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## **ETHICAL CONCERNS RAISED BY USING NFC TECHNOLOGY FOR MOBILE PAYMENTS: AN EMPIRICAL STUDY**

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### **ABSTRACT**

Technology develops rapidly and this continually leads to the raising of new ethical problems. Technology, like medicine, sometimes causes negative side effects. One of these emerging technologies is near field communication (NFC). This paper aims to explore the ethical concerns that arise as a result of using NFC technology for mobile payments. A qualitative focus group method was used to identify the ethical concerns raised by using this technology. The research findings raised ethical concerns which are categorised into three main issues: dependency and vulnerability, inequality, and privacy. The research findings also proposed a set of proactive actions, from the participants' perspective, that can be taken to address these concerns, and it identified which agents are responsible for addressing them.

**Keywords:** Near Field Communication, NFC, ethics, emerging technologies, mobile payments, focus group

### **INTRODUCTION**

NFC is a wireless communication technology that enables the transfer of data over distances of up to twenty centimetres. It is based on radio frequency identification (RFID) technology. NFC enables mobile devices to automatically exchange data when two devices are physically close to each other. This technology has been recently (2009) used in various industries such as retail, automobile, security, and transportation. The first trials of using this technology started in 2006/2007 [30]. In this research, the focus will be on addressing the ethical concerns of using NFC-enabled technology to make mobile phone payments in the retail industry. Mobile payments are payments made for goods, services, and bills using a mobile device by taking advantage of wireless and communication technologies [4]. As it is emerging technology, it is still not widely used or applied for mobile payments. However, Juniper Research expects that there will be rap-

id adoption of NFC and that one in five users worldwide will have an NFC-enabled phone by 2014 [29].

As soon as a new technology is created, any possible ethical concerns should be highlighted immediately in order to use this technology in such a way that protects human values such as life, health, justice, freedom, happiness, opportunities, and security. One should not wait until the ethical problems negatively impede society and individuals in an extreme manner. This also conforms with Stahl et al. [21, P.1] viewpoint that "The best way of creating IT policy that is sensitive to ethical issues pertain to being proactive in addressing such issues at early stage of the technology life cycle". This means that the ethical discussion and questions of any emerging technology should be addressed at early stage of adoption and use, and once releasing it in the market. In addition, IT development team needs to ensure that ethical principles are revised when begin the process of designing and developing the technology.

Sandler [19] indicated, some people have misconceptions about ethics and emerging technology. One of

these misconceptions is the belief that “It is too soon to tell what the social and ethical issues are” [p.6]. He states that some people believe that it is too early to discuss the ethical and social issues raised by the emerging technology. This is due to the narrow focus on the technology itself and neglecting the broader contextual factors. Therefore, it is timely and reasonable to think about the possible impact of this emerging technology earlier. The current paper aims to explore the ethical problems that NFC raise, an area that has clearly not been covered by researchers, as will be shown later in the literature.

The remainder of this paper is organised as follows: the next section provides a literature review on NFC related research. Section 3 presents the research methodology applied to the current study. Section 4 presents the ethical issues that might arise by adopting NFC technology for mobile payments, as perceived by the research participants. Section 5 presents proposed strategies/actions to address the ethical concerns that arise as a result of using this technology, from the participants’ perspective. Section 6 provides discussion. Finally, the conclusion and future research directions are provided.

## LITERATURE REVIEW

NFC is a short-range, standards-based wireless technology, based on RFID technology which enables communication between electronic devices in close proximity. NFC operates in the standard unlicensed 13.56MHz frequency band over a distance of up to around 20 centimetres. It offers data transfer rates of 106kbit/s, 212kbit/s and 424kbit/s [31]. The NFC Forum was formed in 2004 with the aim to advance the use of NFC technology by developing specifications, ensuring interoperability among devices and services, and educating the market about NFC technology. However, regarding the specifications and standards, the NFC Forum [30] website mentions that: *work on more specifications is well underway*. Consequently, some specifications and standards were recently defined in 2011/12 to insure mobile-enabled NFC meets global interoperability, whereas some are still in progress.

The NFC technology is designed for usage in mobile phones. The first mobile phone enabled by NFC was developed by Nokia (Nokia 6131) in 2006 [32]. The NFC tag can be read by mobile phone NFC-enabled or reader-NFC (Figure.1.A and B). The mobile phone NFC-enabled can communicate with the reader-NFC or another mobile phone NFC-enabled (Figure.1 C and D) [2].

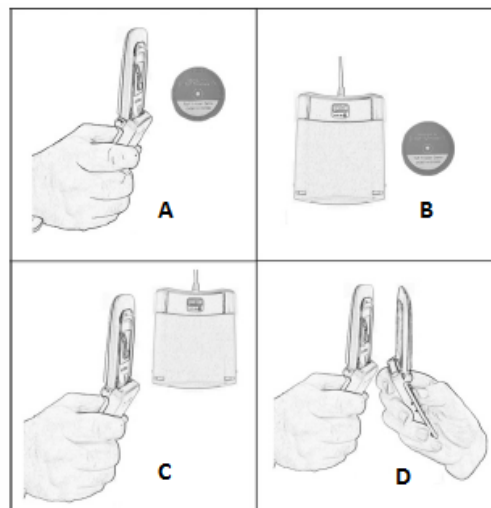


Figure1: Four Ways of NFC Communications  
Adapted from Chavira et al. [2]

There are benefits of using NFC technology for mobile payments, as specified by Massoth and Bingel [12]. They mentioned that NFC enables faster and more convenient payments that are 25 per cent more efficient than traditional payment methods. McElligott [13] supports this, stating that it requires twenty-two seconds to make a payment using a debit card compared to only three seconds when paying using NFC-enabled mobile phones. Furthermore, using NFC for mobile payments reduces the risk and increases the safety level by preventing individuals from having to carry three or four credit/debit cards in their wallet, thus avoiding disclosure to thieves.

Technology-creating countries will always appear to be those starting the revolutions. For example, the first trials of NFC use started in the United States between 2006 and 2007, in 2008 in Canada, between 2007 and 2008 in the United Kingdom, and 2007 in Japan [3]. Other countries such as the UAE have recently (2011-2012) introduced NFC technology for payment services [33] which is six years after its invention. Undoubtedly, many countries still lag far behind in terms of adopting and using this technology. NFC Forum members have been involved in over 65 NFC implementation projects in countries such as the United States, Germany, Austria, Netherlands, Finland, Spain, United Kingdom, France, South Korea, China, and Taiwan [3].

In fact, very little scientific research has been published on NFC. As Thomas et al. [24] pointed out, this technology has not yet received a lot of attention from researchers due to its recent emergence. Özdenizci et al. [18] also noted that the literature review on NFC does not

include many articles published in journals. However, they wrote a state-of-the-art paper by examining the literature on NFC. They reviewed 74 academic papers from 2006 to 2010. Their findings reveal that the majority of NFC research (30 out of 74) is related to NFC applications and NFC application developments, with the second largest proportion of papers being related to the “NFC infrastructure”. Only a few of them (7 published papers out of 74) focused on the “NFC ecosystem”. They examined the NFC ecosystem in three major categories. The first two are “NFC economics and strategy”, and “NFC business models and processes”, which deal more with the business requirements, analysis and managerial side of NFC technology. The third aspect is the “NFC stakeholders, structure and culture”, which deals more with the social and ethical issues of NFC technology. Özdenizci et al. [18] pointed out that this is a demanding area of investigation. Thus, according to the previous state-of-the-art articles regarding previous NFC research (from 2006-2010), it is evident that there is a need to highlight the social and ethical concerns that might arise by adopting NFC-enabled technologies. This is an interesting area for investigation, as no previous research has highlighted it.

Thomas et al. [24] conducted research study to investigate the adoption of NFC by retailers. They conducted a survey of European retailers to identify their plans and perceptions regarding the application of NFC technology. The survey showed that NFC applications are not considered a potential cost saver by the responding retailers. Conversely, the respondents expect that the implementation of NFC will result in additional costs. The respondents also agreed that NFC-based payment has the potential to speed up the payment part of the check-out process. However, they are not convinced that their customers will be enthusiastic about NFC-based services.

Wiechert et al. [24] explored the use of NFC-based applications in retail stores. They conducted semi-structured interviews with nine European retailers in Switzerland and Germany. The nine European retailers pointed out that supermarket store operators indicate a greater interest in NFC technology that can accelerate the check-out process while department store operators are more interested in improving the shopping experience on the store floor. Retailers operating department stores were less interested in expediting their checkout processes, because, in their viewpoint, queues do not cause as major of a problem in their stores as they do in supermarkets. In addition, the check-out process is a less important part of the shopping process at a department store than it is in a supermarket. The reason is that the average number of products bought by customers is smaller, which results in shorter scanning processes. Another reason is the fact that

many customers do not have specific needs in department stores, but rather ramble idly or leisurely through the stores and enjoy the shopping experience. This means that customers are not in a hurry and do not wish to leave the store as quickly as possible. On the other hand, the retailers highlighted that shoppers usually do not visit supermarkets for pleasure or to treat themselves, but rather to fulfill the basic needs of acquiring food and household necessities. Therefore, most customers wish to spend as little time as possible in a supermarket. Wiechert et al. [24] emphasised in their paper that NFC-based applications would not fundamentally change the customer shopping process, but merely support it in the check-out area.

Many previous research studies addressed the ethical implications of RFID technology—of which the NFC is an extension—with concerns about privacy, tracking people and surveillance, the risk of coercion and health problems [5] [6][9][15]. However, no existing research highlights the ethical concerns associated with using NFC in the retail context. Although the NFC is based on RFID technology, it has different uses and applications. Thus, these pose additional ethical questions, which will be discussed in the next sections. The main difference between RFID and NFC is that the first has a wider range of data transmission, whereas NFC has a limited range that does not exceed a few centimetres.

The development of ICT raises a new problems, which create new debates and questions that are linked to ethics. Ethics is an integral part of philosophy that is concerned with issues of good and bad or right and wrong acts (Stahl, 2007). One approach to study ethics and ICT is through the identification and analysis of the impact of ICT on human values like health, equality, opportunity, freedom, democracy, privacy and security [7][11][14].

The current paper will avoid discussing a variety of ethical theories and the philosophy behind each one. Rather, it will focus on identifying the ethical problems associated with the usage of NFC technology for mobile payment, from the customers’ perspective. In another words, it explores the negative impact of this emerging technology on individual customers and provides, based on their perception, solutions that could limit its negative impact. Taking the advice by Lucas [11] who stated that:

Irrespective of whether information technology creates new types of ethical problems that require new ethical theory or whether established ethical theory is sufficient, one tends to find the debate centered on questions of policy that is intended to regulate or justify conduct vis-à-vis the negative impact produced by certain uses or implementations of IT.

## RESEARCH METHODOLOGY

A qualitative focus group method was adopted in this study. Focus groups allow the researcher to obtain insights into people's perceptions, attitudes and experience from a group discussion in a short amount of time [16][17]. As NFC technology is relatively new and not widely spread, the focus group is an appropriate method in this research as some of the participants may not know much about the research topic; this requires a group discussion to stimulate all the participants to make a contribution and enrich the discussion. All group members were undergraduate students and some of them were professional workers. All participants had mobile phones (the great majority had modern ones) and some of them had mobile phones which were NFC-enabled.

The literature suggests that the number of focus group meetings needed within a study should be more than one [17]. In the current research, three focus groups sessions were carried out. Each one lasted about 75 minutes. The literature also suggests that the number of focus group participants should be in the range 4–12 [8], 6–10[17], or 6–12 [10]. In the current study, there were four participants in Group 1, and none of them had NFC-enabled mobile phones. The second group consisted of 16 participants, and 10 had mobile phones enabled by NFC. The third group consisted of 17 participants, but only five of them had NFC technology in their mobile phones. Some of the participants discovered during the course of the meeting that they had this technology in their mobile phones. They were not previously aware that they had it, or of the need for it. The current research study used a different numbers of participants from that recommended by literature. The number of participants in Group 2 and 3 was relatively higher than previous literature has suggested. However, the reason for this larger number is due to nature of the research topic which involves discussion and debate about new emerging technology that is not widely accepted by individuals or merchants, so it was expected that some of the participants would be unfamiliar with this technology. However, their contribution could still be considered as effective in raising questions and enquiring about it, and providing their opinions, while others who were more familiar could provide answers based on their opinion and experience.

The researcher led the discussion by introducing the objectives of this research and providing a briefing about NFC technology its applications. A short video presentation about using NFC for mobile payment was also viewed in the meeting. The questions asked in the discussions were semi-structured and open in nature. The discussions revolved around two main questions: 1) What

are the negative impacts of using NFC technology for mobile payment, on individuals and society? 2) What are the possible actions and solutions that can be set out to regulate, and minimise the negative impact of its usage?

Because the number of participants in Group 2 and 3 were relatively large, the researcher divided the groups into four subgroups. The participants were asked to spend a few minutes writing their answers in note form and discussing them, first with the members of each subgroup, and then in open discussion among the whole group. The focus group session results were documented on paper by the participants themselves (sample is attached in the appendix), and notes were taken by the researcher during the open discussion. The researcher applied comparative analysis [23] on collected data by comparing the ideas with each other's and then similar key points were grouped under one category. The categories names were reflected from the data itself as well as from previous theoretical concepts which are well-defined in the literature (e.g. privacy issue).

## RESULTS: ETHICAL CONCERNS OF USING NFC FOR MOBILE PAYMENTS

The findings that came out from the focus groups' discussions were categorised into three main ethical/social concerns as perceived by the participants:

### Dependency and Vulnerability

Some participants pointed out that Mobile phones emit radio waves that will affect the user's body long term and may cause cancer especially when people become highly dependent on mobile phones. One group also pointed that reliance on technology (i.e. NFC) will replace human with machine which does the job instead of them as there is no need for cashiers to process the payment at check-out points. Rather, customers can communicate directly with machines.

The participants reported that losing or misplacing a mobile phone would cause inconvenience and could get individuals into trouble, especially when they are totally reliant on NFC-enabled mobile phones for making payments. One group stated: *"If you lost the device having the NFC without having cash or credit card, you maybe got in trouble"*. Another group also pointed that *"battery damage will make hard times"*. This is because they cannot manage without access to funds. Participants also pointed out that the mobile phone is more accessible than cash or credit cards since, whilst the last two are usu-

ally kept in pocket or wallet, the mobile phone is usually carried in the hand for much of the time and the probability that family members or friends or thieves might get access to it becomes higher. This could make immature youths misuse their parents' mobile phones, as they (the youths) could obtain the pin number easily from their parents. In this regard, the participants perceived that there should be an additional security feature on the mobile phone like fingerprint. In addition, according to the one subgroup's participants, using an NFC-enabled mobile phone might make users irresponsible about their spending behaviour as they become less conscious about easy-to-make payments by mobile phone, as just "Wave and Go" process.

Participants also indicated that using this technology might be very difficult for people to adjust to. This technology is not complementary which means it cannot be added to the currently used mobile phones. Instead, it requires the replacement of the current mobile phone with a new one which has this technology built into it. This means that it will require a long time for this technology to be widespread, as the great majority of current mobile phones are without this technology. In this context, some participants also pointed out that it will be complicated for some to make payments with this technology, especially elderly people who wish to pay by cash directly.

Participants also reported that not all shops accept payment using this technology (*"not all stores may be able to afford this technology"*). They said that once the user depends on it in a particular area, they will find it difficult when moving from one city or area to another one, since the user was used to avoiding carrying cash/credit cards, but might need it in the new area. Also, some pointed out that, there is no value of mobile-enabled NFC if no merchant provides payment service through it. They stated: *What is the point of having mobile-enabled NFC if no payment services are provided by merchants through this technology?*

### **Inequality**

The participants pointed out that NFC technology will also increase inequality between people; it will enable individuals who have Blackberry mobile phones, for example, to enjoy rapid payment services at sales points, whereas others who do not have a smartphone will have to wait longer in queues. Participants pointed out that not everyone can afford to purchase a Blackberry or iPhone to make payments using these special smartphones. Therefore, the level of inequality will increase, even among the high class of people. The participants also pointed that prices could be reduced by estab-

lishing standard universal NFC chips which all mobile phones manufacturers, including manufacturers of cheaper phones, could add to their mobile devices. They pointed that not all phones have it and that limiting this technology to leading manufactures like Apple, Blackberry and Nokia, will keep the prices high for a longer period, and delay its widespread acceptance by the ordinary consumer. Participants also pointed out that since this technology is new, some early adopters will consider it to be a prestigious way of payment; they may be high tech people, whereas majority are not familiar with this technology. This could lead to snobbishness about the technology and inequity among customers.

### **Privacy**

An additional ethical concern, revealed by the participants, is that banks will know more about customers, who will use NFC-enabled mobile phones to pay for every purchase. When banks collect data about customers, they can analyse this data to identify customers' purchase patterns, preferences, habits and behaviours such as where they spend their money, when they spend it, and in which shops. For example, one group pointed that *"Bank will easily know our location, and our payment processes, we can easily be tracked"*. In fact, this is not new, as banks can identify this information by tracking credit card transactions. However, as perceived by the participants that by using NFC technology, this might be extreme. Every payment can be tracked, whereas before NFC, there was a possibility of avoiding being tracked by paying cash for some purchases. Thus, the more data gathered, processed and transmitted, the more privacy is violated and breached.

Obviously, this issue is related to the first issue of dependency and vulnerability. As participants pointed out, because of the high dependency on mobile phones, banks and telecommunication companies will easily know individuals' locations and their payments if their phones are NFC-enabled. The participants pointed out that nobody leaves home without provision of sufficient funds (cash or credit cards); therefore if this becomes available via mobile phones, then no one can leave home without carrying their mobile phone, and thus there would be greater violation of people's privacy (information and physical privacy).

## STRATEGIES/ACTIONS TO ADDRESS THE ETHICAL CONCERNS

Table 1 summarises the ethical/social implications of using NFC technology for mobile payments, the appropriate solutions to address them, and the responsible agents for that, from the participants' perspective. To address the ethical concerns that arise as a result of using NFC technology for mobile payments, businesses, banks and telecommunication should establish relevant strategies and policies, with the aim of avoiding or alleviating the negative consequences of using this emerging technology. As indicated in this paper, this technology is relatively new. Therefore, considering these ethical concerns from the beginning will help to reduce the negative effects of the use of the technology. The following are some actions, came out from the focus group meetings that need to be taken, in collaboration with stakeholders, to address some of the ethical/social concerns:

- ♦ Continue providing alternative payment methods at the sales point to cover all categories of purchaser (by cash, credit card, cheque, and NFC-enabled mobile phones). Although this seems obvious but it is essential as cash notes will have disappeared by the time as forecasted by Trendwatching [25]. Users also need to have spare cash or credit cards just in case their mobile phone is stolen or lost.
- ♦ Limiting the purchase amount, so if the phone is stolen or misused, someone else cannot spend huge sums on purchases.
- ♦ Developing mobile phones with robust security features, for example, using fingerprints to logon to the mobile and authorise payment, as there is the probability of losing the mobile or its misuse by friends or family members who know the password and pin number.
- ♦ Providing a mobile payment service for customers at zero cost; therefore, customers do not have to pay fees if they want to process a payment through an NFC-enabled mobile phone. Rather, merchants should pay the fees, as this can be considered a better service provided to customers, which accelerates the checkout process.
- ♦ Offering NFC-enabled mobile phones at affordable prices, so most customers with moderate salaries can purchase them and use them to pay for goods and services.
- ♦ Banks that offer credit cards for the mobile payment service should obtain informed customer consent and agreement over how their data will be used and for what purposes, as this becomes more necessary when using NFC technology, where people information and location privacy might be violated.
- ♦ NFC manufacturers should create universal standard NFC chips and cooperate with other industries in incorporating them in all cheaper mobile phones.

Table 1: Ethical/social concerns raised by using NFC technology for mobile payments, and the appropriate polices and solutions to address them and by which agents

Ethical and Social concern	Policies/ strategies/ actions/ solutions to tackle the concern	Responsible agents
Dependency and vulnerability	Providing alternative payment methods at the sales point to cover all categories of purchaser (by cash, credit card, cheque, and NFC-enabled mobile phones).	-Merchant -User -Banks -Mobile phone developer and designer
	Using spare cash or credit cards to avoid vulnerability and being in critical situations just in case mobile phone is stolen or lost	
	Limiting the purchase amount made via mobile phones NFC –enabled so if the phone is stolen or misused, someone else cannot spend huge sums on purchases.	
	Developing mobile phones with robust security features, for example, using fingerprints to logon to the mobile and authorise payment	
Inequality	Providing a mobile payment service for customers at zero cost (no extra charges)	-Merchants -Mobile phone manufacturers
	Offering NFC-enabled mobile phones at affordable prices	
	NFC manufacturers should create universal standard NFC chips and cooperate with other industries in incorporating them in all cheaper mobile phones.	
Privacy	Obtain informed customer consent	-Banks -Telecommunication companies

## DISCUSSION

It is obvious that technology is not neutral, but rather is an instrument that raises the above-mentioned ethical concerns. However, there is also the question of accountability: who is responsible for these ethical and social concerns and the damage that will occur to customers and/or society as a consequence of introducing this technology in the retail industry? When technology inventors, producers (telecommunication and mobile phone providers), and customers (retailers and banks) bring this technology to the market, they think first about the competitive advantage and business value that this technology achieves.

Mobile phone producers want to sell new innovative technology (for example, Blackberries with NFC) in the market. Banks and/or merchants want to charge for this service, which they consider a source of revenue. Nonetheless, they are also responsible for introducing this technology in an ethical way. They may not be aware of all the discussed ethical concerns when this technology is brought to the market. Ethical concerns may also be the

furthest from their mind, as their main priority is the business value that this technology offers. Hence, one can also argue that humans are responsible for raising the ethical concerning the technology. Technology itself does not intentionally raise these problems; rather, they result from the way in which people decide to use it. If one supposes that everyone is able to purchase mobile phones enabled by NFC technology, then the technology does not per se raise the inequality among customers at the check-out point. All will receive the same service, assuming that the mobile phones enabled with NFC are affordable and no fees are charged for this payment service. This is the responsibility of the banks and merchants from one side to provide this service at no charge, and the telecommunication companies from another side to offer mobile phones NFC-enabled at affordable prices. The notion that is important to highlight from this discussion is that both technology and humans together cause these ethical concerns to surface.

In fact, many previous research studies indicated that the development and diffusion of ICTs have increased the social and economic inequality among individuals and societies [1][26][27][28]. However, using NFC will also

go one step further to exacerbate inequality, even among people in the same class or level. For example, two types of Blackberry NFC phone have been recently (2011/12) offered in the market: the Bold 9900/9930 and Curve 9350/9360/9370. The price of mobile phones NFC-enabled is relatively high, which excludes large number of people who cannot afford smartphones enabled by NFC, even in high-income countries. In developing countries, this price is higher than the average salary.

The digital divide will spread among the micro-population, among people who are educated, high class, living in urban cities, and are familiar with the technology. This is the second level of a digital divide. It is not like traditional digital divide which usually happens when two distinguished classes or levels of people, for example, people who live in urban cities, have used technology and have access to the Internet and people who live in rural areas who do not.

The cost of substituting the technology is also high, as the majority of consumers own mobile phones that are not NFC-enabled. Here adoption of this technology requires undoubtedly replacing the traditional mobile phone as majorities have mobile phones without NFC technology. When only one or very few manufacturers provide smart phone NFC-enabled, the price tends to be high. For this reason some consumers wait to adopt this technology until the price drops. However, if many manufacturers offer it, its price decreases due to strong competition. Indeed, before NFC is produced by many manufacturers, its standards and specifications need to mature. The participants pointed that there is no value of mobile phone NFC-enabled if no shop provides payment service through it. The value of having mobile phone NFC-enabled is zero if no merchants accept the payment through it. Otherwise, it is useless to substitute the traditional mobile phone with another one that is NFC-enabled.

Previous research showed that privacy is one of the main concerns associated with using other technologies like RFID technology. The current paper also showed that this concern is associated with NFC technology. However, the level and scope of this concern are different depending on the technology and its application. Obviously, when a new emerging technology is used in different applications, new unexpected concerns arise. For example, RFID technology is used in many applications. When it was used for managing and tracking goods in inventory, the ethical concerns were very minor. However, when it was later used for human tracking by implanting an RFID under the skin, it raised new concerns. Therefore, when a new application is identified, new social and ethical concerns are expected. However, this will increase to a certain point where no more applications are expected to

appear and where similar concerns such as privacy are repeated across different applications. As mentioned before, because of the high dependency on mobile phones, individuals' locations and their payments can be easily tracked by banks and telecommunication companies, if their phones are NFC-enabled. And this will be extreme as the user will be reliant on his/her mobile for processing the payment for every single and small purchase. Although NFC is based on RFID, a new concerns (i.e. inequality, dependency and vulnerability) are associated with NFC resulted in the current research, which was not addressed clearly with RFID due to the difference in using of these two technologies.

## CONCLUSION AND FUTURE RESEARCH

This paper has made contribution by addressing the ethical concerns that would arise by adopting NFC technology for mobile payments. The notion of this paper came through examining the literature on mobile payments and NFC, which indicated that ethical and social issues need to be discussed and investigated, an area that has not yet been sufficiently covered. This paper has shed some light on these ethical concerns and provided some solutions to address these concerns, from the customers' perspective. These can be considered proactive actions, as this technology is relatively new and not widespread in the retail industry. Any policies and strategies established to regulate the use of NFC for mobile payments in the retail industry should be formulated in coordination with all of the stakeholders who will benefit from it. As discussed, once a new technology emerges, its ethical concerns need to be highlighted, even though it is not currently widespread.

For future research, it is worth conducting empirical research, by quantitative research methods, to determine whether if these discussed concerns are valid, and to empirically examine using large sample whether they influence customers. For example, one hypothesis that can be tested is whether "the use of mobile phones enabled by NFC will negatively influence customers who do not have this option when paying at the sales points. In other words, the use of NFC-enabled mobile phones increases inequality among customers. Another hypothesis that might be tested is whether "the use of NFC-enabled mobile phones for payment increases customers' vulnerability, as their privacy is violated much more than when they pay with a credit card or cash". Examining such a hypothesis will provide further insights into the impact of this emerging technology on customers.



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## APPENDIX: SAMPLE OF NOTES WRITTEN BY THE PARTICIPANTS

