Mohammad Sharif Hanif

Adopting E-invoice: User Experience Analysis of Quick Response Campaign

Guidelines for SMEs and Operators

Helsinki Metropolia University of Applied Sciences
Master of Engineering
Information Technology
Thesis
25-Nov-13
Electronic Invoicing brings proven benefits to business organizations. As Electronic Invoicing offers so many customer values, E-invoice service providers create marketing campaigns to invite potential customers to join the E-invoicing service network so that they can send or receive invoices electronically.

The widespread availability of smartphones and tablet PC has enabled advertisers to integrate Quick Response (QR) code into their marketing campaign. The two-dimensional QR code is an inexpensive way to encode unique campaign data and can be printed on physical invoice. Among all types of mobile marketing, QR Code shows the high level of response. A recent research on E-invoicing revealed that usability is one the main consideration in making a purchase decision. User Experience is also considered as one of the factors creating value to the customers for technology-based products.

In spite of the popularity of the QR Technology in marketing campaigns and the importance of usability in software products, there has been no usability analysis on its practical use in E-invoicing products. Case studies such as (Righi & James 2007) and (Westwood 2012) have been carried out. However, they are mainly conducted on web-based softwares. There is a gap in usability analysis when QR code is used to bridge traditional paper-based invoice receiver with electronic invoicing. This research aims to find out what factors affect the software usability while using QR Technology as part of an E-invoice marketing campaign.

The outcome of this research is a set of recommendations which can be used as guidelines by implementation consultants working for any E-invoice service provider and implementing similar customer projects. Moreover, the guidelines will also serve as a white paper for SMEs considering adopting E-invoicing to automate their business process.
# Contents

1 Introduction 1
   1.1 Research Problem 3
   1.2 Research Objective 3
   1.3 Research Scope and Outcome 4
   1.4 Research Methodologies and Organizations 5

2 Theoretical Background 7
   2.1 E-invoicing 7
      2.1.1 Main Benefits of E-invoicing 8
      2.1.2 Accounts Receivable Automation 9
      2.1.3 Challenges 11
      2.1.4 E-invoicing Service Providers 11
      2.1.5 E-invoicing Process 13
      2.1.6 Interoperability between E-invoice Service Providers 14
      2.1.7 E-invoice Formats 14
      2.1.8 Enterprise Application Integration 15
   2.2 Quick Response Technology 15
      2.2.1 QR in Marketing Campaign 16
      2.2.2 Examples of Successful QR Campaigns 17
   2.3 Software Usability 18
      2.3.1 Nielsen Usability Model 18
      2.3.2 Analysing User Experience 19
      2.3.3 Testing with Five Users 20

3 Methodologies 21
   3.1 E-invoicing Campaign Application 22
   3.2 Usability Questionnaire and Data Collection 23
      3.2.1 Construction of UEQ 24

4 Usability Test Result and Analysis 29
   4.1 Results of User Experience Questionnaire 29
   4.2 Analysis of Performed Task 31
   4.3 Results of User Experience Questionnaire 32
   4.4 Analysis of User Experience Questionnaire 33
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion and Conclusions</td>
<td>35</td>
</tr>
<tr>
<td>5.1 User Experience</td>
<td>35</td>
</tr>
<tr>
<td>5.2 Validity</td>
<td>36</td>
</tr>
<tr>
<td>5.3 Recommendations</td>
<td>37</td>
</tr>
<tr>
<td>5.4 Conclusions</td>
<td>38</td>
</tr>
<tr>
<td>References</td>
<td>40</td>
</tr>
<tr>
<td>Appendices</td>
<td></td>
</tr>
<tr>
<td>Appendix 1. User Experience Questionnaire Response</td>
<td></td>
</tr>
</tbody>
</table>
LIST OF FIGURES

Figure 1: E-invoice Growth in Finland ................................................................. 1
Figure 2: Research focus .................................................................................. 4
Figure 3: Research organization .................................................................... 6
Figure 4: E-invoice market in Europe .............................................................. 9
Figure 5: Business transactions stages ............................................................. 10
Figure 6: Account Receivable Automation Process ......................................... 10
Figure 7: E-invoice Service Provider’s Core Functions .................................... 12
Figure 8: E-invoice service provider’s value creation process ....................... 13
Figure 9: Interoperability flow ....................................................................... 14
Figure 10: QR scanning process ..................................................................... 16
Figure 11: Nielsen’s Usability Framework ....................................................... 19
Figure 12: Invoice flow between sender and receiver .................................... 21
Figure 13: A unique QR code for a specific receiver ...................................... 22
Figure 14: Usability test sequence diagram ................................................... 23
Figure 15: E-invoice campaign page ............................................................... 24
Figure 16: Five stage scale of usability test .................................................... 27
Figure 17: Time Calculation For Each Tasks For Five Users ......................... 30
Figure 18: Graphical Representation of Overall Satisfaction And Task Validation 33
Figure 19: Graphical Representation of User Experience Questionnaire ....... 35

LIST OF TABLES

Table 1: Earlier research scope ................................................................. 3
Table 2: Determining number of test users based on test types .................... 21
Table 3: Token creation for campaign participants ......................................... 22
Table 4: Task cards for usability test users .................................................. 26
Table 5: User Experience Questionnaire .................................................... 27
Table 6: Description of Test Users ............................................................... 28
Table 7: Time Taken With Respect To Each User Experience Taks .............. 29
Table 8: Result of Overall Satisfaction And Task Validation Questionnaire .... 32
Table 9: Result of User Experience Questionnaire ....................................... 34
1 Introduction

Electronic Invoicing, with its burgeoning popularity, is an indispensable part of a modern organization. In recent years, an increasing number of Finnish companies and public organizations have adopted Electronic invoicing (Penttinen 2008). In small Finnish companies 79 percent were able to receive and 64 percent were able to send E-invoices in 2011 (Statistics Finland 2011). As seen in Figure 1 below, there has been a sharp growth in the adoption of E-invoicing in recent years, as the same statistics from the year 2008 show that only 34 percent were receiving and 32 percent were sending E-invoices (Statistics Finland 2008).

![Figure 1: E-invoice Growth in Finland](image)

In the European Union the number of E-invoice users has also grown rapidly. That is because large invoice senders such as mobile phone operators, utilities, credit card agencies have pushed their customers towards accepting electronic invoice or receive a few Euro penalty per invoice, if the customers choose to continue receiving paper invoice. Large EU companies have pushed their trading parties to send or receive E-invoice (Billentis 2012:10). The fact that E-invoicing has grown so much is due to the genuine need of an organization. The main benefits of E-invoicing include automating accounting processes, increasing visibility and control, reducing cost and transaction cycles and improving organizational efficiency (Schaeffer 2005:48). E-invoicing products in general have a low ecological impact. This is mainly due to the elimination of supply and distribution chain of paper invoices. Besides Business-to-Business (B2B), customers from Business-to-Customer (B2C) form a big part of the E-invoicing ecosys-
tem (European Commission 2010:4). As Electronic Invoicing offers so many customer values, E-invoice service providers create marketing campaigns to invite potential customers to join the E-invoicing service network so that they can send or receive invoices electronically. The customers respond to the campaign by providing their acknowledgement of receiving Electronic Invoice from that point onwards. This approach brings the above mentioned benefits to a B2B organization, an in addition brings part of the benefits to B2C customers. The customer data is then stored in a secured repository.

Networked mobile devices, in today’s world, have become an ubiquitous part of lifestyle. The widespread availability of smartphones and tablet PC has enabled advertisers to integrate Quick Response (QR) code into their marketing campaign. The two-dimensional QR code is an inexpensive way to encode unique campaign data and can be printed on physical invoice. The invoice is then delivered to the customer by post. Users respond to the campaign with a smartphone by scanning that QR bar code token (Kitchen 2013:95). The users, therefor, are freed from complex data entry, let it be the campaign URL or inputting the customer details. Instead, the same data is securely encoded within the code. The customer effortlessly lands on the campaign page. And the application scoops out the stored data from the QR code. The programme never stores confidential information on the user's smartphone and instead stores the data on a central repository. A token based mechanism is used to allow data protection, in case the preloaded QR code falls into the wrong hand (see Chapter 3.1). Earlier studies suggest that the use of Quick Response codes offers superior user experience to customers while accessing web site information through their smartphones (Close 2012:272).

Among all types of mobile marketing, QR Code shows the highest level of response. QR code is also more practical, less expensive and less intrusive. Experts estimate that brand spending for marketing campaigns on mobile platform will grow from 0.5% of the total advertising budget in 2010 to over 4% by the year 2015 (Kitchen 2013:107-109).

The QR interface removes the barrier between the physical and online world to allow the customer reach a new level of experience. This is necessary because user experience is considered as one of the factors creating value to the customers for technology-based products (Westwood 2012). And what is most important is that, electronic invoicing is not outside this paradigm. As the recent research on E-invoicing reveals
that end-user experience is one the main consideration in making a purchase decision (Myllynen 2011).

1.1 Research Problem

Despite the well known fact that E-invoicing brings proven benefits both to organizations and to individuals, and the fact that the use of QR technology in marketing offers superior user experience - there is no known user experience analysis on the use of QR technology on E-invoicing campaigns. Table 1 below outlines that the earlier research concentrates mostly on the user centric design principle or customer value proposition in Electronic Invoicing. However, these studies are mainly conducted either exclusively for economic aspects of Electronic Invoicing without taking the user experience into consideration (Westwood 2012) or only for analysing user experience on various web-based softwares other than E-invoicing (Righi & James 2007).

<table>
<thead>
<tr>
<th>Earlier Research</th>
<th>User Experience</th>
<th>Electronic Invoicing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Westwood 2012</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Righi &amp; James 2007</td>
<td>Yes</td>
<td>No</td>
</tr>
</tbody>
</table>

Table 1: Earlier research scope

Based on the best available knowledge, there is a gap in user experience research when QR code is utilized to bridge traditional paper-based invoice receiver with electronic invoicing. This research aims to address this gap and endeavours to explore what factors affect the user experience while using QR Technology as part of an E-invoice marketing campaign.

1.2 Research Objective

As explained above, the purpose of this thesis is to explore what factors affect the user experience while using QR Technology as part of an E-invoicing campaign. In addition, the opportunities and drawbacks of adopting QR Technology in the context of Electronic Invoicing are also examined.
Figure 2: Research focus

Figure 2 above highlights the intersection of the research focus. In particular the research question is:

*What factors influence the User Experience while using QR technology as part of an E-Invoicing campaign?*

Supplementary research objectives are:

1. **Understand the role of QR in promoting user experience of an E-invoice campaign.**
2. **Develop a set of recommendations on how E-invoicing can benefit from QR technology.**

1.3 Research Scope and Outcome

This study takes an exploratory approach to understand the user experience criteria for an E-invoice marketing campaign using QR technology on mobile platform. In order to do so, the thesis focuses on E-invoice campaign from two different perspectives: firstly it sets off to understand the usability aspects and then, secondly, it evaluates the user
experience through a software prototype. E-invoice service providers usually have a campaign plan in place. Hence, this thesis concentrates when an E-invoice service provider has to analyse the user experience as a part of such campaign. Developing a campaign plan for an E-invoice service provider is beyond the scope of this thesis. Moreover, this study only involves business-to-consumer electronic invoicing campaign where the goal is to attract new users. The receiving and sending invoice by the registered user is outside the scope. The software prototype will utilize open source services for generating and scanning QR codes. Developing a QR scanner and providing instruction on how to use QR scanner is outside the scope of this research. Instead, it is assumed that users already have the software and know how to use them. The analysis part of the user experience study evaluates the Nielsen’s five factors attributes which were chosen to be included in the user test. That said, the test users were chosen randomly and represent both novice and expert users.

Besides developing a prototype along with a set of questionnaire to evaluate the user experience this research aims to develop a set of recommendations. The recommendation is a synthesis based on the analysis of the research questions (see Chapter 1.3). This outcome can be used as guidelines by implantation consultants working for any E-invoice service provider and implementing similar customer projects. Moreover, with the growing popularity of E-invoicing, the guidelines will also serve as a white paper for SMEs considering adopting E-invoicing to automate their business process.

1.4 Research Methodologies and Organizations

The focus of this thesis is the intersection of E-invoicing, QR, and user experience. Despite the best effort, at the time of writing the paper, the researcher is yet to discover existing knowledge relevant to the intersection of the thesis. Due to this unique focus, the path chosen involves developing a software prototype which would combine the elements of software usability into the world of E-invoices and QR. This prototype is then used as a tool along with a set of user experience questionnaire to generate data input for this research. For the construction of the User Experience Questionnaire UEQ, the relevant Nielsen’s five factors attributes are taken into consideration. An empirical approach is used for the conducting and evaluating the usability questionnaire. The selected questions are consolidated into a measurable scale of one to five. This UEQ includes attributes such as learnability, efficiency, memorability, error and satis-
faction. The collected data is subjected to further empirical study to measure the user experience for an E-invoicing campaign.

The research is logically organized so that the topics are introduced when they appear the first time. Figure 3 above compares the research phases with the corresponding research objective. Chapter 2 explores the theoretical background required to precisely understand the functional requirements of E-invoice marketing campaign using QR technology on mobile platform. Based on these findings, the next chapter deals with developing a software prototype and takes an empirical approach to construct the user experience questionnaire. The questionnaire is then used to collect and analyse the
user data in the following chapter. The final chapter contains a detail discussion followed by conclusion.

2 Theoretical Background

This chapter begins with a review of the existing literature of Electronic Invoicing or simply E-invoicing. Both the academic literary survey and the industrial practices are thoroughly reviewed to determine the current best practices of E-invoicing. Then the benefits of E-invoicing are discussed along with the various types of E-invoice automations. Also, a typical process involved in implementing an E-invoice project is outlined. An E-invoicing system cannot function as a stand-alone system. It has to interoperate with other existing enterprise applications. How an E-invoicing system seamlessly integrates with the business eco-system cannot be left unnoticed. The chapter, therefore, ends with an overview of the various interfaces available for such integration.

2.1 E-invoicing

The European electronic invoicing industry is regulated by the EU expert group of E-invoicing namely European E-invoice Multi-Stakeholder Forum (EUMSFEI). The EUMSFEI defines E-invoicing as the issuing and receiving of an invoice in a digital format in an structured or unstructured format. They extend this definition so that the pre-processing and the post-processing of this digital invoice also needs to be handled electronically (EUMSFEI 2012). European Commission is the central regulatory authority for E-invoicing within Europe and according to this definition a valid E-invoice is electronic from its creation in the ERP system by the sender organization until it is received, processed and stored by the recipient organization. Moreover, according to the EC definition of E-invoicing a digitalized version of a physical invoice (e.g. by scanning a paper invoice) and sending or receiving it, is not considered to be E-invoicing. In other words, a valid E-invoicing is electronic throughout its lifecycle and does not constitute manual processing at any intermediate stage.
2.1.1 Main Benefits of E-invoicing

It is a fact, as discussed in details in Chapter 1.1, that E-invoicing offers many benefits to organizations. An E-invoice contains all data in digital format. Such E-invoices provides substantial benefits over paper invoices. The European Commission of E-invoicing outlines four major ways to benefit from E-invoicing:

- Shorter payment cycle
- Fewer errors
- Cost reduction
- Increased productivity

1. Shorter payment delays is achieved through accelerated processing and receiving. The processing times of the invoice can be shortened by fully integrating the sender and receiver ERP system. The short processing times also contributes to better cash flow.

2. Fewer errors due to automated invoice processing. The automation also contributes to the transaction and payment efficiency.

3. Reduced printing and postage cost due to elimination of manual work and logistics. The automation also eliminates the risk of losing an E-invoice or delayed delivery.

4. Fully integrated process mean the workforce can be utilized for more productive work

These benefits are observed within the context of a business organization. However, as the Figure 4 below emphasizes that in 2013 business organizations were estimated to comprise 60% of total E-invoicing market within Europe. The rest 40% are contributed by any person from any corner of Europe (Billentis 2012:7).
The same EC studies also identifies that the consumers can also receive benefits from E-invoicing. For example, as opposed to paper invoice a particular consumer may find it convenient to receive E-invoice. However, the EU Charter emphasize that when delivering E-invoices directly to consumers, the fundamental rights or data protection and privacy needs to be considered the same way as commercial receiver. (European Commission 2010:4).

2.1.2 Accounts Receivable Automation

Figure 5 below describes the process of a typical business transactions: in step 1 the buyer initiates the transaction and sends an order. The supplier then delivers the ordered item in next step. Invoices are typically created in step 3 by the supplier organization right after the shipment is completed. Many companies sent these newly created invoices to their accounts receivable department for further processing, such as stamping and taking it to the post office. The Account Receivable A/R department match each invoice to its corresponding purchase order (Schaeffer 2004:4). Upon receiving the invoice, the buyer then makes the payment as described in step 4 above.
A strong (A/R) function greatly improves an organisation’s competitiveness. An efficient management of inward cash flows from completed sales is absolutely critical for staying in business. Therefore, an efficient A/R process can directly impact working capital and hence the profitability of the business (Khalid 2010:125).
As described in Figure 6 above, many ERP software packages contain the A/R module which automatically matches the purchase order and collect shipment information to create invoices in batches. These generated E-invoices reside in the sender organization’s ERP system until an A/R clerk puts them in envelopes and make them ready for delivery. However, in the case of E-invoice, instead of an A/R clerk and the postman, an E-invoicing software collects them, converts them to appropriate receiver format and finally routes them to the recipient ERP system (Basware 2012).

2.1.3 Challenges

As seen in the previous section, the fundamental principle of E-invoicing is that an electronic document is sent from one ERP and arrives in another ERP system. And the E-invoicing software is responsible for this transmission. However, very often the sender organization uses a different ERP system than the receiver organization. Thus, after an invoice is received from an A/R system, the E-invoicing software needs to convert the original invoice into the appropriate recipient format, before delivering it to the recipient ERP. If both the sender and receiver organization had used the same format then the intermediate conversion process would not be necessary. However, as already explained, this is not the case in reality. Currently, there is no global standard for E-invoicing format. Different ERPs and A/R systems are free to choose their own implementation to describe how their proprietary invoice format will look like. This diversity of format and functional requirements have consequently fragmented the E-invoice markets.

The European Commission expert group on E-invoices identifies that defining a single and clear semantic data model describing all the necessary elements of an E-invoice is one of the key challenges. Due to this diverse data model, the conversion process can be challenging to implement. The E-invoice software must know the receiver’s format prior to routing an invoice to the destination ERP system (European Commission 2010, 2013).

2.1.4 E-invoicing Service Providers

As the possibility of large data models imposes conversion challenges, integrating all these different formats is far beyond an easy task. For a sender organization, maintain-
ing an ever increasing number of connections with all of its receivers can become a nightmare and quickly spiral out of control. E-invoice service providers offer the transport, routing and conversion services of digital invoices between digital invoice senders and receivers (see Figure 7).

Instead of maintaining a lot of connections with various receivers the invoice sender can just focus on a single point of contact. This option simplifies the senders’ invoice sending process, as they do not need any prior implementation of any specific format with the receiver. Instead, senders can just deliver the E-invoice to their chosen service operator using their original A/R format. Since, E-invoice service providers are specialized in various format to format transformation, they can operate both cost effectively and reliably while reducing the cost for the supplier.

Figure 7: E-invoice Service Provider’s Core Functions
2.1.5 E-invoicing Process

This section describes what happens when a sender sends an invoice and after it arrives to the E-invoice service provider or simply operator’s network. Figure 8 below describes each step involved in E-invoice operator’s value chain process. The senders typically send the invoices as a data bundle (Basware 2012). The operator first opens up the bundle and splits every invoice(s). Based on the sender’s preferences, the operator then performs database lookups for both the sender’s and the receiver’s supported invoice formats. If a sender has multiple receivers then the operator looks into the invoice content to find out the appropriate receiver. On the other hand, if a receiver supports multiple formats then the operator checks for the default option. Once the receiver and the sender of an invoice is identified, the next phase is to validate the invoice.

![Figure 8: E-invoice service provider’s value creation process](image)

Invoice validation involves details analysis to check if each item in the invoice fulfils the minimum requirements of a routable documents. If the validation is not successful, then the invoice is marked as invalid and notifies the sender who then performs the required updates before resending. Routable invoices are then converted to an invoice image based on the receiver’s layout. An invoice image is a graphical representation and human readable version of the original invoice. The receiver organization sometimes chooses to receive digitally signed invoices instead of an unencrypted format. Having signed digitally enables the sender to protect the invoice from data manipulation during routing. Finally the operator delivers the generated invoice image along with the origi-
nal invoice to the receiver. Below is an example of a raw invoice and the corresponding invoice image:

2.1.6 Interoperability between E-invoice Service Providers

European e-Invoice Multi-Stakeholder Forum on e-Invoicing (2012) defines interoperability as the ability of multiple E-invoice service providers to exchange digital invoices. Interoperability for routing an invoice is necessary because very often both the sender and the receiver do not belong to the same E-invoice operator. For example, a sender may send an invoice from Operator A in Finland to a receiver under Operator B in Sweden.

![Image of interoperability flow]

**Figure 9: Interoperability flow**

In the Figure 9 above, the Operator A will perform database lookup to identify that the receiver belong to Operator B. If the Operator A has an interoperability service agreement between Operator B, then Operator A will route the invoice to Operator B who will then take care of the conversion and final delivery.

2.1.7 E-invoice Formats

Depending on the origin, an invoice may have many different formats. Although ERP manufacturers are free to choose their own proprietary formats, there are many nationally and regionally defined formats. For example, Finnvoice format in Finland and Cenbii format in EU (Finnvoice & Cenbii Format). The European Commission’s invoice expert group considers an invoice is valid if it contains the minimum set of required data. The structure and content are typically described as XML. This means a format is a combination of a structure and technology used to describe that content. Unlike the paper document where the invoice receiver is unaware of the incoming format, the
structure of a valid E-invoice is pre-defined and both parties are pre-informed so that both parties know how to convert them.

2.1.8 Enterprise Application Integration

As described in Chapter 2.1.2, the integration interface provides a mechanism to transfer the invoice from the sender A/R system to operator’s network. Depending on the sender’s preferences, an interface can be a plug and play solution which is integrated with the existing financial or A/R system. These interfaces systems normally create the invoices and save the output to a predefined directory or directly routes the invoice data to the invoice operator. In most cases the interface can resend the invoice if a transmission attempt is interrupted due to network error or software malfunction. The sender organization can choose between HTTP, HTTPS, FTP or SFTP as the network protocol (Pagero; Basware 2012).

2.2 Quick Response Technology

Quick Response Technology or simply QR Code is a two dimensional barcode which was first created by Denso Wave, a Japanese company, in 1994. At first it was designed for warehouse tracking in Japanese automobile industry. As the internet and mobile telephony became more ubiquitous, QR code also became more popular among the public users (Sansweet 2011). The QR code has three main characteristics:

1. It enables quick two-dimensional data capturing.
2. It provides storage capacity within the two-dimensional area.
3. It can connect offline information to the internet with a standard browser.

It means that information stored in the code can be scanned by a QR reader and automatically lead the user to a designated webpage, see Figure 10 below.
A QR code can be scanned by a mobile device. For example, most people with a standard smartphone can capture the QR code and open the encoded link. When the smartphone camera scans the code and the software within the phone deciphers the encrypted information and identifies it as a web link. The software then prompts the link with the default web browser to display the associated webpage. The response is pretty immediate and eliminates the need to content search. This way of responding quickly also means convenience resulting to superior user experience.

2.2.1 QR in Marketing Campaign

The integration of physical and virtual world via QR code opens the door to new opportunities for marketing campaigns. The budget for mobile advertising is expected to grow from 0.5% in 2010 to 4% in 2015. Moreover, as QR Technology is less intrusive it will become more common in marketing campaigns (Kitchen. P, 2013:109). This means there is room for more innovation on how smartphone users utilize the QR technology. Research shows that in order to get the most out of a QR advertising campaign, a corresponding mobile portals or platforms should be used (Kitchen. P, 2013:107).
2.2.2 Examples of Successful QR Campaigns

As QR campaigns offer great benefits over conventional paper based campaigns, many well-known organizations have successfully implemented QR campaigns. The following list describes five such successful QR campaigns:

**Toyota GT86:** Toyota, the car manufacturing company, recently used QR in promoting their new GT86 model. The main advertisement appeared in sports magazine where the QR code was placed on the right-bottom corner along with a simple instruction to scan to watch the film toyota.co.uk/GT86. In this campaign, Toyota used the Call-to-Action (CTA) functionality where the customer could easily distinguish the QR code from the rest of the advertisement.

**Verizon Wireless:** In their marketing campaign the QR codes were distributed through printed materials, banners and direct mails. In this campaign the customers were asked to share responses in Facebook to win a smartphone. The combination of social media and direct sales was the key to this successful campaign.

**Turkish Airlines:** During London Olympics 2012, Turkish Airlines promoted a scavenger hunt around London’s local bus stops using QR codes. The campaign included QR flags which travellers scanned while they travelled around the city. The QR flags also pointed them to a mobile site where the users could search other nearest QR flag locations and could see their personal check-in data.

**Heinz:** In 2011 Heinz included QR codes on the labels of their ketchup bottles to promote ecologically friendly packaging. When the customers scanned the QR code and landed on the campaign page, they could participate in a green knowledge trivia questionnaire to win prizes.

**Transport for London:** Transport for London (TfL) provides QR codes on posters at underground metro stations to promote TfL’s real-time journey planner. TfL reports that both the number of scanning and the amount of posters are on constant rise.

The above examples show that QR technology can provide benefits to many different campaigns and likewise E-invoicing can also benefit from the creative use of QR technology.
2.3 Software Usability

Upon discussing E-invoicing and QR technology, a natural question that follows is how these two separate domains can benefit the user experience. A recent research on E-invoicing revealed that end-user experience is one the main consideration in making a purchase decision (Myllynen 2011). Software usability is considered as one of the factors creating value to the customers for technology-based products (Westwood 2012).

As discussed in Chapter 1.1, QR code is widely popular for smartphone based advertisements. The underlying assumption of this thesis is that by giving the users a superior experience the same benefit can also be realized for E-invoicing advertising campaigns. Since, user experience is a highly abstract concept, one way to address this assumption is to carry out a set of usability test and then validate the result. This chapter, therefore, sets off to investigate various factors of usability using the Nielsen’s usability framework, which is widely recognized both in academic research and industry.

2.3.1 Nielsen Usability Model

Nielsen Jakob (1993:24) defines usability as the overall principle of system acceptability. He continues that usability is the benchmark for evaluating if the system satisfies all the needs and requirement of its end users and the associated stakeholders. As shown in Figure 11, The usability benchmark is further divided into two parts:

- Social acceptability
- Practical acceptability

Social acceptability considers if the system prevents itself from exploitation and undesirable consequences. In contrast, practical acceptability concerns categories such as cost, support, reliability, compatibility with existing system, maintenance or any other specific requirement from the users and stakeholders. Moreover, social acceptability and practical acceptability are mutually exclusive, meaning and system can be socially acceptable but practically unacceptable and vice versa.

Usefulness, however, primarily focuses on the objectivity and if the system is able to achieve the desired goal. Usefulness is again categorized into the following two parts:
Utility checks if the system can fulfil the functional requirements set by the users and the stakeholders. Whereas, usability determines how successfully the users can use those functionality.

2.3.2 Analysing User Experience

Nielsen argues that usability is not a single dimensional property of a user experience. The analysis of usability is always relative to certain test users performing a set of pre-specified tasks. That means, another set of test users performing a different set of tasks will result to a relatively different usability characteristics. Usability is in principle a combination of five distinct attributes: learnability, efficiency, memorability, errors and satisfaction (see Figure 11). And, a system’s overall usability is measured against the relative mean value of each of the above attributes

Learnability refers to ability to quick learn to use the system and rapidly utilize the system for its intended purpose. Learnability is the most fundamental usability attribute and most systems are expected to be easy to learn. System with low learnability may result to the fact that the user is reluctant to use it and will avoid future uses unless they do not have a choice, for example in workplaces.
Efficiency means once the user has learnt to use the system it is possible to use the application for highly productive purposes. Efficiency is typically a measure of the time taken by test users to perform a predefined test task. However, the prerequisite of efficiency test is that the selected users need have the same level of experience in using the system.

Memorability is the measure of how easily users can remember the system after a prolonged interval. A system with good memorability does not require leaning all over again when reused after a period of no-use.

Errors implies that while using the system the user should make few errors and even if they do it is easy for them to recover. Moreover, the system should avoid catastrophic errors which may lead to faulty outcome and make recovery impossible. Errors attribute in usability is measured by collecting overall error rate.

Satisfaction is a measurement of pleasant experiences which the user gets while using the system. Subjective satisfaction is an important aspect of usability because users may sometimes look for an overall experience rather than how fast the system can perform a specific task. The subjective opinion about the system itself and the computer where that system is installed are mutually exclusive. The user may like the system but not the computer where it is running and vice versa.

2.3.3 Testing with Five Users

Earlier usability research shows that - irrespective of the size, features and target user - it is enough to test the user experience of an application with five test user (Nielsen 1999:168). This is because analysing the user experience of an applications functionality is independent of how many people test it the number of features the application offers and the different group of users the application is targeted to (Nielsen 2012).

In contrast as seen in Table 2 below, when performing a quantitative study, which aims at statistics and not insights, the higher number of test users is usually recommended in order to gain statistically significant numbers.
21

<table>
<thead>
<tr>
<th>Different usability test types</th>
<th>Suggested number of test users</th>
</tr>
</thead>
<tbody>
<tr>
<td>User experience analysis</td>
<td>5</td>
</tr>
<tr>
<td>Quantitative analysis</td>
<td>20</td>
</tr>
<tr>
<td>Card sorting</td>
<td>15</td>
</tr>
<tr>
<td>Eyetracking</td>
<td>39</td>
</tr>
</tbody>
</table>

Table 2: Determining number of test users based on test types

Because this research focuses on user experience evaluation of qualitative values such as the five distinctive attributes mentioned above, the software prototype will also be tested with five users.

3 Methodologies

As discussed in Chapter 2.1.2, a supplier organization typically creates the invoice after the shipment is fulfilled. In the context of E-invoicing, the supplier then becomes an E-invoice sender and the buyer becomes an E-invoice receiver (see Figure 12).

If the buyer uses paper-based invoice, the Accounts Receivable A/R automation software in the supplier organization creates a paper invoice. On the other hand, if the buyer is an E-invoice receiver, then the A/R system creates the electronic invoice and sends it to the E-invoice service provider's interface. So, once a receiver is updated to E-invoicing, the A/R department correspondingly updates their application. This research proposes a solution in order to make such update possible.

![Figure 12: Invoice flow between sender and receiver](image_url)
In determining whether a buyer is capable of receiving E-invoice, the A/R department looks into the corresponding entry from the invoicing application. The goal of an E-invoicing campaign is to get acknowledgement from the buyer that they want to start receiving invoice electronically. Once the buyers successfully responded to the campaign, E-invoice service provider creates a list of positive respondents. The list is then sent to the A/R department of the supplier organization, who then update their system accordingly.

3.1 E-invoicing Campaign Application

Once the E-invoice service provider agrees to create a campaign on behalf of the sender, it then identifies and creates a list of receiver who are still using paper invoice. As Table 3 underneath describes, a unique token is created for each receiver.

<table>
<thead>
<tr>
<th>Test users</th>
<th>Paper invoice</th>
<th>E-invoice</th>
<th>token</th>
</tr>
</thead>
<tbody>
<tr>
<td>tu1</td>
<td>✓</td>
<td>x</td>
<td>QR4YU7</td>
</tr>
<tr>
<td>tu2</td>
<td>✓</td>
<td>x</td>
<td>QR7YX2</td>
</tr>
<tr>
<td>tu3</td>
<td>✓</td>
<td>x</td>
<td>QRZ4T0</td>
</tr>
<tr>
<td>tu4</td>
<td>✓</td>
<td>x</td>
<td>QR9RB7</td>
</tr>
<tr>
<td>tu5</td>
<td>✓</td>
<td>x</td>
<td>QR9PT5</td>
</tr>
</tbody>
</table>

Table 3: Token creation for campaign participants

Using a QR code generator, the E-invoice service provider then creates an unique QR code for each receiver. Each of the QR code links the unique customer token with the campaign webpage. For example, the QR below encodes the unique token of the user 123 and link to the campaign page (see Figure 13 below).

Figure 13: A unique QR code for a specific receiver
Figure 14 describes the campaign process. As part of the E-invoice campaign the buyer scans this QR code using a smartphone and comes to the campaign page.

![Usability test sequence diagram](image)

Figure 14: Usability test sequence diagram

Once the acknowledgement is made, the approval corresponding to this unique code is stored in the server. The customer information is later identified against that unique code and sent to the supplier’s A/R department.

3.2 Usability Questionnaire and Data Collection

Nielsen suggests that the summation evaluation technique is useful in deciding the overall user experience between two alternatives (Nielsen 1998:170). The questionnaire requires users to give their comparative opinion between paper based invoice and digital invoice. As the objective of the campaign to ask the user to switch from paper-based invoice to E-invoice, the summation evaluation is used in order to determine the overall user experience of the E-invoicing campaign, as well as to compare the result against traditional paper based invoicing.
Nielson continues that questionnaires and interviews can be used when the usability aspects relates to subjective satisfaction and potential anxieties (Nielsen:209). This implies that questionnaires and interviews are a suitable tool for user experience. Responding to E-invoicing campaign using the QR technology is not very common. Due to the unfamiliarity with this approach the users may experience anxiety regarding unwanted consequences. Since potential anxiety influence the overall user experience, one of the objective of the usability test would be to explore that area as well.

3.2.1 Construction of UEQ

Once the User Experience Questionnaire (UEQ) based on Nielsen’s summation technique are in place, the next step is to use this questionnaire to collect user data based on the prototype (see Figure 15). In this thesis the data collection is done in three stages: usability test, usability questionnaire and observation.

**Usability Test**

Usability test requires the users to actually test the newly developed prototype using a predefined instruction.
The following tasks in Table 4 are designed to be carried out against the software prototype developed earlier in this section. The tasks are designed carefully for the purpose for usability evaluation.

**Task 1:**
Open the E-invoicing campaign page

Scan the QR campaign code using the smartphone’s QR code reader.
Wait until the campaign page appears on the smartphone screen

**Task 2:**
Read the campaign terms and conditions

Click on the tab “Terms and Conditions”
Wait until the terms and conditions fully appear on the smartphone screen
Read the Terms and Conditions

**Task 3**
Call the customer service

Click on the “Call Customer Service” button
Wait until a customer service personnel responds to the call
Continue your customer enquiry
Once the conversation is over hang off the phone
Press the back button of your smartphone
Task 4
Accept the campaign offer and exit the campaign

Click on the “I want to receive E-invoice from now on” button.
Wait until the confirmation is shown

Task 5
Exit the campaign without accepting

Click on the “Back button” of the smart phone
Wait until the screen exits

Table 4: Task cards for usability test users

Usability Questionnaire

Once the test users finish doing their tasks, the usability questionnaire allows asking about their experience while performing those tasks. The main user experience questionnaire can be divided into two themes:

1. To validate the above usability task, the first set of questions consist of the usability test itself. The question related to overall satisfaction of the test procedure, relevance and anxiety related to this unfamiliar way of campaigning are asked.

2. The following Table 5 contains the actual usability questionnaire related to the tasks. The selection of this questionnaire is based on Jakob Nielsen’s (1993) usability framework which is already explained in the background section. According to Nielsen, usability of a software application can be assessed by five attributes: learnability, efficiency, memorability, error and satisfaction.
## Questionnaire for the user experience analysis

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Code</th>
<th>Item</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Usability</strong></td>
<td>ust1</td>
<td>The objective of this experiment was clear and I felt comfortable to respond to this campaign</td>
</tr>
<tr>
<td><strong>Task</strong></td>
<td>ust3</td>
<td>I was happy to take part in this experiment and I am satisfied that I didn’t have to use my computer keyboard.</td>
</tr>
<tr>
<td><strong>Learnability</strong></td>
<td>lrn1</td>
<td>It was easy to learn to respond to the campaign</td>
</tr>
<tr>
<td></td>
<td>lrn2</td>
<td>I have learned a lot during this experiment</td>
</tr>
<tr>
<td></td>
<td>lrn3</td>
<td>I’m interested to use similar campaign in future</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>efy1</td>
<td>The entire process is quick and I could accomplish my objective</td>
</tr>
<tr>
<td></td>
<td>efy2</td>
<td>I consider the QR scanning procedure saved my time</td>
</tr>
<tr>
<td><strong>Memorability</strong></td>
<td>mem1</td>
<td>I am able to respond to a similar campaign without any further instruction</td>
</tr>
<tr>
<td><strong>Error</strong></td>
<td>err1</td>
<td>I did not make any error while performing the tasks</td>
</tr>
<tr>
<td></td>
<td>err2</td>
<td>The application performed the tasks without any error</td>
</tr>
<tr>
<td><strong>Satisfaction</strong></td>
<td>stf1</td>
<td>I am satisfied about how this campaign used QR technology on a smartphone.</td>
</tr>
<tr>
<td></td>
<td>stf2</td>
<td>Now that I have seen the whole process, I believe it positively exceeded my expectation.</td>
</tr>
</tbody>
</table>

### Table 5: User Experience Questionnaire

The user give their response using the following five stage scale (see Figure 16).

![Five stage scale of usability test](image)

The research then uses the answer to measure the users’ response.
Observation
Jakob Nielsen points out that observing test users while they are performing the test tasks is extremely important. Moreover, the observation method should be the simplest possible and avoid interfering users with their work. (Nielsen 1998:207). Based on this principle, observer will take notes while the test users are going through each of the five test tasks. Besides, the observer mostly stays quiet and becomes virtually invisible to the test users. However, the users are allowed to interrupt the observer and ask question or explanation. The result of this observation will be presented in the analysis section.

Description of the test scenarios
In doing the usability test on the software prototype the focus is put both on the novice and experienced users (see Table 6 below). Novice users in the context of this research are defined as those who are already familiar with a paper invoice but do not have experience QR Code and thus are unfamiliar or uncomfortable in using it for the first time. On the other hand the expert are defined as those who have used both paper invoice and QR code before but not to complement each other.

<table>
<thead>
<tr>
<th></th>
<th>Used Invoice</th>
<th>Used QR scanning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Novice</td>
<td>✓</td>
<td>⌂</td>
</tr>
<tr>
<td>Expert</td>
<td>✓</td>
<td>✓</td>
</tr>
</tbody>
</table>

Table 6: Description of Test Users

The test environment is designed so that the E-invoicing software prototype is hosted on a remote website. Test users then use the Samsung Galaxy Note smartphone to scan the QR code. The smartphone is preloaded with the QR code scanner replicating the fact that most of the current versions of smartphone have a built-in QR code reader already installed.

The test user is first greeted by the interviewer and then given a short introduction about E-invoicing, how QR technology works and the purpose of the tests. Then the test user and the interviewer sit face to face. The user then performs the required user experience task while the interviewer silently observes the user behaviours and takes notes.
4 Usability Test Result and Analysis

In this section the test result of the user experience questionnaire and the analysis is presented. The chapter is divided into two parts. The first part contains the result and analysis of the user experience test. The second part analyse the result of the user experience questionnaire.

4.1 Results of User Experience Questionnaire

In the previous chapter, this research carried out an user experience questionnaire with two different sets of users: novice and expert (see Table 6: Description of test users). There were two novice users and three expert users totalling five test users. The test was comprised of a list of pre-defined tasks. And all the test users were given the same task to perform. In the beginning of the test, the interviewer briefly told the purpose of this test and then handed down the task list and user experience questionnaire. Once the test users begin the tasks the interviewer quietly observed the ongoing tasks and responded to questions whenever necessary.

The results regarding the task accomplishment with respect to time taken are summarized below in Table 7.

<table>
<thead>
<tr>
<th>Test users</th>
<th>User Type</th>
<th>Total (min)</th>
<th>Task 1 (min)</th>
<th>Task 2 (min)</th>
<th>Task 3 (min)</th>
<th>Task 4 (min)</th>
<th>Task 5 (min)</th>
</tr>
</thead>
<tbody>
<tr>
<td>tu1</td>
<td>Novice</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>tu2</td>
<td>Novice</td>
<td>12</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>tu3</td>
<td>Expert</td>
<td>10</td>
<td>4</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>tu4</td>
<td>Expert</td>
<td>7</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>tu5</td>
<td>Expert</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 7: Time Taken With Respect To Each User Experience Taks

Before beginning the user experience test, the interviewer demonstrated how QR code scanning works so that the users can immediately proceed with the tasks. The interviewer then noted the task completion time for each task without interrupting the test user. The interviewer also observed the facial expression during the tasks. Most of the time the facial expression was positive. Some test users were confused with task three
which required them to call to the customer service. This functionality did not support in one of test user’s device. The user was found to be using tablet which did not have phone call functionality. Most of the test users were able to accomplish all the test tasks without much supervision and error.

Figure 17 below shows the distribution of time taken by the test users to complete each task. The analysis of the above diagram shows that for every user the task number one took the longest time.

![Figure 17: Time Calculation For Each Tasks For Five Users](image)

For two novice users task number one took almost double then the time taken by the expert users. This phenomenon is explained by the fact that novice users took additional time to get acquainted with the software as they had encountered QR code for the first time. Task two was completed by all the five users within one minute except the second user, who took twice as much as time taken by others to perform the same task. This apparent longer time may be explained by the fact that the text in the terms and conditions was quite small in the user’s mobile device. Task three involved a relatively lengthy procedure of calling the customer service. One of the expert users was not able to complete that task due to the fact that the phone call functionality was missing from the user’s mobile device. Other than that, the novice users took twice as much as the expert users. In task four, the novice users also spent double the time taken by
the expert users. The task was related to acknowledging the campaign and exiting the application. The examiner observed that most users quickly acknowledged the campaign, the application exit step took longer. Instead of looking for the application back link, the users were looking for the phone “back” button. Both the novice users had to ask the interviewer for help. Task five was the final task and was about exiting the application without accepting the offer. All the users were able to complete this task. The users were quite comfortable in performing this task.

4.2 Analysis of Performed Task

This section contains an analysis of the performed tasks based on interviewer observation.

**TASK 1:** The task was about opening the E-invoicing campaign page by scanning the QR campaign code. The interviewer observed that both the novice users were unfamiliar with the QR technologies. The brief discussions prior to starting of the tasks were relatively more helpful to these group. Once the scanning was complete, some of the device only showed the campaign link and did not go directly to the campaign page. This caused confusion to both the novice users and one of the expert users. Two of the expert users had used QR code before and using this application was not new to them.

**TASK 2:** This task involved reading the terms of conditions related to the campaign. The interviewer observed that the test users could quickly open the terms of condition page, but one expert user had difficulty reading the content due to small font size. All the test users were able to return to the main campaign page after reading the terms.

**TASK 3:** This task involved the important functionality of calling the E-invoice operators customer service. One of the expert user was using a tablet to respond to the questionnaire and therefore could not make the call. The rest of the four test users were all able to complete this task. One of the steps was to return to the campaign home page using the device’s build-in back button – since the actual calling process is handled by the smartphone and is done outside the E-invoice campaign application. Most of the test users were not sure how to proceed and asked for instruction from the interviewer.

**TASK 4:** In this task, the users performed the most important objective of the campaign: accepting the E-invoice service offer. All the users were able to accomplish the
objective without any error. However, once the application displayed a confirmation message and asked the user to exit the application, novice users particularly looked a bit confused and did not know what button to press.

**TASK 5**: Here the users were asked to exit the campaign without accepting the offer. All the users by now knew how to exit the application and did not encounter any difficulties.

4.3 Results of User Experience Questionnaire

Upon completion of the test tasks, every test user was asked to fill up a usability questionnaire form. The questionnaire can be divided into two parts where the first set of questions asked about the validity of the test tasks: these groups contained three questions measuring overall satisfaction, the purpose of the task and the relevance of the task. The next group of question dealt with the user experience of the E-invoice campaign itself. Nielsen’s usability framework (see Chapter 2.3.2 and Figure 11) was used to assess learnability, efficiency, memorability, error and satisfaction. The findings of the validity questionnaire are gathered in following Table 8:

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Code</th>
<th>Very Satisfied (%)</th>
<th>Partly Satisfied (%)</th>
<th>Satisfied (%)</th>
<th>Not Satisfied (%)</th>
<th>Very Unsatisfied (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Usability Task</td>
<td>ust1</td>
<td>60</td>
<td>20</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>ust1</td>
<td>80</td>
<td>20</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>ust3</td>
<td>80</td>
<td>0</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>73.33</td>
<td>13.33</td>
<td>13.33</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Table 8: Result of Overall Satisfaction And Task Validation Questionnaire**

Figure 18 below graphically illustrates the result of the usability task questionnaire. A pie chart is chosen as it shows the different levels of satisfaction as a whole. The horizontal lines represent the percentage of very satisfied test users. The rectangular tilted brick section is used for partly satisfied responses whereas the solid square block rep-
represents the averagely satisfied test users. There were no *Not Satisfied* or *Very Unsatisfied* responses and so there are not included in the pie chart.

![Usability Task](image)

*Figure 18: Graphical Representation of Overall Satisfaction And Task Validation*

The questionnaire had a scale of five different satisfaction levels. The test found out that the test users were *Very Satisfied* with over 73% of the given tasks. While the test users were *Partly Satisfied* and *Satisfied* with an equal percentage of just above 13% for each.

### 4.4 Analysis of User Experience Questionnaire

The test session included a list of questionnaire which the users filled up once the test tasks were complete. Similar to the usability satisfaction and validity survey above, the user experience questionnaire also included a scale of five stages. Table 9 below outlines the result of the user experience questionnaire:
<table>
<thead>
<tr>
<th>Attributes</th>
<th>Code</th>
<th>Agree Completely (%)</th>
<th>Partly Agree (%)</th>
<th>Neutral (%)</th>
<th>Partly Disagree (%)</th>
<th>Disagree Totally (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learnability</td>
<td>lrn1</td>
<td>60</td>
<td>40</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>lrn2</td>
<td>0</td>
<td>40</td>
<td>60</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>lrn3</td>
<td>20</td>
<td>0</td>
<td>60</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Efficiency</td>
<td>efy1</td>
<td>60</td>
<td>20</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>efy2</td>
<td>40</td>
<td>20</td>
<td>20</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Memorability</td>
<td>mem1</td>
<td>40</td>
<td>40</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Error</td>
<td>err1</td>
<td>40</td>
<td>40</td>
<td>20</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>err2</td>
<td>60</td>
<td>0</td>
<td>20</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>stf1</td>
<td>60</td>
<td>20</td>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>stf2</td>
<td>20</td>
<td>60</td>
<td>0</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>40</td>
<td>28</td>
<td>22</td>
<td>8</td>
<td>2</td>
</tr>
</tbody>
</table>

Table 9: Result of User Experience Questionnaire

Figure 19 below graphically represents the result of the user experience questionnaire. Again, a pie chart is chosen as it shows each of the five factor attributes in relation to the other. This is justified by the fact that the most fundamental concept of usability attributes is the system’s overall usability which is calculated relative to all the other attributes (see Chapter 2.3.2). In Nielsen’s usability framework, usability is a multidimensional property and is relevant to test users performing a set of predefined tasks.
A score of 40% as *Agree Completely* means that the system has highly usable and the users have mostly positive experience of the E-invoicing campaign using QR technology. Moreover, the next scale of *Agree Partly* was assessed to be 28%. The combination of these two positive agreeable level results to a total score of 68% indicating that the system is largely usable. On the contrary, user experience score on *Partly Disagree* was 8% and *Totally Disagree* was 2% - a combined factor of 10% on poor usability is relatively low than the combined agreeing level of 68%.

5 Discussion and Conclusions

This chapter contains a discussion on the derived result found during the usability test tasks and user experience questionnaire. The discussion is based on Nielsen’s Usability Model (see Chapter 2.3.1) and includes reliability and validity of the methodologies in this research.

5.1 User Experience

Learnability allows the user to quickly utilize the system for productive purpose. When the users were performing the test tasks in E-invoice QR campaign, some users had
never been exposed to QR technology before. The novice users experienced small
difficulties in scanning the QR code and calling the customer service. In terms of
learnability, 27% of the users indicated that the application is highly learnable and
about 6% of the users marked that the system had very poor learnability.

Efficiency of E-invoicing campaign application means that the users are able to perform
all the required tasks and respond to the campaign. In efficiency time is an important
factor. The research result shows that the longest and shortest time taken to complete
all five tasks was 12 minutes and 6 minutes respectively. In this case the novice user
took twice as much time as the expert user. Moreover, 50% of the users believed that
the application is highly efficient while only 10% users thought the exactly opposite.

In terms of memorability, when the users were asked if they would be able to respond
to a similar QR campaign in future, 80% users told that they can do so without further
assistance while the rest 20% told they would still need help in future.

Since the E-invoice QR campaign is meant to run on mobile platform, Error prevention
resulting from software and hardware support is important. During the test one user
was able to respond to the campaign but was not able to use the call service feature.
Other than that 50% of the users were able to perform all the campaign task completely
error free while 10% of the users encountered severe errors such as the case of miss-
ing hardware functionality mentioned above.

Satisfaction in this research context measures how pleasant was to respond to the E-
invoicing campaign. Upon completion of all the campaign tasks 80% of the users re-
sponded that the E-invoicing campaign with QR code exceeded their average satisfac-
tion level while 20% of the users mentioned the application did not fulfil their expecta-
tion.

5.2 Validity

The validity of the usability questionnaire and data collection methodologies is im-
portant as the E-invoicing campaign used a relatively new approach to collect customer
responses. The design of the user experience questionnaire is based on Nielsen’s
summation evaluation technique (see Chapter 3.2). Two groups of test users were
chosen – expert and novice. Both these user groups had used paper invoice before but never used electronic invoice. So the summation evaluation approach was chosen in order to let the users compare the benefits of E-invoicing against paper based invoice.

As E-invoice campaign based on QR technology is a new phenomenon, it was important to experiment various usability aspects related to subjective satisfaction and potential anxieties. The first set of questions in the user experience questionnaire were designed to validate the usability task itself. In this part, three questions related to test procedure, relevance of the tasks and personal emotions were asked. Table 8 and Figure 18 above outline the outcome of that questionnaire. 73% of the user mentioned that the objective of the task and test relevance were clear and they were very happy to take part in this test. While 13% of the users were just satisfied with the experiment. This outcome is consistent in a manner that QR code technology is very popular among public users (Sansweet 2011).

5.3 Recommendations

The following is a list of recommendations which this research has identified while developing the E-invoice campaign using QR technology:

**QR code placement:** While designing a QR campaign, it is very important to place the QR code correctly so that the traditional paper invoice users can easily notice and can use the code. Moreover, the QR code should follow a short yet meaningful instruction to allow the users see the benefit from scanning the code. Sometimes it is worthy to personalize the QR code itself to reflect the sender organization or the E-invoice service operator’s emblem.

**Mobile Optimized Campaign Page:** Another equally important aspect of such campaign is that the campaign page should be optimized for smartphones. If the campaign web page is not adapted to fit the small mobile screens, then it means a serious usability problem and as a result the users might not bother to read the content further.

**Campaign Information:** QR code should be used to achieve a specific campaign objective such as promoting E-invoice or capturing customer data. Therefore, the campaign page should contain minimum possible data – precise to that particular campaign. An enormous amount of content regarding the benefits of E-invoicing and the
service operator should be excluded from the campaign page to maintain superior user experience. The principle is to allow simplicity over information overload.

**Tracking the campaign:** E-invoicing campaign with QR technology provides many ways to track the effectiveness of the campaign in real time. For example: who scans the code, when, how often, where and what to user does after coming to campaign site can all be tracked. The tracking information can give both the E-invoice service providers and the senders a great deal of valuable insights.

**Social Media:** The E-invoicing campaign should consider integrating social media. The vast amount of user generated content can provide useful insight on service improvement and the success of the ongoing campaign. Moreover, the use of social media can lead to word of mouth and hence provide many promotional opportunities through popular social networking sites.

### 5.4 Conclusions

The research objective was to gain understanding of various user experience factors related to E-invoicing campaign with QR technology. For this purpose the study adopted a research methodology based on Nielsen’s usability framework which the users seemed to like. Five test users who never used electronic invoicing were chosen. The users were then given to perform a set of predefined task related to responding to an E-invoice campaign. In the first stage of the test, the users scanned the QR code and open the campaign page on their smartphone screen. The users then gradually performed all the five tasks related to acknowledging the campaign, calling the customer service for more information or denying to receive electronic invoice altogether. In the second stage of the test the users replied to a set of user experience questionnaire based on Nielsen’s five usability attributes and the validation of task itself.

The main research question was to find out what factors influence the User Experience while using QR Technology in the context of E-invoicing campaign. According to the findings of this research the users were highly satisfied with the fact that QR scanning saved their time and they did not have to perform any data entry. Furthermore, this study shows that most of the users were willing to use QR technology for similar purpose and without any further assistance. Some of the users were very happy to use such a fresh technology in the context of E-invoice campaign. The outcomes imply that
the use of QR can have a positive impact in promoting user experience of an E-invoicing campaign.

A key limitation of this study was that the users were assumed to have a smartphone built in with QR reader. Older generation who have never used a smartphone or QR technology were left outside the scope. Young users are just one segment of Electronic Invoicing users, and therefore, the findings of this research might not be transferable to elderly users. Further research may include developing a campaign specially meant for the elderly generation and carrying out a user experience analysis based on that prototype.
References

Metropolia Thesis Instruction and Guidelines, 2013, Access on 30.9.1013


Westwood, Eveliina 2013. Perceived Customer Value and Software Usability: a Multiple Case Study in Electronic Invoicing. Aalto University School of Economics.


User Experience Questionnaire Response

The objective of this experiment was clear and I felt comfortable to respond to this campaign.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

The instruction for the tasks were clear and it was easy to follow them.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

I was happy to take part in this experiment and I am satisfied that I didn’t have to use my computer keyboard.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

It was easy to learn to respond to the campaign.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

I have learned a lot during this experiment.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

I’m interested to use similar campaigns in future.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

The entire process is quick and I could accomplish my objective.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

I consider the QR scanning procedure saved my time.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

I am able to respond to a similar campaign without any further instruction.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

I did not make any error while performing the tasks.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

The application performed the tasks without any error.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

I am satisfied about how this campaign used QR technology on a smartphone.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |

Now that I have seen the whole process, I believe it positively exceeded my expectation.

| Agree | 5 | 4 | 3 | 2 | 1 | Disagree |
The objective of this experiment was clear and I felt comfortable to respond to this campaign

agree 5 4 3 2 1 disagree

The instruction for the tasks were clear and it was easy to follow them

agree 5 4 3 2 1 disagree

I was happy to take part in this experiment and I am satisfied that I didn’t have to use my computer keyboard.

agree 5 4 3 2 1 disagree

It was easy to learn to respond to the campaign

agree 5 4 3 2 1 disagree

I have learned a lot during this experiment

agree 5 4 3 2 1 disagree

I’m interested to use similar campaign in future

agree 5 4 3 2 1 disagree

The entire process is quick and I could accomplish my objective.

agree 5 4 3 2 1 disagree

I consider the QR scanning procedure saved my time

agree 5 4 3 2 1 disagree

I am able to respond to a similar campaign without any further instruction

agree 5 4 3 2 1 disagree

I did not make any error while performing the tasks

agree 5 4 3 2 1 disagree

The application performed the tasks without any error

agree 5 4 3 2 1 disagree

I am satisfied about how this campaign used QR technology on a smartphone.

agree 5 4 3 2 1 disagree

Now that I have seen the whole process, I believe it positively exceeded my expectation.

agree 5 4 3 2 1 disagree
The objective of this experiment was clear and I felt comfortable to respond to this campaign.

agree 1 2 3 4 5 disagree

The instruction for the tasks were clear and it was easy to follow them.

agree 1 2 3 4 5 disagree

I was happy to take part in this experiment and I am satisfied that I didn’t have to use my computer keyboard.

agree 1 2 3 4 5 disagree

It was easy to learn to respond to the campaign.

agree 1 2 3 4 5 disagree

I have learned a lot during this experiment.

agree 1 2 3 4 5 disagree

I am interested to use similar campaign in future.

agree 1 2 3 4 5 disagree

The entire process is quick and I could accomplish my objective.

agree 1 2 3 4 5 disagree

I consider the QR scanning procedure saved my time.

agree 1 2 3 4 5 disagree

I am able to respond to a similar campaign without any further instruction.

agree 1 2 3 4 5 disagree

I did not make any error while performing the tasks.

agree 1 2 3 4 5 disagree

The application performed the tasks without any error.

agree 1 2 3 4 5 disagree

I am satisfied about how this campaign used QR technology on a smartphone.

agree 1 2 3 4 5 disagree

Now that I have seen the whole process, I believe it positively exceeded my expectation.

agree 1 2 3 4 5 disagree
Appendix 1

The objective of this experiment was clear and I felt comfortable to respond to this campaign.

agree [1] 2 3 4 5 disagree

The instruction for the tasks were clear and it was easy to follow them.

agree [1] 2 3 4 5 disagree

I was happy to take part in this experiment and I am satisfied that I didn’t have to use my computer keyboard.

agree [1] 2 3 4 5 disagree

It was easy to learn to respond to the campaign.

agree [1] 2 3 4 5 disagree

I have learned a lot during this experiment.

agree 1 2 3 4 5 disagree

I'm interested to use similar campaign in future.

agree [1] 2 3 4 5 disagree

The entire process is quick and I could accomplish my objective.

agree [1] 2 3 4 5 disagree

I consider the QR scanning procedure saved my time.

agree 1 2 3 4 5 disagree

I am able to respond to a similar campaign without any further instruction.

agree [1] 2 3 4 5 disagree

I did not make any error while performing the tasks.

agree 1 2 3 4 5 disagree

The application performed the tasks without any error.

agree [1] 2 3 4 5 disagree

I am satisfied about how this campaign used QR technology on a smartphone.

agree [1] 2 3 4 5 disagree

Now that I have seen the whole process, I believe it positively exceeded my expectation.

agree [1] 2 3 4 5 disagree
The objective of this experiment was clear and I felt comfortable to respond to this campaign.

agree | 1 | 2 | 3 | 4 | 5 | disagree

The instruction for the tasks were clear and it was easy to follow them.

agree | 1 | 2 | 3 | 4 | 5 | disagree

I was happy to take part in this experiment and I am satisfied that I didn’t have to use my computer keyboard.

agree | 1 | 2 | 3 | 4 | 5 | disagree

It was easy to learn to respond to the campaign.

agree | 1 | 2 | 3 | 4 | 5 | disagree

I have learned a lot during this experiment.

agree | 1 | 2 | 3 | 4 | 5 | disagree

I’m interested to use similar campaign in future.

agree | 1 | 2 | 3 | 4 | 5 | disagree

The entire process is quick and I could accomplish my objective.

agree | 1 | 2 | 3 | 4 | 5 | disagree

I consider the QR scanning procedure saved my time.

agree | 1 | 2 | 3 | 4 | 5 | disagree

I am able to respond to a similar campaign without any further instruction.

agree | 1 | 2 | 3 | 4 | 5 | disagree

I did not make any error while performing the tasks.

agree | 1 | 2 | 3 | 4 | 5 | disagree

The application performed the tasks without any error.

agree | 1 | 2 | 3 | 4 | 5 | disagree

I am satisfied about how this campaign used QR technology on a smartphone.

agree | 1 | 2 | 3 | 4 | 5 | disagree

Now that I have seen the whole process, I believe it positively exceeded my expectation.

agree | 1 | 2 | 3 | 4 | 5 | disagree