A User Satisfaction Study of the London Congestion Charging e-Service

Completed Research Paper

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Abstract

This research seeks to measure citizen satisfaction with the electronic London Congestion Charging (LCC) payment system offered by Transport For London (TFL) in the United Kingdom (UK). The paper reports on the findings of a survey of 500 users of the TFL LCC online payment system. Satisfaction is measured using the four dimensions from the COBRA framework 0that comprise the cost, opportunity, benefits and risk assessment constructs. The results show that most citizens using the LCC electronic service are satisfied with the service and that the service meets their essential needs. The paper also presents the results of qualitative feedback obtained from the participants that can be used to determine the areas that need further improvement in the current electronic LCC electronic-service (e-service) system and potential influences on user satisfaction.

Keywords

London congestion charging (LCC), user satisfaction, costs, opportunities, benefits, risks, e-service.

Introduction

User satisfaction with electronic government (e-government) services has a vital influence on their large scale adoption (Osman et al. 2014). It has to be assessed at different points in time and if necessary measures have to be taken to be improved, as citizens expectations are changing permanently (Verdegem and Verleye, 2009). Despite citizen satisfaction being such an essential element in the sustainability and viability of e-government services and also an important aspect to be assessed and taken into account when improving existing services or designing new ones, little research has been performed on understanding it. Transport For London's (TFL) London Congestion Charging (LCC) is one of the innovative electronic services offered by the UK government to the citizens. LCC was introduced with the aim of reducing congestion by having commuters who travel during peak hours pay a fee, otherwise being liable to a penalty charge. In stark contrast to the conventional road charging schemes, the LCC does not involve any toll booths or barriers (Santos and Bhakar, 2006). The method of enforcing the charge is in fact the most innovative part of the scheme. It uses a video-based system which relies on accurate reading of license plates as a means of identifying, charging and enforcing vehicles (Blythe, 2005). There are several payment methods for the LCC; Auto Pay (automated payment following an initial online registration), Online, SMS, Phone and Post. The online LCC e-service system system allows two options in terms of registering as an individual or as an organization (TFL, 2014). As an individual, one can register up to a maximum of 10 vehicles, also allowing discounted charges if using the Auto Pay option for up to 5 vehicles. Once registered, users can pay via the automated telephone service, or SMS as well as being able to manage their payments and vehicles online. Organisations with 6 vehicles or more can also register with special functions to this account such that multiple users can manage a vehicle fleet to allow easier administration.

Although some studies have addressed the implications of the introduction of the congestion charge (Givoni, 2012; Janson, 2008; Santos and Bhakar, 2006), there has been a lack of research performed to

address user satisfaction of the online LCC e-service system managed by the TFL. In this research, the authors' seek to address this gap by adding to the state of the art by focusing on evaluating the user satisfaction of the LCC e-service system and then presenting the results of a study assessing the user satisfaction of the system, across four dimensions: cost, benefit, opportunities and risk. These constructs are drawn from the research performed in the Integrated Model for Evaluating E-government Services Transformation (I-MEET) and are hypothesised to be the main constructs for evaluating the citizen and providers' perspective of e-government services (Osman et al., 2011). In this study the authors seek to analyse citizens' satisfaction by assessing the aforementioned constructs with the users of LCC e-service. Moreover this research is assessing whether the service meets the citizens' needs and how it can be improved.

The rest of this paper is organised as follows. First, the paper presents the research context of London congestion charging schemes in UK focusing on the citizen's satisfaction of the existing e-service system provided online. This is followed by the research design section that sets out the questionnaire design, distribution and data handling. The subsequent sections provide details regarding the survey participants' demographic information followed by a discussion of the study findings on participant satisfaction with the online LCC service. The paper concludes by presenting the theoretical and practical implications of the study and acknowledging the research limitations and next steps for the study.

London Congestion Charging Scheme in the UK: An Overview

Overview

In February 2003, the former Mayor introduced the London Congestion Charge within the City of London, United Kingdom (Kaparias and Bell, 2012; Blow et al., 2003). The LCC translates as a fee levied on all vehicles entering a specified zone of Central London. This was a significant change introduced as part of the Mayor's Transportation Strategy, the main priorities of which were to: reduce congestion, improve bus service, improve travel time reliability for drivers and increase the efficiency of the distribution of goods and services (TfL, 2014).

The LCC addresses this with the aim to reducing congestion and avoidable traffic particularly during the working week (Berman, 2012). The charging zone is in effect on weekdays between 0700-1800 hours (excluding public holidays) and all vehicles entering and leaving the zone during this time are recorded through cameras using an automatic number plate recognition system. Transport for London, which is the public transport agency, is responsible for the enforcing the charges as well as offering discounts and exemptions to certain types of vehicles and drivers. Currently a charge of £10 is levied if the fee is paid in advance or on the day the driver passes through the charging zone, which then increases to £12 if paid on the next day. If a payment is not made by midnight on the next day, there is a penalty charge of £130 (AA, 2013). Registered disabled drivers and motorcycles are however exempt from these charges.

The revenue collected from the congestion charges is then invested on relevant transport related purposes by the Greater London Authority (GLA), TFL or London Borough Council for a period of 10 years; a condition that was stipulated as part of the legislation that allowed the introduction of congestion charging (Blow et al., 2003). Over the 10 year period between 2003 to 2013, over £1.2 billion has been invested in transport, including £960 million on improving the bus network, £102 million on roads and bridges, £70 million on road safety, £51 million on local transport/borough plans and £36 million on sustainable transport and the environment (Sunderland, 2014)

Proposed Changes to the LCC

Since the introduction of the LCC in 2003, there have been a number of modifications to the scheme. One of the current proposed changes is increasing the daily charge from £10 to £11.50 in June 2014 in line with inflation (TFL, 2014). TFL believes that this increase would also help maintain the financial deterrent effect of the charge in comparison to the costs of the other public transportation options. Some other proposed changes to the LCC include enabling discount applications and renewals to be made online, allowing direct debit payments for the "Auto Pay" option, changes to the National Health Service

(NHS) reimbursement scheme and other minor administrative changes (*ibid).* According to TFL (2014), the proposed changes are believed to have a small positive economic impact through:

- Increase in congestion charges in keeping with inflation and other transport costs would ensure that traffic volumes and congestion do not increase causing delays, which in turn could have a negative impact on economic productivity.
- Maintenance of the congestion charging ensures that all revenue from this continues to be used for transport improvements as required by Schedule 23 to the GLA Act 1999. This is beneficial to all in the form of efficient transport links thus boosting the economy.
- Improvisations to the current LCC system to better meet user requirements e.g. introduction of different methods of payment to suit the needs of different users.

Implications of LCC

The introduction of the LCC is thought to have brought about significant implications in travel behavior. Givoni (2012) published a study that estimated that as a direct result of the congestion charge, 60-70% of previous drivers had switched to an alternative mode of transportation (40% to buses, 50% to trains and 10-20% to walking, cycling, taxi's or motorcycles. It is however important to note that Central London being a dense area with robust public transportation systems and facilities for walking and cycling which while being supported by the congestion charge, have also been key in the congestion charge strategy being successful. Although congestion in Central London decreased significantly in the first two years after the introduction of the LCC, it then stabilized and subsequently returned to the same levels as before (Berman, 2012). However, it has also been argued that if LCC had not been introduced, it is likely that the congestion would have continued to increase by the same proportion as well (Givoni, 2012). An attempted Western extension to the LCC was ineffective in bringing about any reductions in congestion, thus highlighting its ineffectiveness in areas where alternative transport links were not as strong (Berman, 2012).

In London, the revenue from the congestion charge is used towards improvements in other transport options thus strengthening the effectiveness of the scheme (Sunderland, 2014). Since its introduction, a significant proportion of the funds were used towards improving the bus service including increasing the frequency and coverage of buses and introduction of more bus lanes to speed up the service. In addition, speedier payment methods were introduced including the "out of bus" ticket sales as well as being able to use the "Oyster" smart card for payment (Givoni, 2012). All of this has resulted in being able to provide an efficient alternative road transport system to previous car commuters.

In addition to improving transportation, reduced congestion comes with other benefits including reduced air pollution, reduced traffic noise and safety for pedestrians (Kaparias and Bell, 2012). Whilst reducing air pollution was not a motivating factor for the introduction of the LCC, it was indeed a pleasant side effect (Berman, 2012). As fewer cars are sat idling for long periods, it is suggested that there has been an overall decrease in air pollution – which would not have occurred had the congestion charge not been introduced. In general, emissions both inside and outside of the zone have been steadily decreasing but it is difficult to quantify exactly what proportion of this is a direct result of congestion charging.

Overall, the LCC is widely considered a success as an effective way to reduce congestion and encourage use of alternative transport options in a central city (Kaparias ad Bell, 2012; Berman, 2012). This strategy has been replicated in other cities, including Stockholm and Singapore, with London researcher's even encouraging U.S cities to follow suit as it encourages commuters to switch to more sustainable modes of transportation (Booth, 2008).

User Satisfaction Studies of LCC e-Service System

To the best of the authors' knowledge there haven't been any studies that have focused on the user satisfaction of the online LCC e-service system managed by the TFL, so far. However, there are other studies conducted on different aspects of the LCC that include Santos and Bhakar (2006) who looked at the impact of the LCC on commuters from a value of travel time savings perspective. Janson (2008) studied the possibilities of a zero-fare (i.e. free public transport) policy on the basis of the new experiences

of congestion charging in London and Stockholm. More recently, Givoni (2012) conducted a study looking at the degree to which observed effects (e.g. congestion, traffic levels, change in travel behaviour and air pollution) could be attributed to congestion charging, raising questions about the practical effectiveness despite the evident theoretical rationale.

As highlighted in the introduction, despite citizen satisfaction being a key element in the sustainability and viability of e-government services, there has been a lack of research performed on understanding it. Therefore, in this study, the authors seek to add to the existing literature by measuring TFL's LCC e-service system's overall user satisfaction as well as the satisfaction across the four dimensions described in the COBRA framework: cost, risk, benefits and opportunity of the. In addition, it also looks at whether the LCC e-Service system meets the needs of the average user.

Research Design

The study conducted involved three stages to gather empirical data which included research design, data collection and finally data analysis and synthesis. In the first phase, the authors reviewed the normative literature and performed desk research of secondary sources to acquire background knowledge on the research area under investigation (i.e. the user satisfaction with using TFL's online payment system of LCC). This allowed the authors to identify and report the progress and implications of the LCC e-service system and an analysis of the studies conducted on the LCC. In the second phase, as part of the data collection strategy, the authors decided to utilise a quantitative approach based on a survey research as the appropriate methodology (Saunders et al., 2003; Creswell, 2003) to follow to meet the research aim. A questionnaire was used as a survey instrument that included both closed questions (to help investigate user satisfaction across a given analysed dimension) and qualitative questions (to help assess why the participants were satisfied or not and whether the LCC met (or not) the survey responders' needs).

Design and Questionnaire Development

The questionnaire used for this study was designed based on the COBRA framework (Osman et al., 2011). The COBRA framework provides a holistic evaluation for stakeholders by considering "the most successful factors that impact the satisfaction of users within an e-government service" as opposed to other evaluation models that aim to assess e-government services from a general perspective (Osman et al., 2011). The framework compromises of four main constructs (i.e. cost, opportunity, benefit and risk) and the factors affecting e-services are organised around these main constructs in order to analyse user satisfaction. The *cost* construct encompasses tangible (e.g. cost of internet subscription) and intangible cost factors (e.g. time needed to find certain information). The *opportunity* construct comprises of factors that account for instances that arises when the user can take advantage of a service, such as providing flexibility in doing certain transactions (e.g. accessibility, service support). The *benefit construct* is the value that the user gains as a result of utilising the service. These benefits include money or time saved, information accuracy etc. The *risk construct encompasses factors that capture instances that* arise when certain conditions could make the system vulnerable, such as the potential for fraud. The risks construct includes factors that are often uncontainable and which can be personal (e.g. social isolation) or financial (e.g. hidden costs, payment mistakes).

By using the constructs from the COBRA framework, an online survey was developed to include questions based on these constructs in addition to questions on demographics and experience with the internet and the usage of the e-prescription system. The questionnaire used was assessed by five experts in the area of e-government for readability and language clarity, consistency of style and layout and further validated by 25 experts in the field of public sector and e-government research at a public conference.

The questionnaire compromised of two sections. The first section contained 49 closed multiple-choice questions focusing on the four main constructs of the COBRA framework and eight questions on the users' overall opinion: five about the cost, risk benefits, opportunity, and value; two about how the service meets user needs (one closed multiple-choice and one open); and another on collecting users' general comments. For the multiple-choice questions a seven-point Likert scale was used, where 7 was labelled as "Strongly Agree" and 1 as "Strongly Disagree" except on the last multiple choice questions assessing how the service meets user needs, where 1 was labelled as "Strongly meets my essential needs" and 7 was

labelled as "None of my essential needs". The second section compromised of multiple-choice questions assessing demographic data, user internet usage and experience with the service.

Distribution of the Questionnaire

The questionnaires of this study were distributed with the help of an international market research and survey company that recruited UK users of the online TFL LCC. The participants were surveyed from 10 to 23 July 2013. The survey was distributed to 530 citizens who were regular users of the TFL online system through selective sampling. Of these 500 valid responses were selected for the analyses after eliminating 30 questionnaires that were incomplete. The participants filled in the anonymous questionnaire online using an existing survey tool (SurveyMonkey). The questionnaires used made it clear from the beginning that the completion of the survey was voluntary and the survey took between 10 - 15 minutes to complete. A random sampling in this case was not deemed appropriate as the focus of the research was to examine citizen satisfaction with the electronic LCC system and only selected citizens would have used this service. As a result a specialist survey company had to be used to gather the required data.

Data Handling and Statistical Analysis

The data gathered were transferred into a spreadsheet tool (Microsoft Office Excel) for the quantitative analysis, storage and retrieval purpose. Descriptive statistics were used to present the quantitative results and a thematic analysis process (Boyatzis, 1998) was used to analyse qualitative data obtained from the open-ended questions.

Age Group		**Education Level**		**Income**		**Internet Usage**		**LCC Use**	
<24	12%	Secondary or less	7%	> £10,000	8%	Beginner (less than 3 Years)	2%	Everyday	17%
25-34	35%	High school	22%	£10,000 – £19,999	17%	Fair (3-6 Years)	10%	Several times weekly	17%
35-44	23%	Undergraduate Education	38%	£20,000-£39,999	36%	Good (6-10 Years)	30%	Once a month	21%
45-54	18%	Postgraduate Education	21%	£40,000-£69,999	22%			Several times a month	12%
55-64	12%	Doctorate	3%	£70,000 – £99,999	4%	Excellent (over 10 Years)	58%	Once a year	14%
>65	0%	Other Professional Qualifications	9%	>£100,000	5%			Several times a year	19%

Table 1. Participants Information

Demographics

The survey resulted in 500 respondents who were users of the TFL LCC e-service. The participants had varied levels of experience with using the TFL LCC e-service. Of the participants, 51% were male and 49% female and the age and income of the participants varied. Table 1 presents in details the participants' age group, education level, income, Internet usage and usage of the LCC e-service. Most of the participants, 58%, declared having excellent skills in using the internet and very few were beginners (2%). The usage of the TFL LCC e-service varied from every day usage to several times a month. A total of 8% of the participants preferred not to disclose their income. Apart from declaring the income, the rest of the questions were mandatory and as a result all participants answered them.

Study Findings

This study measures citizens' satisfaction of the electronic LCC system across four constructs: cost, risk, benefits and opportunity, as described in the COBRA framework. The questionnaire used was designed to collect detailed data across the four dimensions of the COBRA framework; however due to space restriction this paper focuses only on the questions in which the users' overall opinion is assessed. The evaluation findings are reported in the subsequent sections.

Cost

In order to evaluate the impact of cost (of using the system) on user satisfaction, there were 10 variables: time to find the e-service, time needed to up/download information, time to receive acknowledgement, effort (in terms of time and cost) needed to complete the task, time to find information, number of steps to complete the e-service, registration cost, internet subscription cost and cost of renewing the prescription were measured. Citizen satisfaction with the overall cost incurred as a result of using LCC only service is presented in Figure 1. A total of 26% of citizens using this service strongly agreed with being satisfied with the cost of the service, 19% selected 6, 23% selected 5 and 20% selected 4 respectively on the given seven-point Likert scale. Some 3% of users strongly disagreed with being satisfied with the cost of this service.

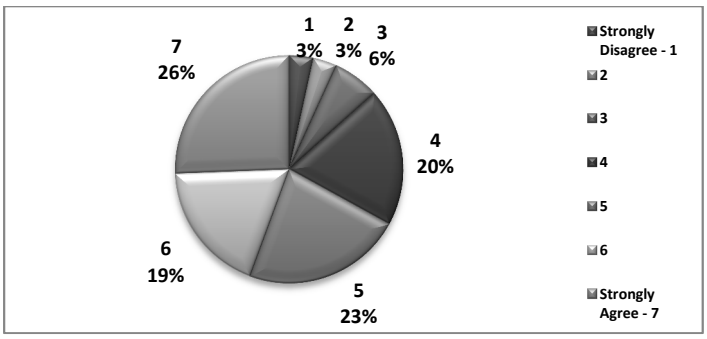

Figure 1. Satisfaction with the overall cost of the service

Risk

The risk section in the survey comprised eight multiple-choice, close-ended questions. The following variables were assessed: fraud, payment mistakes, hidden cost, audit by government/agency, future audit, social isolation, usage of the data by e-government for other purposes, and data privacy. The participants were afterwards asked to rate their overall satisfactions with the risk this services poses. Figure 2 presents the results. A total of 18% of the participants strongly agreed with being satisfied with the risk that occur when using this service, 21% selected the 6, 24% selected 5 and 22% selected 4 as an option on the seven-point Likert scale. As in the previous case, 3% strongly disagreed with the statement.

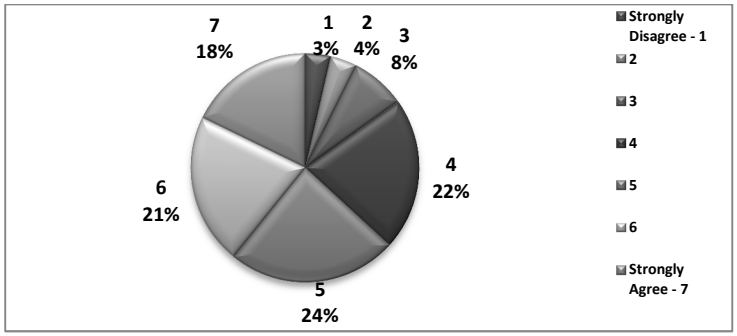

Figure 2. Satisfaction with the overall risk of the service

Benefit

The benefits of the system were assessed through 17 questions: time savings, reductions in overall cost, reductions in transportation cost, money savings, service security, ease of finding the contact information for support, ease of understanding, ease of use, information presentation, information sufficiency, ease of navigation, information accuracy, up-to-date information, information relevance, ease of searching for information, necessity of training and the steps that needed to be completed offline. Figure 3 presents the participants' options when asked to assess their satisfaction with the overall benefits of the PPC e-service on a seven-point Likert scale. A total of 27% of participants strongly agreed with the statement: "I am satisfied with the overall benefit of this e-service", 24% selected 6 on the Likert scale and 21% selected 5 as an option. Only 2% strongly disagreed with the above statement.

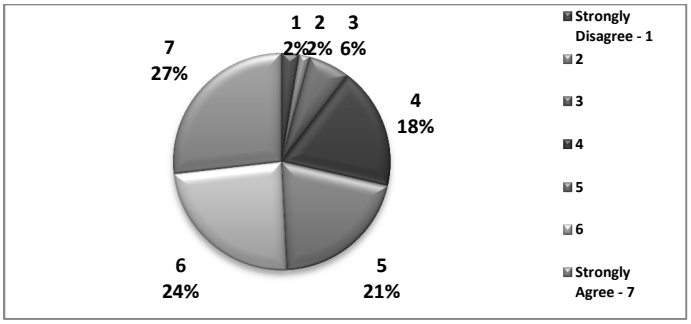

Figure 3. Satisfaction with the overall benefits of the service

Opportunity

The opportunity offered by the LCC e-service was assessed through 14 variables: potential for corruption, access at any time, customisation, delivery options, error alerts, options for getting support, support from e-service officers, options for receiving update alerts, payment methods, transaction history access, ability to recommend the service, language translation, information updates, and directions for completing it. Figure 4 highlights the results obtained when asking the respondents to rate which options best on the given seven point Likert scale best describe their opinion on the following statement: "I am satisfied with the overall opportunity of this e-service". As it was the case with the risk, benefit and cost, most of the participants were satisfied with the overall opportunity offered by this service. A total of 23% strongly agreed with the above affirmation", 26% selected 6 as their option and 21% selected 5 on the seven-point Likert scale. Some 4% strongly disagreed with the above affirmation.

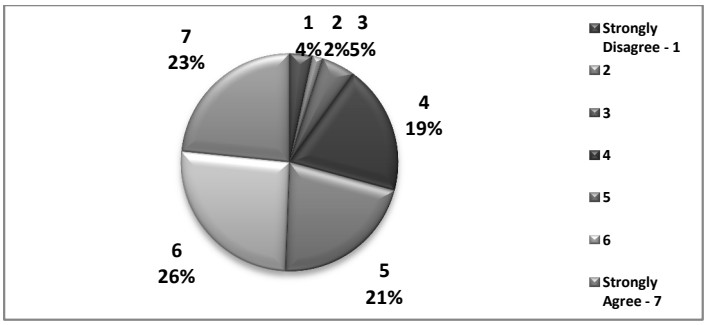

Figure 4. Satisfaction with the overall opportunities offered by the service

Overall Generated Value

The results reported when assessing the participant's opinion with the overall satisfaction with the LCC online service are presented in Figure 5. The results are similar to the ones presented for each of the four constructs above. A total of 25% of participants strongly agreed with being satisfied with the overall value of this service, 22% selected 6 as an option, and 23% selected 5 on the seven-point Likert scale.

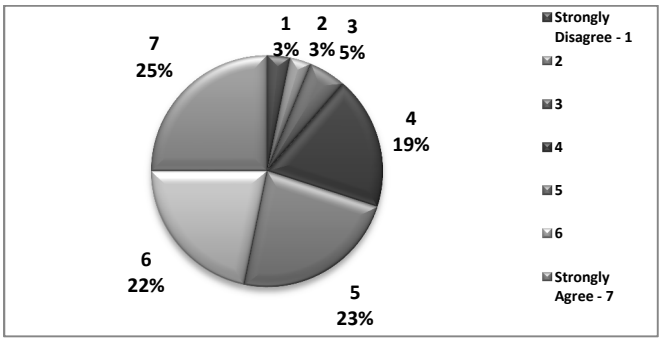

Figure 5. Satisfaction with the overall value of the service

Essential Needs

Figure 6 summarises the respondents' view on whether the LCC online system meets their needs. 20% strongly agreed that their essential needs are satisfied by using this system, 17% of the participants selected 6, and 12% selected 3. A total of 4% of participants strongly disagree that their essential needs are met through this system.

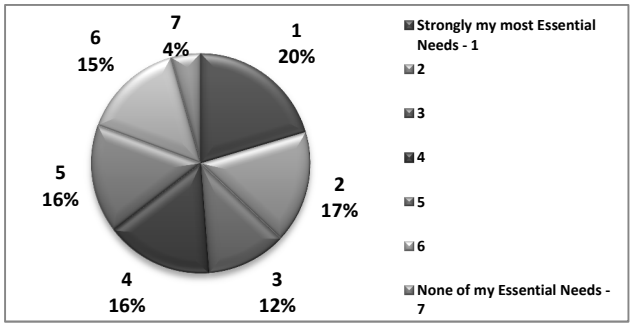

Figure 6. How well the service meets user needs

Qualitative Feedback

Two open-ended questions were used to collect qualitative feedback on how the service meet or not the participants needs and another one asking for general comments. Most of the survey participants provided positive comments about the service. They reported that the service was easy to use, quick, convenient, and it saved time. Among the issues mentioned were concerns regarding the website security and trust in the government, the service being impersonal and lack of feedback (i.e. acknowledgement for the payment being done).

Study Contributions and Concluding Comments

The research focused on the general satisfaction of the citizens with the LCC e-service system across four dimensions: cost, risk, benefits and opportunity, as described in the COBRA framework. A large sample study (n=500) of the online LCC system was used to study user satisfaction. The results showed that the people are generally satisfied with the LCC. Qualitative feedback from the users suggests areas for improvements to the service.

From a theoretical perspective, the study adds to the body of knowledge in user satisfaction studies with e-services by evaluating the satisfaction of a key public service offered by the UK government (the LCC e-service). In this respect, this paper has evaluated the opinion of citizens using four constructs that have not been applied before in the UK when studying government e-services. To the best of our knowledge this is also one of the first studies that assess the usability of LCC e-service in UK.

In terms of practical contribution, the findings offer valuable insights to public sector policymakers and ICT managers who are responsible for developing and maintaining online systems such as the LCC. While detailing user satisfaction in terms of cost, risk, benefits and opportunities of using the system, the results also point to further improvements that can be addressed across these dimensions. The descriptive statistics presented in the article could be used to prioritise the areas of importance in addressing issues that are perceived of importance from the user point of view. The qualitative feedback provides valuable insights on the areas that need attention. The feedback can be used to further improve the LCC website functionality, user support, and increase citizens' trust and awareness both in the governmental agencies providing these services and in the online services provide.

Future Work

Data will be collected from several other e-government services in UK, Qatar and Lebanon as part of the research effort in the I-MEET project. The empirical data will be collected both from the providers and citizens to provide both their perspective across the COBRA's constructs. This will help to determine how citizens and providers view of the e-government services vary across different cultures with the aim to determine an integrated model to evaluate and enhance the e-government services to the satisfaction of both citizens and public organization providing these services. Furthermore, as highlighted in the qualitative feedback by the survey participants several additional factors emerged in relation to user satisfaction of LCC e-service which needs to be further investigated. These include issues concerning the website security and trust in the government and the service being impersonal.

Acknowledgements

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