far more rapidly and far less expensively than developed countries. Nevertheless, the viability of ITS in developing countries remains contentious due to a lack of financial resources, basic infrastructure, and institutional capacity and substantial funding is required in order to implement high-level ITS at a large scale (Daberkow, Ehlert, &Kaise, 2013).

The indifferent attitude of many local professionals and a lack of user trust in new technologies have also undermined wide-scale ITS acceptance (Andrijanovits, Hoimoja,

&Vinnikov, 2012). Another concern is that the adoption of high-technology transport solutions in developing cities might eliminate low-skilled jobs, which are desperatelyneeded by the population and in view of these experiences and concerns, ITS needs to be introduced cautiously in smaller developing cities (Delille&François, 2008).

2.5Control of Land Uses

Generally, public transport and non-motorized modes require high densities and mixed uses in order to be practically and financially feasible (Braid, 1996). Compact urban development is also often associated with shorter distances and lower use of motorized transport and therefore, land-use controls have important implications for travel behavior(Calfee & Winston, 1998).

In smaller cities in particular, the manipulation of urban form such as shape, size, density, compactness, intensification, decentralization, land-use type and mix, building layout and type, and green and open spaces can help to overcome city problems (Goodwin, Dargay, &Hanly, 2004). However, there are many complexities in the relationship between transport and land-use (Leape, 2006). The desirable degree of compaction of existing settlements is clearly understood (Liu & MacDonald, 1998). Moreover, a wide range of variation in terms of urban form, density, governance, economy, zoning controls, and enforcement capacity, exists in the developing world and therefore, sustainability choices depend on local characteristics (May, Liu, Shepherd, &Sumalee, 2002).

Developing cities often have higher densities than developed cities, especially in the urban core (Mun, 1994). The densest urban areas in the world are found in developing countries (Miller, Levy, Spicer, &Letina, 1998). This is due to higher urbanization rates, smaller dwellings, a prevalence of high-rise housing, later advent of the automobile and lax regulations that allow land and housing subdivisions (Lindsey, 2006). However, there is

disparity among regions. While Asian cities are often extremely dense, cities in sub-Saharan Africa are some of the world's most spread out, with large squatter settlements (Goodwin, 1992). In contrast to the planned sprawl of developed cities, sprawl here is mostly unplanned and poses a different set of challenges (Brownstone&Small, 2005). Densitiesare high in North African cities but low in Latin American ones (Arnott, de Palma, &Lindsey, 1994). Many cities are dual, with dense inner areas and peripheral sprawl (Cohen, 1987). Climate variations, as well as cultural factors, play a role in the level of acceptable space consumption and proximity (De Corla-Souza, 2004). Evidence to date suggests that there is no single sustainable urban form but uncontrolled low-density sprawl is never the best option (Glazer, 1981).

Some developing cities have strong economies which enable transport investments and land use control, while other are poor and have a laissez-faire approach to development and are dominated by the informal sector (Greenwood & Bennett, 1996). However, in most developing-city contexts, land use intensification often occurs in the absence of land use controls (Mackie, 1996). Strict enforcement to avoid sprawl and high public investment to purchase land or development rights e.g., for the creation of urban green belts, green corridors, or ecological reserve areas appear to be unlikely here given a past history of loose or patchy enforcement (Noland, 2001).

In contrast with de-industrialized European cities, the potential for conversion of derelict urban land such as brownfield sites is limited in many developing cities where industrialization has been minimal (Parry & Bento, 2001). In developing cities which are built in naturally hazardous areas such as floodplains, seismically active zones, foot of volcanoes, etc., densification has implications for disaster mitigation and management (Pickrell & Schimek, 1997). The densification is a very contentious issue in both

overcrowded inner-city shanty towns and low-density suburban squatter settlements with large plot sizes but with maximum lot coverage (Poterba, 1989).

In terms of functional mix, developing cities are generally characterized by high levels of mixed use, as well as vitality and vibrancy (Santos, 2004). This is due to a limited penetration of modernist concepts and loose land use controls rather than specific policies (Santos&Bhakar, 2006). However, in higher income developing cities, shopping centers, strip malls, wholesale supermarkets, and sometimes high-tech industry clusters, have started to appear in the peripheries, causing traffic congestion. Interest in linear city models, often at a very large scale, is high in Southeast Asia and South Africa (Small, 1983). Attempts to manipulate urban form e.g., towards a classic radio-circular form for smaller cities and a polycentric de-concentration form for larger cities have been limited due to the shift from comprehensive planning to piecemeal project-based and strategic planning, which has also occurred in developed cities (Small &Yan, 2001).

Given the great diversity of land use approaches, preferences, and constraints in developing cities, it is difficult to come up with a set of recommendations that can apply to all (Tretvick, 2003). Experience to date suggests that some degree of success can be achieved if a pragmatic rather than idealistic approach is taken (Verhoef, 2002). If an overall dense and compact development cannot be achieved or if densification is not desirable in a given context i.e., already hyper-dense inner city areas, densification and intensification of land uses can be encouraged around transport nodes and along transport corridors such as the transit-oriented development or TOD model at a regional scale in order to increase access for larger portions of the population (Santos, 2005). TOD has been successful in a variety of settings, including some developing cities (May&Milne, 2000). Compaction efforts can be concentrated on the development of new neighborhoods rather than on modifying existing ones, although this approach could lead to urban sprawl and consequently, the degradation of

inner cities (Parry, 2004). Incentive schemes involving land-sharing arrangements, the transfer of development rights, and public-private partnerships, have prospects (Hau, 2005). In some cases, small yet significant interventions, either through planning discourse or symbolic development on the ground, can help change public perceptions of sustainable urban form (Arnott, de Palma, &Lindsey, 1991).

III. Implementing ITS in Developing Countries

3.1 Points to be Considered in Implementing ITS

Following several points (Ministry of Land, Infrastructure, and Transport,& KDI School, Korea, 2013) should be considered to maximize the effect of the ITS after its establishment:

Items	Details
Base Infrastructure	i) Physical conditions of roads (paving and surface marking) ii) Possibility whether base infrastructure such as electricity and communication lines can be installed on the roads
Traffic Infrastructure	i) Whether traffic signs are installed and working properly ii) Whether license number plates are unified
Public Transportation System	i) Whether intra-city buses abide by routes ii) Rate of use of public transportation
Obedience to Traffic Rules and People's Level of Consciousness	i) People's obedience to traffic rules ii) People's level of consciousness about the obedience to traffic rules
Possibility whether to Allocate the Budget for the ITS	i) Total volume of national budget ii) Income levels

Table 1: Points to be Considered to Maximize the Effect of the ITS(Ministry of Land, Infrastructure, and Transport, & KDI School, Korea, 2013)

3.2 Directions for the Establishment of ITS Projects at Each Stage

Following points (Ministry of Land, Infrastructure, and Transport,& KDI School, Korea, 2013) are to be considered during the establishment process of theITS in a countryin different stages:

Stage	Focus	Details
Introductory Stage	Establishment of relevant plans, laws and regulations	i) Establishment of the plans to promote the ITS at each stage on a yearly basis (mid and long term plans) to establish the ITS systemically ii) Formation of the legal grounds for the implementation of the ITS iii) Establishment of standardization plan for the expansion of the ITS and for coordination between systems and establishment of the methods to carry out the standardization iv) Establishment of the system to successfully perform ITS projects
Development Stage	Establishment of each component of the ITS and revise the method to evaluate the component	i) Implementation of the ITS projects and standardization efforts ii) Development of methods to be connected with relevant government organizations and other cities when implanting the ITS projects iii) Development of methods to evaluate and assess the established systems iv) Use the evaluation results of the established ITS as a basis for future planning
Maturity Stage	More sophisticated system and coordination between different systems	i) Further development of the established ITS ii) Seeking system integration with relevant government organizations and other cities iii) Launching new research and development projects

Table 2: Points to be Considered During the Establishment Process of the ITS in Different Stages (Ministry of Land, Infrastructure, and Transport, & KDI School, Korea, 2013)

3.3 Findings from previous studies regarding implementation of ITS

During the implementation of ITS in public transportation, factors affecting procedural justice such as process control, decision control, accessibility, timing, speed, and flexibility and factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be focused on. In regard to satisfaction with complaint handling, factors affecting distributive justice such as equity, equality and need and factors affecting

interactional justice such as explanation, honesty, politeness, effort, and empathy are to be emphasized.

Willingness to complain would reduce public confidence, but if complaint handling can be done satisfying distributive, procedural and interactive justice, public confidence can be restored. Since the results suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction, there is no importance of extra measure to address the special need of any particular age group or gender.

During the implementation of ITS in private transportation, factors affecting factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be focused on. In regard to satisfaction with complaint handling, factors affecting interactional justice such as explanation, honesty, politeness, effort, and empathy are to be emphasized.

Willingness to complain would reduce public confidence, but if complaint handling can be done satisfying distributive, procedural and interactive justice, public confidence can be restored. Since the results suggest that there is no variation among different groups on the basis of demographics regarding the effects of justice dimensions on satisfaction/dissatisfaction, there is no importance of extra measure to address the special need of any particular age group or gender.

IV. Qualitative Research

4.1 Methodology for Qualitative Research

Qualitative research permits the researchers to provide elaborate interpretations of facts without depending much on numerical measurements (Bahin & Griffin, 2009). The prime focus of qualitative research is mainly on discovering the accurate inner meanings and novel insights (Zikmund, Banin, Carr, & Griffin, 2009). The major objectives of

qualitative research are to provide an in-depth and interpreted understanding of the survey participants by learning about the sense they make of their material and social circumstances, their perspectives, histories and experiences (Ormston, Spencer, Barnard, & Snape, 2013). Though the ultimate purpose of in-depth interview is not to test any hypotheses it is nonetheless a powerful instrument to have an insight into the topic under study through understanding the experience of the individuals whose practical experience reflect the topic (Seidman, 2013).

4.2 Findings from In-depth Interviews

Current study conducted in-depth interview to better identify the problems without ITS, potentials of ITS and implementation of ITS. The respondents are experts in the field of ITS working in the public sector in Korea (Korean Expressway) and Bangladesh (Ministry of Communications) that are responsible for implementation of ITS. Therefore, it is expected that their opinions are valuables since these would be based on their work experience in the field of ITS.

The following table summarizes the distinctive items from in-depth interview.

No	Interviewee	Age	Gender	Education	Marital Status	Annual Income ($)	Area of Expertise	Work Experience
1	A	18–25	Male	Bachelor	Unmarried	50000	Analyst	2 Years
2	B	36–45	Female	Master	Married	70000	Finance	9 Years
3	C	26–35	Male	Bachelor	Unmarried	75000	Technology	3 Years
4	D	36–45	Male	Master	Married	70000	Analyst	2 Years
5	E	26–35	Female	Master	Married	65000	Technology	4 Years
6	F	36–45	Female	Bachelor	Married	72000	Analyst	10 Years
7	G	36 – 45	Male	Master	Unmarried	78000	Analyst	12 Years
8	**H**	26–35	Male	Master	Unmarried	55000	Technology	3 Years
9	**I**	36–45	Male	Master	Unmarried	60000	Finance	7 Years
10	**J**	18–25	Male	Bachelor	Unmarried	45000	Technology	2 Years
11	**K**	26–35	Female	Master	Married	65000	Finance	4 Years

Table 3: Summary of the In-Depth Interview

The following table summarizes the answers from in-depth interview.

Topic	**I. Problems without ITS**
Question	**1. What is your opinion about the transportation sector in the developing countries?**
Answer	

A	Rather than piecemeal developments such as increasing road capacity, improving traffic congestion or safety, or improving the transportation environment, long-term development of the overall system is required.
B	There is no coordination among the authorities.
C	The road network is not well designed.
D	There is lack of automation.
E	Road network does not match with travel demand.
F	Road capacity is inadequate compared to demand.
G	Technology is not fully utilized.
H	There is lack of coordination among the authorities.
I	There is lack of automation in the vehicles and among the coordinating bodies.
J	Road network is insufficient compared to travel demand.
K	Use of technology is limited.
Question	**2. What are the current most important problems of urban traffic in the developing countries?**
Answer	
A	Most developing countries encounter issues such as traffic congestion and low shares of expenses regarding transportation. Also the number of traffic accidents is increasing due to rapid urbanization. And the sudden increase of deteriorated vehicles is causing environment contamination as well.
B	Too much congestion prevails.
C	Environmental pollution is very high in the city area.
D	Pollution and congestion are the main issues.
E	Road network does not expand with travel demand.
F	There is a lack of automation.
G	Lack of resource causes inadequate infrastructure.
H	Congestion in every mode of transport causes delay.
I	Air and noise pollution is very high in the urban area.
J	Travel demand always exceeds the existing road network.
K	Road infrastructure is inadequate due to lack of public revenue.
Question	**3. How lack of ITS causing problems in urban traffic in the developing countries?**
Answer	
A	The provision of transportation information (such as detours) is insufficient to improve traffic congestion. Responses toward speeding and management of incident situations are insufficient to improve traffic safety conditions. Also, management of public transportation operation and vitalization of environment-friendly transportation usage to improve traffic conditions are lacking.
B	Travelers do not get the information they require.
C	There is always congestion.
D	Lack of information causes delay in travel.
E	Travel becomes costlier.
F	Travelers cannot choose the most efficient route.
G	Commuters have to pay higher prices.
H	Travelers lack their required travel information.
I	There is always congestion in the road network.
J	Travel becomes more expensive due to congestion.
K	Travelers cannot choose the most efficient route due to lack of travel information.
Question	**4. How does lack of ITS cause dissatisfaction of the commuters in the developing countries?**
Answer	
A	There is dissatisfaction regarding the increase of economic activity costs due to congestion. Also social overhead cost increases and city environment anxiety factors increase because of traffic accidents. In addition, vehicle exhaust worsens city environment pollution resulting in the degrading of quality of life.
B	Congestion causes dissatisfaction among the passengers.
C	Lack of travel information causes dissatisfaction.
D	Delay in travel causes dissatisfaction.
E	More travel cost makes the commuters dissatisfied.
F	Pollution causes dissatisfaction among the commuters.

G	Failure to choose most efficient route causes dissatisfaction.
H	Passengers are dissatisfied due to congestion.
I	Passengers are dissatisfied due to lack of travel information.
J	Higher travel cost makes the commuters dissatisfied.
K	Passengers are dissatisfied due to failure to choose most efficient.
Topic	**II. Potentials of ITS**
Question	**1. How introduction of ITS can be beneficial to the developing countries?**
Answer	
A	ITS can efficiently contribute to improving traffic congestion, traffic safety, and the traffic environment.
B	It would reduce congestion.
C	It would increase road safety.
D	There would be less pollution.
E	It will reduce travel time.
F	It will ensure commuters' satisfaction.
G	It would make commuting more comfortable.
H	It would contribute to reduce congestion.
I	There would be increased road safety.
J	It would reduce pollution.
K	There would be reduction in travel time.
Question	**2. How ITS can solve problems in urban traffic such as congestion, pollution etc. in the developing countries?**
Answer	
A	The traffic information provision and real-time traffic control functions of ITS can improve congestion issues. CCTV can be used to manage incident situations and traffic enforcement cameras can be used to automatically crackdown on drivers in order to induce observation of traffic safety principles and ultimately enhance traffic safety. And to improve the traffic environment, public transportation operation management and public transportation information provision functions of ITS can be used to vitalize the use of environment-friendly transportation.
B	Availability of real-time data would reduce congestion.
C	Use of CCTV would increase road safety.
D	Better traffic management will increase commuters' satisfaction.
E	Road side cameras can help reduce violation of traffic regulations.
F	Availability of travel information will ensure commuters' satisfaction.
G	It would encourage the use of environment-friendly transportation..
H	Real-time data would reduce congestion.
I	Use of technology would increase road safety.
J	Better traffic management will increase travelers' satisfaction.
K	Road side cameras can help reduce violation of traffic regulations.
Question	**3. How ITS can ensure satisfaction of the commuters in the developing countries?**
Answer	
A	From the perspective of traffic congestion improvement, ITS offers provision of traffic information, real-time traffic control, and also public transportation operation management and public transportation information provision functions in order to increase the convenience of public transportation and its usage.
B	Use of advanced technology can help reduce violation of traffic regulations.
C	Use of real-time data would increase road safety.
D	Availability of online information will increase commuters' satisfaction.
E	Availability of CCTV would mitigate congestion.
F	It would promote the use of environment-friendly transportation..
G	Availability of real time data will ensure commuters' satisfaction regarding route choice.
H	Use of technology can reduce violation of traffic rules.
I	Use of technology would increase road safety.
J	Availability of CCTV would help to mitigate congestion.
K	Availability of real time data will enable commuters to choose best route.
Question	**4. How introduction of ITS can contribute towards the economic development of the developing countries?**
Answer	

A	When traffic congestion is improved, economic contributions such as various social benefits (worth about 11.8 trillion won for Korea) and the increase of the average travel speed (15%-20% in Korea) arise. Traffic safety enhancement can bring minimization of loss of lives by alerting hazardous elements in advance and reduction of city adverse effects through second and third accident preventions. In terms of traffic environment improvement, contributions can be made to reducing fuel consumption and greenhouse gas emissions owing to congestion and idling. Also, public transportation service improvement can contribute to increasing the shares of transportation expenses.
B	Reduction in travel time contributes towards economic growth.
C	Reduction in congestion helps economic growth.
D	Reduction in pollution contributes towards better health standard and economic growth.
E	Choice of most efficient route causes faster travel and leads to economic growth.
F	Use of environment-friendly transportation improves health condition and contributes growth.
G	Less congestion improves the well-being and leads to economic growth.
H	Reduction in travel time will help to achieve economic growth.
I	Reduction in congestion helps better health standard.
J	Choosing most efficient route would lead to shorter travel time and lead to economic growth.
K	Environment-friendly mode of transportation improves health condition and contributes growth.
Topic	**III. Implementation of ITS**
Question	**1. What are the major obstacles to introduce ITS in the developing countries?**
Answer	
A	The budget for road infrastructure improvement is insufficient. When allocating the budgets for road capacity increase and ITS, the former is given priority. And there is a lack of acknowledgement and experience regarding the effects of ITS in comparison to its investment. Also, developing countries lack professional manpower in efficient transportation management.
B	Lack of public revenue is the major obstacle.
C	Lack of IT infrastructure is main obstacle.
D	Shortage of personnel having experience is the main challenge.
E	Commuters are not proficient in using IT.
F	Lack of initiatives from the government is the main obstacle.
G	Lack of government fund is the major challenge.
H	Lack of fund is the major obstacle.
I	Lack of IT infrastructure is main obstacle.
J	Shortage of personnel having experience in ITS is the main challenge.
K	Lack of government initiatives is the main obstacle.
Question	**2. How the major obstacles can be overcome to introduce ITS in the developing countries?**
Answer	
A	Appropriate proposals on the economic and social effects of ITS compared to its cost need to be presented. A mid-long term plan with systematic introduction of ITS from the initial stage is needed in order to make efficient investment in the road information and prevent overlapping investments.
B	Sources of public revenue are to be broadened.
C	Extended IT infrastructure is to be established.
D	Personnel should be trained in the ITS sector abroad.
E	Commuters should be trained about IT proficiency.
F	Initiatives from the government should be undertaken.
G	Government should seek fund from the development partners.
H	Sources of fund are to be extended.
I	IT infrastructure is to be enhanced.
J	Personnel should be trained in the ITS sector in developed countries.
K	Government initiatives should be undertaken.
Question	**3. What are the major steps to introduce ITS in the developing countries?**
Answer	
A	Develop an ITS plan and support the required foundation, create an exclusive organization within the developing country, implement an ITS trial project, establish mid-long term financing method, etc.
B	Comprehensive implementation plan is to be undertaken.
C	Ideas from successful cases from abroad are to taken.

D	There should be exchange program with successful foreign countries regarding the personnel.
E	Mass awareness should be created about IT proficiency.
F	Government should undertake collaboration with successful countries.
G	Government should influence potential development partners regarding the fund.
H	Comprehensive implementation plan is to be undertaken.
I	Successful cases from developed countries are to be replicated.
J	Mass awareness should be created about use of IT.
K	Collaboration with successful countries should be undertaken.
Question	**4. How introduction of ITS can be funded in the developing countries?**
Answer	
A	Financing can be requested in terms of loans or investment from the World Bank, Asia Development Bank, or other multilateral development banks. Projects can be implemented with private investment through public private partnerships.
B	PPP should be effective mechanism.
C	Grants and loans from multilateral organizations can be utilized.
D	Internal resources should be mobilized by the government.
E	Assistance from the developed country would be a potential source.
F	Government should attract loan from developed countries.
G	Government should attract private organizations for PPP.
H	Private companies should be attracted for funding and operation.
I	Grants and loans from multilateral organizations can be sought.
J	Assistance from the developed country would be a potential source.
K	Government should attract funding from developed countries.
Question	**5. How policy planners in the developing countries can be motivated to introduce ITS?**
Answer	
A	ITS can be presented as a solution for resolving issues (investment cost and construction period) and limitations that come from increasing the road capacity in order to improve congestion, traffic safety, and transportation environment.
B	Lack of resources to construct new road network can be presented to motivate policy planners.
C	Policy planners can be motivated by the economic slowdown due to congestion.
D	Increasing pollution can be presented to motivate policy planners.
E	Reduction in travel time can be cited to motivate policy makers.
F	Increased satisfaction can be mentioned to motivate policy makers.
G	Higher economic growth can be presented to motivate policy planners.
H	Lack of resources to construct new road network can be presented.
I	Economic slowdown due to congestion can be cited.
J	Adverse effects of pollution can be demonstrated.
K	Increased commuters' satisfaction can be mentioned.
Question	**6. How use of ITS can be promoted among the commuters in the developing countries?**
Answer	
A	Commuters need to realize the actual time and cost that can be saved by receiving optimal traffic information regarding their commute routes. Also VMS, smart phones, and broadcasting should be actively used to promote and provide traffic information.
B	Commuters should be informed about the reduction in travel time using ITS.
C	Commuters should be informed about the selection of best possible route using ITS.
D	Commuters should be informed about the reduction in travel cost using ITS.
E	Commuters should be informed about the availability of travel information using ITS.
F	Commuters should be informed about the reduction in congestion using ITS.
G	Commuters should be informed about the increased satisfaction using ITS.
H	Commuters should be informed about the reduction in travel time using ITS.
I	Commuters should be informed about the selection of best possible route using ITS.
J	Commuters should be informed about the reduction in travel cost using ITS.
K	Commuters should be informed about the availability of travel information using ITS.

Table 4: Summary of theAnswers from In-Depth Interview

Regarding opinion about the transportation sector in the developing countries, majority of the respondents mentioned about lack of long-term plan, lack of coordination, lack of automation and lack of road capacity. A few also mentioned about under-utilized technology as well. Regarding the current most important problems of urban traffic in the developing countries, majority of the respondents indicated congestion, pollution and health hazard. A few also mentioned about lack of public revenue and lack of automation.

Regarding how lack of ITS causing problems in urban traffic in the developing countries, greater part of the respondents indicated absence of automation and lack of availability of travel information. Some also mentioned about increased cost of traveling and failure to choose most efficient route. Concerning how lack of ITS causing dissatisfaction of the commuters in the developing countries, most of the respondents pointed out dissatisfaction due to congestion and delay in commuting. Some also mentioned about higher travel cost and failure to choose most efficient route.

Relating to how introduction of ITS can be beneficial to the developing countries, most of the respondents specified reduction of congestion, pollution and travel cost. Some also mentioned about higher satisfaction of the commuters. Involving how ITS can solve problems in urban traffic such as congestion, pollution etc. in the developing countries, most of the respondents specified real-time traffic control functions of ITS can improve congestion issues. Few also mentioned about use of CCTV to increase road safety.

Regarding how ITS can ensure satisfaction of the commuters in the developing countries, most of the respondents specified use of advanced technology to help reduce violation of traffic regulations. Few also mentioned about availability of online information to increase commuters' satisfaction. Relating to how introduction of ITS can contribute towards the economic development of the developing countries, most of the respondents specified reduction in travel time contributes towards economic growth. Some also

mentioned about choice of most efficient route causes faster travel and leads to economic growth.

Regarding opinion about the major obstacles to introduce ITS in the developing countries, majority of the respondents mentioned about lack of public revenue and lack of IT infrastructure. A few also mentioned about lack of trained personnel as well. Relating to how the major obstacles can be overcome to introduce ITS in the developing countries, most of the respondents specified sources of public revenue are to be broadened and extended IT infrastructure is to be established. Some also mentioned that personnel should be trained in the ITS sector abroad and commuters should be trained about IT proficiency.

Regarding views about the major steps to introduce ITS in the developing countries, majority of the respondents mentioned about comprehensive implementation plan is to be undertaken. A few also mentioned about there should be exchange program with successful foreign countries regarding the personnel and IT infrastructure. Concerning how introduction of ITS can be funded in the developing countries, most of the respondents pointed out grants and loans from multilateral organizations can be utilized. Some also mentioned that PPP should be effective mechanism.

Regarding opinion about how policy planners in the developing countries can be motivated to introduce ITS, most of the respondents mentioned about lack of resources to construct new road network can be presented to motivate policy planners. A few also mentioned about increased satisfaction can be mentioned to motivate policy makers. Relating to how use of ITS can be promoted among the commuters in the developing countries, the majority of the respondents specified commuters should be informed about the reduction in travel time using ITS. Some also mentioned that commuters should be informed about the availability of travel information using ITS.

4.2.1 Problems without ITS

Regarding opinion about the transportation sector in the developing countries, the respondents mentioned about lack of coordination among government agencies, lack of well-designed network, disparities between road capacity and travel demand and lack of utilization of technologies. About most important problems of urban traffic in the developing countries, they mentioned congestion, pollution, traffic accidents and dissatisfaction of the commuters.

Regarding problems in urban traffic in the developing countries due to lack of ITS, they mentioned lack of required travel information, delay in travel, increased cost of travelling and dissatisfaction of the commuters. Regarding dissatisfaction of the commuters in the developing countries caused by lack of ITS, they stated failure to choose most efficient route, higher travel time, and increased cost of travel.

4.2.2 Potentials of ITS

Concerning how introduction of ITS can be beneficial to the developing countries, the survey participants mentioned increased road safety, reduction of congestion and pollution, and increased commuters' satisfaction. About how ITS can solve problems in urban traffic in the developing countries, they indicated reduction in congestion due to availability of real time data, increase in road safety due to use of CCTV, and reduction in violation of traffic regulations due to use of road-side camera.

Regarding how ITS can ensure satisfaction of the commuters in the developing countries, they mentioned promotion of environment-friendly transportation, use of advanced technology to mitigate congestion, and availability of real time data to ensure commuters' satisfaction regarding route choice. About how introduction of ITS can contribute towards the

economic development of the developing countries, they pointed out increased productivity due to wastage of travel time and better health standard due to reduction in pollution.

4.2.3 Implementation of ITS

About the major obstacles to introduce ITS in the developing countries, the respondents mentioned lack of public revenue, unavailability of IT infrastructure, lack of skilled personnel, and lack of government initiatives. Concerning how the major obstacles can be overcome to introduce ITS in the developing countries, they indicated broadening of public revenue sources, establishment of IT infrastructure, training of concerned personnel, and technical assistance from developed countries. Regarding the major steps to introduce ITS in the developing countries, they mentioned formulation of comprehensive plan, creating a special agency, attracting local and overseas fund, getting technical assistance from successful countries, and training key personnel overseas.

Regarding how introduction of ITS can be funded in the developing countries, they indicated PPP within the country and attracting aid and grant from multilateral organizations. About how policy planners in the developing countries can be motivated to introduce ITS, they indicated lack of resources to construct new road network, economic slowdown due to congestion, and increased satisfaction among the commuters can be presented to motivate policy planners. Concerning how use of ITS can be promoted among the commuters in the developing countries, they pointed out that commuters should be informed about the reduction in travel time, the selection of best possible route, the reduction in travel cost, and the increased satisfaction using ITS.

References

Adler, J. L. and Blue, V. J. (1998), "Toward the Design of Intelligent Traveler Information Systems," *Transportation Research C*, 6, 157–172.

Amjadi, Z. and Williamson, S. S. (2010), "Power-Electronics-Based Solutions for Plug-in Hybrid Electric Vehicle Energy Storage and Management Systems,"*IEEE Transactions on Industrial Electronics*, 57(2), 608–616.

Amrhein, M. and Krein, P. T. (2005), "DynamicSimulation for Analysis of Hybrid Electric Vehicle System and Subsystem Interactions Including Power Electronics,"*IEEE Transactions on Vehicular Technology*, 54(3), 825–836.

Anderson, R. E., Poon, A., Lustig, Brunette, W., Borriello, G.and Kolko, B. E. (2009), "Building a Transportation Information System Using only GPS and Basic SMS Infrastructure,"Proceedings of International Conference on Information and Communication Technologies andDevelopment, ICTD 2009, 233-242.

Andrijanovits, A.,Hoimoja, H., and Vinnikov, D. (2012), "ComparativeReview of Long-Term Energy Storage Technologies for Renewable Energy Systems,"*Electronics and Electrical Engineering*, 2(118), 21–26.

Anstrom, J. R.,Zile, B., and Smith, K. (2005), "Simulationand Field-Testing of Hybrid Ultra-Capacitor/Battery Energy Storage Systems for Electric and Hybrid-Electric Transit Vehicles," Proceedingsofappliedpowerelectronicsconferenceand exposition.

Armelius, H. and Hultkrantz, L. (2006), "The Politico-Economic Link between Public Transport and Road Pricing: An Ex-Ante Study of the Stockholm Road Pricing Trial," *Transport Policy*, 13 (2), 162–72.

Arnott, R., de Palma, A., and Lindsey, R. (1991), "Does Providing Information to Drivers Reduce Traffic Congestion?" *Transportation Research A*, 25, 309–318.

Arnott, R., de Palma, A., and Lindsey, R. (1993), "A Structural Model of Peak-Period Congestion: A Traffic Bottleneck with Elastic Demand," *American Economic Review*, 83, 161–179.

Arnott, R., de Palma, A., and Lindsey, R. (1994), "The Welfare Effects of Congestion Tolls with Heterogeneous Commuters," *Journal of Transport Economics and Policy*, 18, 139–161.

Balaji, P. G. and Srinivasan D. (2011), "Type-2 Fuzzy Logic Based Urban Traffic Management,"*Engineering Applications of Artificial Intelligence*,24, 12–22.

Balan, R., Khoa, N., and Lingxiao, J. (2011), "Real-Time Trip Information Service for a Large Taxi Fleet," In MobiSys'11, June 28–July 1, Bethesda, Maryland, USA.

Beevers, S. and Carslaw, D. (2005), "The Impact of Congestion Charging on Vehicle Emissions in London," *Atmospheric Environment*, 39, 1–5.

Bernhard, O. (2000), "Pay Per Mile," *Tolltrans- Traffic Technology InternationalSupplementary*,41–43.

Bhoraskar, R., Vankadhara, N., Raman, B., and Kulkarni, P. (2012), "Wolverine : Traffic and Road Condition Estimation using Smartphone Sensors," Proceedings of the 11th InternationalConference on Mobile and Ubiquitous Multimedia, Article No. 36,,December 04 - 06, Ulm,Germany.

Biagioni, J., Gerlich, T., Merrifield, T., and Eriksson, J. (2011), "Easytracker: Automatic Transit Tracking, Mapping, and Arrival Time Prediction Using Smartphones," In SenSys'11, November 1–4,Seattle, WA, USA.

Borins, S. (1988), "Electronic Road Pricing: An Idea whose Time May Never Come," *Transportation Research Part A*, 22, 37–44.

Borriello, G., Thies, W.,and Chaudhri, R. (2010), “Foneastra: Making Mobile Phones Smarter,” In NSDR ’10, June 15th, San Francisco, CA, USA.

Hoh, B., Gruteser, M., Herring, R., Ban, J., Work, D., Herrera, J.Bayen, A., Annavaram, M., and Q. Jacobson, (2008), “Virtual Trip Lines for Distributed Privacy-Preserving Traffic Monitoring,” Proceedings of the 6th international conference on Mobile systems, applications, and services, June 17 – 20, 15-28, Breckenridge, CO, USA.

Braid, R. M. (1996), “Peak-Load Pricing of a Transportation Route with an Unpriced Substitute,” *Journal of Urban Economics*, 40,179–197.

Brownstone, D. and Small, K. A. (2005), “Valuing Time and Reliability: Assessing the Evidence from Road Demonstrations,” *Transportation Research Part A*, 39, 279–293.

Bureau, B. and Glachant, M. (2008), “Distributional Effects of Road Pricing: Assessment of Nine Scenarios for Paris,” *Transportation Research Part A*, 42 (7), 994–1008.

Calfee, J. and Winston, C. (1998), “The Value of Automobile Travel Time: Implications for Congestion Policy,” *Journal of Public Economics*, 69, 83–102.

Campbell, J. L., Carney, C., and Kantowitz, B. H. (2003), “Human Factors Design Guidelinesfor Advanced Traveler Information Systems (ATIS)and Commercial Vehicle Operation (CVO),”Federal Highway Administration, McLean, VA, FHWA-RD-98-057-2.

Chan, C. C. (2007), “TheState-of-the-Art of Electric, Hybrid And Fuel Cell Vehicles,”Proceedings of the IEEE, 95(4), 704–718.

Chang, S. Q. and Xu, Z. P. (2008), “Conceptual Design of Internal Combustion Linear Generator Integrated Power System,” *Journal of Nanjing University of Science and Technology*, 32 (4), 449–452.

Cheung, S., Coleri, S., Dundar, B., Ganesh, S., Tan, C., andVaraiya, P. (2004), “TrafficMeasurement and Vehicle Classification with a Single Magnetic Sensor,”California Partners forAdvanced Transit and Highways(PATH)Working Paper, UCB-ITS-PWP-2004-7.

Chin, A. (1996), “Containing Air Pollution and Traffic Congestion: Transport Policy and the Environment in Singapore,” *Atmospheric Environment*, 30 (5), 787–801.

Chin, K. (2000), “Sustainable Urban Transportation: Abatement and Control of Traffic Congestion and Vehicular Emissions from Land Transportation in Singapore,” *Environmental Economics and Policy Studies*, 3, 355–380.

Chinnaiyan, V. K.,Jerome, J., and Karpagam, J. (2006), “Designand Implementation of High PowerDC–DC Converter and Speed Control of DCMotor Using TMS320F240DSP,”Proceedings ofIndia International Conference on Power Electronics.

Cohen, Y. (1987), “Commuter Welfare under Peak Period Congestion: Who Gains and Who Loses?” *International Journal of Transport Economics*, 14,239–266.

Coifman, B. and Cassidy, M. (2002), “Vehicle Re-identification and Travel Time Measurement on Congested Freeways,” *TransportationResearch Part A: Policy and Practice*, 36(10), 899–917.

Cornelius, C., Kapadia, A., Kotz, D., Peebles, D., Shin, M., andTriandopoulos, N. (2008), “Anonysense: Privacy-Aware People-Centric Sensing,” In MobiSys’08, Breckenridge, Colorado, USA.

Currie, J. and Walker, R. (2008), “Climate Change, Enhanced Greenhouse Gas Emissions, and Passenger Transport—What Can We Do To Make a Difference?” *Transportation Research Part D*, 13 (2), 95–111.

Daberkow, A.,Ehlert, M., and Kaise, D. (2013), “ElectricCar Operation and Flywheel Energy Storage,”Proceedingsoftheconferenceonfutureautomotivetechnology.

Dailey, D.J., Maclean, S.D., Cathey, F.W., and Wall, Z.R. (2001), “TransitVehicle Arrival Prediction: An Algorithm and a Large Scale Implementation,”*Transportation Research Record*,1771.

Daniel, J. and Bekka, K. (2000), "The Environmental Impact of Highway Congestion Pricing," *Journal of Urban Economics*, 47 (2), 180–215.

Daud, M. Z.,Mohamed, A., and Hannan, M. A. (2012), "AReview of the Integration of Energy StorageSystems (ESS) For Utility Grid Support,"*PrzegladElektrotech(Electrical Review)*, 88 (10), 185–191.

Daunfelt, S., Rudholm, N., and Ra¨mne, U. (2009), "Road Pricing and Retail Revenues: Results from the Stockholm Road Pricing Trial," *Transportation Research Part A*, 43 (3), 306–309.

De Corla-Souza, P. (2004), "Recent U.S. Experience: Pilot Projects. in Road Pricing: Theory and Practice,"Research in Transportation Economics, ed. G Santos, 9, 179–206. San Diego, CA.

Delille, G. and François, B. (2008), "AReview of some Technical and Economic Features of Energy Storage Technologies for Distribution System Integration," *Ecological Engineering and Environment Protection*, 1, 40–49.

Deqi, H., Xiumin, C., and Zhe, M. (2012), "A Simulation Framework for Emergency Responseof Highway Traffic Accident," *Procedia - Engineering*, 29, 1075–1080.

Dong, X. L., Berti-Equille, L., and Srivastava, D. (2009), "Integrating Conflicting Data: The Role of Source Dependence," In VLDB '09, August 24-28, Lyon, France.

Doucette, R. T. and McCulloch, M. D. (2011), "Modelingthe CO2 Emissions from Battery Electric Vehicles given the Power Generation Mixes of Different Countries,"*Energy Policy*, 39(2), 803–811.

Dua, A., Bulusu, N., Feng, W., andHu, W. (2009), "Towards Trustworthy Participatory Sensing," Proceedings of the Usenix Workshop on Hot Topics in Security.

Eliasson, J. (2009), "Cost-Benefit Analysis of the Stockholm Congestion Charging System," *Transportation Research Part A*, 43 (4), 468–480.

Eliasson, J., Hultkrantz, L., Nerhagen, L., and Smidfelt-Rosqvist, L. (2009), "The Stockholm Congestion-Charging Trial 2006: Overview of Effects," *Transportation Research Part A*, 43 (3), 240–250.

Faghri, A. and Hamad, K. (2002), "Applicition of GPS in Traffic Management Systems," *GPSSolutions*, 5(3), 52-60.

Feizhou, Z., Xuejun, C., and Dongkai, Y. (2008), "Intelligent Scheduling of Public TrafficVehicles Based on a Hybrid Genetic Algorithm," *TsinghuaScience and Technology*,13(5), 625631.

Ganeshkumar, B. and Ramesh, D. (2010), "Emergency Response Management and InformationSystem (ERMIS) – A GIS Based Software toResolve the Emergency Recovery Challenges inMadurai City, Tamil Nadu," *International Journal of Geomatics and Geosciences*, 1(1), 1-13.

Ganti, R., Pham, N., Ahmadi, H., Nangia, S., and Abdelzaher, T. (2010), "Green GPS: A Participatory Sensing Fuel-Efficient Maps Application," In MobiSys'10, June 15–18, San Francisco, California, USA.

Gaonkar, S., Li, J., Choudhury, R., Cox, L., and Schmidt, A. (2008), "Micro-Blog: Sharing and Querying Content Through Mobile Phones and Social Participation," In MobiSys'08, June 17–20, Breckenridge, Colorado, USA.

Glazer, A. (1981), "Congestion Tolls and Consumer Welfare," *Public Finance*," 36, 77–83.

Gomez-Ibanez, Jose A. and Meyer, John R. (1993), "Going Private: The International Experience with Transport Privatization," The Brookings Institution, Washington.

Goodwin, P. B., Dargay, J., andHanly, M. (2004), "Elasticities of Road Traffic and Fuel Consumption with Respect to Price and Income: A Review," *Transport Reviews*, 24, 275–292.

Goodwin, P.B. (1992), "A Review of New Demand Elasticities with Special Reference to Short- and Long-Run Effects of Price Changes," *Journal of transport, Economics and Policy*, 26, 155–169.

Graham, D., Glaister, S., Quddus, M., and Wadud, Z. (2009), "Testing for the Distributional Effects of National Road User Charging," *International Journal of Sustainable Transportation*, 3 (1), 18–38.

Greenwood, I. D. and Bennett, C. R. (1996), "The Effects of Traffic Congestion on Fuel Consumption,"*Road & Transport Research Journal*, 5, 18–31.

Guha, S., Plarre, K., Lissner, D., Mitra, S., Krishna, B., Dutta, P., and Kumar, S. (2010), "Autowitness: Locating and Tracking Stolen Property while Tolerating GPS and Radio Outages," The 8th ACM Conference on Embedded Networked Sensor Systems November 3-5, Zürich, Switzerland.

Hall, P. J. and Bain, E. J. (2008), "EnergyStorage Technologies and Electricity Generation," *EnergyPolicy*, 36(12), 4352–4365.

Harsman, B. and Quigley, J. (2010), "Political and Public Acceptability of Congestion Pricing: Ideology and Self-Interest," Paper presented at 49th Annual Meeting of the Western Regional Science Association, Sedona, Arizona, February 21–24.

Hasnat, M. A., Haque, M. M., and Khan M. (2006), "GIS Based Real Time Traveler InformationSystem: An Efficient Approach to Minimize TravelTime Using Available Media,"http://www.bracu.ac.bd/directories/www/?code=56014.

Hatem, B. A. and Habib, H. (2009), "Bus Management System Using RFID in WSN," Proceedings of European and MediterraneanConference on Information Systems (EMCIS),April 12-13, 2009, Abu Dhabi, UAE.

Hau, T. (2005), "Economic Fundamentals of Road Pricing: A Diagrammatic Analysis, Part II Relation of Assumptions," *Transportmetrica*, 1, 119–149.

He, Z. and Zhang, Q. (2009), "Public Transport Dispatch and Decision Support System Based onMulti-Agent," Proceedings of SecondInternational Conference on Intelligent ComputationTechnology and Automation, Zhangjiajie, China.

Hensher, D. (2006), "Integrating Accident and Travel Delay Externalities in an Urban Speed Reduction Context," *Journal of Urban Economics*, 26 (4), 521–34.

Hernandez, J.Z., Ossowski, S., and Garcya-Serrano A. (2002), "Multiagent Architectures forIntelligent Traffic Management Systems,"*Transportation Research Part C*, 10, 473–506.

Ison, S. and Rye, T. (2005), "Implementing Road User Charging: The Lessons Learnt from Hong Kong, Cambridge And Central London," *Transport Reviews*, 25 (4), 451–465.

Itou, Y. and Ukyo, Y. (2005), "Performanceof Linicoo2 Materials for Advanced Lithium-Ion Batteries," *Journal of Power Sources*, 146(1), 39–44.

Jain, S. S. and Kumar, P. (1998), "Application of Intelligent Transportation Systems in India," The International Seminar on Highway Safety Managementand Devices, New Delhi, India.

Jain, V., Sharma, A., and Subramanian, L. (2011), "Road Traffic Congestion in the Developing World,"Proceedings of the 2nd ACM Symposium on Computing for Development, Article No.11.

Jeanneret, B.,Trigui, R.,Badin, F., and Harel, F. (1999), "NewHybrid Concept Simulation Tools, Evaluation on the ToyotaPrius Car,"Proceedingsofthe16thinternational electric vehiclesymposium.

Johansson, O. (1997), "Optimal Road-Pricing: Simultaneous Treatment of Time Losses, Increased Fuel Consumption, and Emissions," Transportation Research Part D, 2, 77–87.

Johansson-Stenman, O. (2006), "Optimal Environmental Road Pricing," *Economics Letters*, 90 (2), 225–229.

Jurdak, R., Corke, P., Dharman, D., and Salagnac, G. (2010), "Adaptive GPS Duty Cycling and Radio Ranging for Energy-Efficient Localization," The 8th ACM Conference on Embedded Networked Sensor Systems, November 3-5, Zürich, Switzerland.

Karlstro¨m, A. and Franklin, J. (2009), "Behavioral Adjustments and Equity Effects of Congestion Pricing: Analysis of Morning Commutes During the Stockholm Trial," *Transportation Research Part A*, 43 (3), 283–296.

Kastrinaki, V., Zervakis, M., and Kalaitzakis, K. (2003), "A Survey of Video Processing Techniques for Traffic Applications," *Imageand Vision Computing*, 21, 359–381.

Kejun, L., Yong, L., and Xiangwu, L. (2008), "Emergency Accident Rescue System in FreewayBased on GIS," Proceedings of InternationalConference on Intelligent Computation Technologyand Automation.

King, J. (1999), "Blowing hot and cold," *ITS International*, 21 (6), 44–47.

Kockelman, K. and Kalmanje, S. (2005), "Credit-Based Congestion Pricing: A Proposed Policy and the Public's Response," *Transportation Research Part A*, 39, 671–690.

Kottenhoff, K. and Brundell, Freij K. (2009), "The Role of Public Transport for Feasibility and Acceptability of Congestion Charging—The Case of Stockholm," *Transportation Research Part A*, 43 (3), 297–305.

Koukoumidis,E., Peh, L., andMartonosi, M. (2011), "Signalguru: LeveragingMobile Phones For Collaborative Traffic Signal Schedule Advisory," In MobiSys '11ACM, New York, NY, USA.

Kumar, P., Jain, S. S., and Singh, P. (2002), "Concept and application of intelligenttransportsystem (ITS)—A case study," *Indian Highways*, 11, 17–38,.

Kumar, P., Singh, V., and Reddy, D. (1999), "Advanced Traveler Information System forHyderabad City," *IEEE Transactions on IntelligentTransportation Systems*, 6(1), 26-37.

Kusdogan, S. (2001), "Evaluationof Battery Energy Storage System for Hybrid and Electric Vehicle,"Proceedingsof InternationalAegean Conferenceon Electrical Machinesand Power Electronics, 79–82.

Lai, F., Griffin, M., & Babin, B. J. (2009), "How Quality, Value, Image, and Satisfaction Create Loyalty at a Chinese Telecom," *Journal of Business Research*, 62(10), 980-986.

Le, H., Pasternack, J., Ahmadi, H., Gupta, M., Sun, Y., Abdelzaher, T. F., Han, J., Roth, D., Szymanski, B. K., and Adali, S. (2011), "Apollo: Towards Fact Finding in Participatory Sensing," InIPSN 2011, Chicago, IL.

Leape, J. (2006), "The London Congestion Charge," *Journal of Economic Perspectives*, 20 (4), 157–176.

Leape, J. (2006), "The London Congestion Charge," *Journal of Economic Perspectives*, 20, 157 176.

Li, Q. and Kurt, C. E. (2000), "GIS-Based Itinerary Planning System for Multimodal and Fixed-Route Transit Network," Proceedings of Mid-Continent TransportationSymposium, Ames, IA, May, 47–51.

Lin, J. and Yu, D. (2008), "Traffic-Related Air Quality Assessment for Open Road Tolling Highway Facility," *Journal of Environmental Management*, 88, 962–969.

Lin, K., Kansal, A., Lymberopoulos, D., and Zhao, F. (2010), "Energy Accuracy Trade-Off for Continuous Mobile Device Location," In MobiSys'10, June 15–18, San Francisco, California, USA.

Eriksson, J., Girod, L., Hull, B., Newton, R., Madden, S., and Balakrishnan, H. (2008), "The Pothole Patrol: Using a Mobile Sensor Network for Road Surface Monitoring," In MobiSys'08, June 17–20, Breckenridge, Colorado, USA.

Lin, W. and Zeng, J. (1999), "Experimental Study of Real-Time Bus Arrival Time Prediction with GPS Data*," Transportation ResearchRecord*, 1666, 101–109.

Lindsey, R. (2006), "Do Economists Reach a Conclusion on Road Pricing? The Intellectual History of an Idea," *Econ Journal Watch*, 3 (2), 292–379.

Liu, L. N. and MacDonald, J. F. (1998), "Efficient Congestion Tolls in the Presence of Unpriced Congestion: A Peak and Off-Peak Simulation Model," *Journal of Urban Economics*, 44, 352–366.

Logi, F. and Ritchie, S. G. (2001), "Development and Evaluation of a Knowledge-Based Systemfor Traffic Congestion Management and Control,"*Transportation Research Part C*, 9, 433–459.

Mackie, P. (1996), "Induced Traffic and Economic Appraisal," Transportation, 23,103–119.

Mackie, P. J., Wardman, M., Fowkes, A. S., Whelan, G., Nellthorp, J., and Bates, J. (2003), "Value of Travel TimeSavings in the UK," Summary Report, Institute of Transportation Studies, University of Leeds, Leeds, UK.

Magrini, I., Manes, G., Manes, A., Barbagli, B.,and Bencini, L. (2011), "AnEnd To End WSNBased System for Real-Time Traffic Monitoring,"In European Conference onWireless SensorNetworksEWSN, February 23-25, Bonn, Germany.

Mathur, S., Jin, T., Kasturirangan, N., Chandrasekaran, J., Xue, W., Gruteser, M., and Trappe, W. (2010), "Parknet: Drive-By Sensing of Road-Side Parking Statistics," In MobiSys'10, June 15 18, San Francisco, California, USA.

May, A. D. and Milne, D. S. (2000), "Effects of Alternative Road Pricing Systems on Network Performance,"*Transportation Research Part A*, 34, 407–436.

May, A. D., Liu, R., Shepherd, S.P., and Sumalee, A. (2002), "The Impact of Cordon Design on the Performance of Road Pricing Schemes," *Transport Policy*, 9,209–220.

May, A., Shepherd, S., Sumalee, A., and Koh, A. (2008), "Design Tools for Road Pricing Cordons," In Roadcongestion pricing in Europe: Implications for theUnited States. ed. H. Richardson and C. Bae,138–155. Cheltenham, UK: Edward Elgar.

Mayeres, I. and Proost, S. (2001), "Marginal Tax Reform, Externalities and Income Distribution," *Journal of Public Economics*, 79, 343–363.

McShane, W., Roesss, R. P., and Prassas, E. (1998), Traffic Engineering, Prentice-Hall, Inc.

Mikalsen, R. andRoskilly, A. P. (2007), "A Review of Free-Piston Engine History and Applications," *Applied Thermal Engineering*, 27 (14), 2339–2352.

Miller, T. R., Levy, D. T., Spicer, R. S., and Letina, D. C. (1998), "Allocating the Costs of Motor Vehicle Crashes between Vehicle Types," *Transportation Research Record*, 1635, 81–87.

Mitchell, G., Namdeo, A., and Milne, D. (2005), "The Air Quality Impact of Cordon and Distance Based Road User Charging: An Empirical Study of Leeds, UK," *Atmospheric Environment*, 39, 6231–6242.

Mohan, P., Padmanabhan, V., and Ramjee, R. (2008), "Nericell: Rich Monitoring of Road and Traffic Conditions using Mobile Smartphones,"In Proceedings of the 6th ACM conference onEmbedded network sensor systems, 323-336, November 05 – 07, Raleigh, NC, USA

Molina, M. (2005), "An Intelligent Assistant for Public Transport Management," Proceedings ofInternational Conference on Intelligent Computing (ICIC2005), Part II, LNCS 3645, 199-208.

Morandi, A.,Trevisani, L.,Negrini, F.,Ribani, P. L., and Fabbri, M. (2012), "Feasibilityof Superconducting Magnetic Energy Storage on Board of Ground Vehicles with Present State-of-the- Art Superconductors,"*IEEE Transactions on Applied Superconductivity*, 22(2), 570-586.

Mousavi, G. S. M. and Nikdel, M. (2014), "VariousBattery Models for Various Simulation Studies and Applications,"*Renewable & Sustainable Energy Reviews*, 32, 477–485.

Mouskos, K. and Greenfeld, J. (1999), "A GIS Based Multi Modal Advanced Traveler

Information System (MATIS)," *Journal of Computer-Aided Civil and Infrastructure Engineering*,14 (4),267-279.
Mulay, S. A., Dhekne, C. S., Bapat, R. M., Budukh, T. U., and Gadgil, S. D. (2013), "IntelligentCity Traffic Management and Public TransportationSystem," *International Journal of ComputerScience Issues*, 10(3), 46-50.
Mun, S. I. (1994), "Traffic Jams and the Congestion Toll," *Transportation Research PartB*, 28, 365–375.
Newbery, D. (1990), "Pricing and Congestion: Economic Principles Relevant to Pricing Roads," *Oxford Review of Economic Policy*, 6 (2), 22–38.
Noland, R. (2001), "Relationships between Highway Capacity and Induced Vehicle Travel," *Transportation Research PartA*, 35, 47–72.
Olszewski, P. and Xie, L. (2005), "Modeling the Effects of Road Pricing on Traffic in Singapore," *Transportation Research Part A*, 39 (7–9), 755–772.
Ormston, R., Spencer, L., Barnard, M.,& Snape, D (2003),*The Foundations ofQualitative Research* in Ritchie, J. Lewis, J. McNaughton-Nicholls, C. & Ormston, R.(eds), Qualitative Research Practice, London, Sage.
Ortiz, G., Amin, S. M. and Wootton, J. R. (1995), "Intelligent transportation systems—Enabling technologies," *Mathematical and Computer Modelling*,22 (7), 11–81.
Ossowski, S., Hernandez, J. Z., Belmonte, M. V., Fernandez, A., Garcıa-Serrano, A., Perez-dela-Cruz, J., Serrano, J. M., and Triguero, F. (2005), "Decision Support for Traffic ManagementBased on Organisational and Communicative Multiagent Abstractions," *TransportationResearch Part C*, 13, 272–298.
Pal, S. and Singh, V. (2011), "GIS Based Transit Information System for Metropolitan Cities inIndia," Proceedings of Geospatial WorldForum, 18 – 21 January 2011, Paper Reference No.:PN-250.
Parry, I. (2009), "Pricing Urban Congestion," *Annual Review of Resource Economics*, 1 (1), 461 484.
Parry, I. and Small, K. (2009), "Should Urban Transit Subsidies Be Reduced?" *American Economic Review*, 99 (3), 700–724.
Parry, I. and Timilsina, G. R. (2010), "How Should Passenger Travel in Mexico City Be Priced?" *Journal of Urban Economics*, 68 (2), 167–182.
Parry, I. W. H. (2004), "Comparing Alternative Policies to Reduce Traffic Accidents," *Journal of Urban Economics*, 56, 346–368.
Parry, I. W. H. and Bento, A. M. (2001), "Revenue recycling and the welfare effects of road pricing," *The Scandinavian Journal of Economics*, 103, 645–671.
Parry, I. W. H. and Small, K. A. (2009), "Should Urban Transit Subsidies Be Reduced?" *American Economic Review*, 99, 700-724.
Parry, I., Walls, M., and Harrington, W. (2007), "Automobile Externalities and Policies," *Journal of Economic Literature*, 45, 374–400.
Pasternack, J. and Roth, D. (2010), "Knowing what to Believe (When You Already Know Something)," In COLINGConference,Beijing, China.
Pattara-attikom, W. and Peachavanish, R. (2007), "Estimating Road Traffic Congestion from Cell Dwell Time Using Neural Network," In 7th International Conference on ITS.
Peng, Z. R. (1997), "A Methodology for Design of a GIS-Based Automatic Transit TravelerInformation System,"*Computers, Environment and Urban Systems*, 21(5), 359-372.
Pickrell, D. and Schimek, P. (1997), "Trends in Personal Motor Vehicle Ownership and Use: Evidence from the Nationwide Personal Transportation Survey," Proceeding of Nationwide Personal Transportation Survey Symposium SearchSolution Policy Discussion Series, 17, 85 127, Washington DC, US Federal Highway Administration.

Poterba, J. M. (1989), "Lifetime Incidence and the Distributional Burden of Excise Taxes," *American Economic Review Paper and Proceeding*, 79, 325–330.

Proost, S. and Van Dender, K. (2008), "Optimal Urban Transport Pricing in the Presence of Congestion, Economies of Density and Costly Public Funds," *Transportation Research Part A*, 42 (9), 1220–30.

Prud'homme, R. and Bocarejo, J. (2005), "The London Congestion Charge: A Tentative Economic Appraisal," *Transport Policy*, 12, 279–287.

Purushothaman, B. M., Arunachalam, S., Srinivasan, R., and Suresh Babu, S. (2011), "Emergency Response Management System for Mysore City,"*International Journal of EarthSciences and Engineering*, 4(1), 48-54.

Quinn, A. and Nakibuule, R. (2010), "Traffic Flow Monitoring in Crowded Cities," In AAAI Spring Symposium on Artificial Intelligencefor Development.

Ramachandran, N. and Devi, G. (2011), "Accident Emergency Response and Routing Software(AERARS) Using Genetic Algorithm,"*International Journal on Computer Science andEngineering (IJCSE)*, 3(7), 2835-2845.

Ramesh, R., Ezhilarasu, Y., Ravichandran, P., and Prathibha, S. (2012), "Regulating BusManagement System Using Cloud Platform," *InternationalJournal of e-Education, e-Business,e-Management and e-Learning*, 2(6), 517-520.

Rana, R., Chou, C., Kanhere, S., Bulusu, N., and Hu, W. (2010), "Earphone: An End-to-End Participatory Urban Noise Mapping System,"Proceedings of the 9th ACM/IEEE InternationalConference on Information Processing in Sensor Networks, New York, NY, USA.

Ratan, A., Thies, W., and Davis, J. (2011), "Paid Crowdsourcing as a Vehicle for Global Development," In CHI Workshop on Crowdsourcing and Human Computation.

Ren, G. Z. and Chang, S. Q. (2011), "A Novel Scheme Design of UC Banks Based on Series Parallel Connections Switch over for Internal Combustion Linear Generator Integrated Power System," *International Journal of Electric and Hybrid Vehicles*, 3 (1), 83–98.

Ren, G. Z. and Chang, S. Q. (2011), "Optimization Design of Bi-Directional DC/DC Power Converter of Internal Combustion Linear Generator Integrated Power System," *Power System Protection and Control*, 39 (6), 105–111.

Ren, G. Z. and Ma, G. Q. (2012), "A Novel Scheme Design of Power Unit for Extended Range Electric Vehicles," *International Journal of Electric and Hybrid Vehicles*, 4 (4), 314–326.

Rodriguez, F. and Emadi, A. (2007), "ANovel Digital Control Technique for Brushless DCMotor Drives,"*IEEE Transactions on Industrial Electronics*, 54(5), 2365–2373.

Rotaris, L., Danielis, R., Marcucci, E., and Massiani, J. (2010), "The Urban Road Pricing Scheme to Curb Pollution in Milan, Italy: Description, Impacts, and Preliminary Cost–Benefit Analysis Assessment," *Transportation Research Part A*, 44 (5), 359–375.

Roy, S., Sen, R., Kulkarni, S., Kulkarni, P., Raman, B., andSingh, L. (2011), "WirelessAcross Road: Rf Based Road Traffic Congestion Detection," Proceeding of5th Annual IEEECommunications Society Conference, WISARD, 246–270.

Santos, G. (2004), "Urban Congestion Charging: A Second-Best Alternative,"*Journal of Transport, Economics and Policy*, 38, 345–369.

Santos, G. (2005), "Urban Congestion Charging: A Comparison between London and Singapore," *Transport Reviews*, 25, 511–534.

Santos, G.and Bhakar, J. (2006), "The Impact of the London Congestion Charging Scheme on the Generalized Cost of Car Commuters to the City of London,"*Transport Policy*, 13, 22–33.

Santos, G. and Rojey, L. (2004), "Distributional Impacts of Road Pricing: The Truth Behind the Myth," *Transportation*, 31 (1), 21–42.

Sasaki, T.,Ukyo, Y., and Novák, P. (2013), "MemoryEffect in a Lithium-Ion Battery,"*Nature Materials*, 12(6), 569–575.

Seidman, Irving (2013), *Interviewing as Qualitative Research: A Guide for Researchersin Education and the Social Sciences*, Fourth Edition, Teachers College Press, New York,NY.

Sen, R., Raman, B., and Sharma, P. (2010), "Horn-ok-please," In MobiSys'10, June 15–18, SanFrancisco, California, USA.

Sen, R., Siriah, P., and Raman, B. (2011), "RoadSound Sense: AcousticSensing Based Road Congestion Monitoring in Developing Regions," Proceeding of 8th Annual IEEE Communications Society Conference,SECON, 125–133.

Sharma, P. and Bhatti, T. S. (2010), "AReview on Electrochemical Double-Layer Capacitors," *Energy Conversion and Management*, 51(12), 2901–2912.

Shumin, S, Zhaosheng, Y., and Maolei, Z. (2010), "A Decision Support System of Urban Traffic Emergency Control Based on Expert System," Proceedings of IEEE Int. Conference on SoftwareEngineering and Service Sciences (ICSESS), 16-18 July 2010, Beijing, 221–225.

Singh, A., Naik, V., Singh, P. Bharadwaj, A.,and Arjunan, P. (2011) "Melos: A Low Cost and Low Energy Generic Sensing Attachment for Mobile Phones," In NSDR'11, June 28, Bethesda, Maryland, USA.

Singh, A., Singh, P., Yadav, K., Naik, V.and Chandra, U. (2012), "Low Energy and Sufficiently Accurate Localization for Non-Smartphones," In MDM, July, 2012.

Singh, B. and Gupta, A. (2013), "Advancements in Intelligent Transportation Systems: AReview," Proceedings of International Conference onAdvanced Trends in Engineering andTechnology (ICATET), Jaipur, 375-383.

Singh, B., Gupta, A. and Suman, S. (2014), "Framework for Development of Advanced TravelerInformation System: A Case Study forChandigarh City," Proceedings of InternationalConference on Transportation Planning and implementation Methodologies forDevelopingCountries 2014 (TPMDC-2014).

Singh, V. and Kumar, P. (2011), "Web-Based Advanced Traveler Information System forDeveloping Countries," *Journal of TransportationEngineering*, 136(9), 836-845.

Small, K. A. (1983), "The Incidence of Congestion Tolls on Urban Highways," *Journal of Urban Economics*, 13, 90–111.

Small, K. A. and Yan, J. (2001), "The Value of "Value Pricing" Roads: Second-Best Pricing and Product Differentiation,"*Journal of Urban Economics*, 49,310–336.

Small, K. and Parry, I. (2005), "Does Britain or the United States Have The Right Gasoline Tax?" *American Economic Review*, 95, 1276–1289.

Steimetz, S. (2008), "Defensive Driving and the External Costs of Accidents and Travel Delays," *Transportation Research Part B*, 42 (9), 703–724.

Thackeray, M. M.,Wolverton, C., and Isaacs, E. D. (2012), "ElectricalEnergy Storage for Transportation —Approaching the Limits of, and Going Beyond, Lithium-Ion Batteries,"*Energy & Environmental Science*, 5(7), 7854–7863.

Thapar, M. S. (1999), "Emergency Response Management System for Hyderabad city,"http://www.gisdevelopment.net/ ?user=vmnkY64AAA.

Thiagarajan, A., Biagioni, J., Gerlich, T., and Eriksson, J. (2010), "CooperativeTransit Tracking using Smart-Phones," In SenSys'10, November 3–5, Zurich, Switzerland.

Thiagarajan, A., Ravindranath, L., Balakrishnan, H., Madden, S., and Girod, L. (2011), "Accurate, Low-Energy Trajectory Mapping for Mobile Devices," In Proceedings of the 8thUSENIX conference on Networked systems design and implementation, 267-280, March 30 -April 01, Boston, MA.

Thiagarajan, A., Ravindranath, L., LaCurts, K., Madden, S., Balakrishnan, H., Toledo, S., andEriksson, J. (2009), "Vtrack: Accurate, Energy-Aware Road Traffic Delay Estimation using Mobile Phones," In SenSys'09, November 4–6, Berkeley, CA, USA.

Tie, S. F. and Tan, C. W. (2013), "AReview of Energy Sources and Energy Management System in Electric Vehicles,"*Renewable & Sustainable Energy Reviews*, 20, 82–102.

Tretvick, T. (2003), "Urban Road Pricing in Norway: Public Acceptability and Travel Behavior," In Acceptabilityof Transport Pricing Strategies, ed. Schade, J.and Schlag, B., 77–92. London, UK: Pergamon.

Van Goeverden, C., Rietveld, P., Koelemeijer, J., and Peetersm P. (2006), "Subsidies in Public Transport," *Trasporti Europei*, 32, 5–25.

Verhoef, E. and Small, K. (2004), "Product Differentiation on Roads: Constrained Congestion Pricing with Heterogeneous Users," *Journal of Transport Economics and Policy*, 38 (1), 127–156.

Verhoef, E. T. (2002), "Second-Best Congestion Charging in General Networks: Heuristic Algorithms of Finding Second-Best Optimal Toll Levels and Toll Point," *Transportation Research Part B*, 36, 707–729.

Wang, G., Xiao, D., and Gu, J. (2008), "Design and Implementation on Software Platform ofEmergency Management System for TrafficIncidents," Proceedings of CCECE/CCGEI, May 57, 2008, Niagara Falls, Canada.

Wang, J., West, M., Howe, D., La Parra H. D., and Arshad, W. M. (2007), "Design and Experimental Verification of a Linear Permanent Magnet Generator for a Free-Piston Energy Converter," *IEEE Transactions on Energy Conversion*, 22 (2), 299–306.

Winslott-Hiselius, L., Brundell-Freij, K. Vagland, Å., and Bystro¨m, C. (2009), "The Development of Public Attitudes towards the Stockholm Congestion Trial," *Transportation Research Part A*, 43 (3), 269–282.

Wu, C. H., Su, D. C., Chang, J., Wei C. C., Ho, J. M., Lin, K. J., and Lee, D.T. (2003), "AnAdvanced Traveler Information System With EmergingNetwork Technologies," Proceedings of6th Asia-Pacific Conference on Intelligent Transportation Systems Forum.

Wu, Y. H., Miller, H. J. and Hung, M. C. (2001), "A GIS Based Decision Support System for Analysis of Route Choice in Congested Urban Road Networks,"*Journal of Geographical Systems*, 3 (1), 3–24.

Yang, H. and Huang, H.J. (1998), "Principle of Marginal-Cost Pricing: How does it Work in a General Road Network?" *Transportation Research Part A*, 32 (1), 45–54.

Yin, X., Han, J., and Yu, P. S. (2007), "Truth Discovery with Multiple Conflicting Information Providers on the Web," In SIGKDD Conference on Knowledge Discovery and Data Mining, August 13 - 17, San Francisco, California.

Yoon, J., Noble, B., and Liu, M. (2007), "Surface Street Traffic Estimation,"In MobiSys'07,ACM, June 11-14, San Juan, Puerto Rico, USA.

Zhang, J., Liaoa, F., Arentzea, T., and Timmermansaa H. (2011), "A Multimodal TransportNetwork Model for Advanced Traveler InformationSystems," *Procedia - Computer Science*, 5,912–919.

Zhenlin, W., Peng, Z., and Shulin, A. (2012), "Efficiency Evaluation of Beijing IntelligentTraffic Management System Based on super-DEA,"*Journal of Transportation Systems, Engineering and Information Technology*, 12(3), 254-287.

Zhian, L. and Han, H. (2010), "A Bus Management System Based on ZigBee and GSM/GPRS," Proceedings of International Conference onComputer Application and System Modeling(ICCASM 2010), Taiyuan, China.

Zikmund, William G., Babin, Barry J., Carr, Jon C., & Griffin, Mitch (2009), *BusinessResearch Methods*, South-Western College Publishers, Nashville, TN.

Appendix A.
In-Depth Interview Questionnaire

Dear Sir/Madam,

I am a Ph.D. student of KDI School of Public Policy and Management. I am working on my dissertation under the supervision of Prof. Cho Yoon C.

I would like to carefully ask you whether you could provide your precious time to give opinions for the following questions. Your answer will be very helpful for the future application of ITS in developing countries.

The purpose of the study is to investigatehow **Intelligent Transportation Systems (ITS)** can improve the management of urban traffic and what are the **implementation strategies** of ITS **in the developing countries**.

The responses to the survey questionnaire are solely to be used for the research purposes. So all the respondents will remain anonymous during and after this research work.The responses to the survey questionnaire are voluntary.

If you have any questions, feel free to reach me at rahman_anisur@yahoo.com or Prof. Cho at ycho@kdischool.ac.kr. I greatly appreciate your participation. Thank you so much.

Please provide your personal viewpoint regarding the issuesof ITS in developing countries.

Main questions

I.Problems without ITS

1. What is your opinion about the transportation sector in the developing countries?

2.What are the current most important problems of urban traffic in the developing countries?

3. How lack of ITS causing problems in urban traffic in the developing countries?

4. How does lack of ITS cause dissatisfaction of the commuters in the developing countries?

II. Potentials of ITS

1. How introduction of ITS can be beneficial to the developing countries?

2. How ITS can solveproblems in urban traffic such as congestion, pollution etc. in the developing countries?

3. How ITS can ensure satisfaction of the commuters in the developing countries?

4. How introduction of ITS can contribute towards the economic development of the developing countries?

III. Implementation of ITS

1. What are the major obstacles to introduce ITS in the developing countries?

2. How the major obstaclescan be overcome to introduce ITS in the developing countries?

3. What are the major steps to introduce ITS in the developing countries?

4. How introduction of ITS can be funded in the developing countries?

5. How policy planners in the developing countries can be motivated to introduce ITS?

6. How use of ITS can be promoted among the commuters in the developing countries?

Demographic questions

1. How old are you?
( ) Below 18 ( ) 18 – 25 ( ) 26 – 35 ( ) 36 – 45 ( ) 46 – 55
( ) 56 – 65 ( ) 65 +

2. What is your gender? _____ Male _____ Female

3. What is your education level?
( ) High school or below
( ) Associate degree (completed 2 years of college)
( ) Bachelor degree (completed 4 years of college)
( ) Master degree or higher

4. What is your marital status? _____ Married _____ Single

5. What is your annual income (optional)?

( ) $ 10,000 or less	( ) $ 10,001 - $ 20,000
( ) $ 20,001 - $ 30,000	( ) $ 30,001 - $ 40,000
( ) $ 40,001 - $ 50,000	( ) $ 50,001 - $ 60,000
( ) $ 60,001 - $ 70,000	( ) $ 70,001 or more

6. What is area of expertise?_____

7. How long is your work experience?_____ years