VALUE-BASED ADOPTION OF CONTACTLESS NEAR FIELD COMMUNICATION (NFC) PAYMENTS: AN EMPIRICAL INVESTIGATION

Abstract

The objective of this study is to investigate empirically the adoption of credit card contactless payments with smartphones. Contactless Near Field Communication (NFC) mobile payments, that are sought to develop exponentially worldwide in the near future due to their unquestionable advantages, may also face some user doubts. To investigate consumer possible positive and negative perceptions about this innovative mobile service, a value-based adoption model was developed and tested through a cross-sectional survey experiment involving 289 participants in Canada. Findings indicate that utilitarian and enjoyment values are the main motivators while perceived psychological and privacy risks the most significant user deterrents of NFC payments with smartphones. Overall, this research indicates enabling elements of consumer adoption of contactless NFC payments that should be reinforced, on one side, and perceived obstacles that should be mitigated, on the other side, to ensure the success of this new information and communication technology (ICT) service. Furthermore, from a theoretical perspective, this study proposes a broader view of the perception of value by integrating perceived risk into an unbiased value-based model of ICT adoption.

Keywords: Near field communication mobile payments, Perceived value, Perceived risk, Adoption.
1 Introduction

Contactless credit card payments with smartphones using Radio Frequency Identification (RFID) and Near Field Communication (NFC) technologies are set to become the most common means of electronic payment in mobile commerce transactions in the near future (Rose, 2012). NFC-based mobile payments using smartphones will, reportedly, increase from $4 billion in 2012 to $191 billion in 2017, breaking the $100 billion mark in 2016 globally (ABI, 2012).

For instance, market analysis companies forecast high figures for Canada alone: Technology Strategy International estimates that about 80% of the smartphones in use will be NFC-enabled while IE Market Research predicts total mobile payments will reach $14.2 billion by 2016 (Canada Newswire, 2012). Contactless mobile payments in Canada are envisioned as a convenient, open, safe and secure system supported by clear standards and operating framework (Canadian Bankers Association, 2012).

These facilitating conditions are expected to increase user choices and satisfaction and, consequently, accelerate the adoption of NFC-based mobile payments. However, it is important to also consider the possible barriers to user acceptance as credit card use itself is sometimes feared as posing various risks and threats. Therefore, a new information and communication technology (ICT) based on more sophisticated use of credit cards might exacerbate some of the already negative user perceptions.

In general, it is well-established in Information Systems (IS) research that, beyond technology and business aspects, user views on an ICT application are a key determinant for the eventual success of that technology (Venkatesh, Speier, and Morris, 2002). Furthermore, a service innovation is successful only when it is accepted by the market (Burgelman, Christensen, and Wheelwright, 2004). Research has shown that there are many factors that could affect the perceptions and attitude of target customers on a new ICT and ensure its acceptance and ultimate success. While positive views like the perception of usefulness or of ease of use are favourable factors, negative views like the perception of risk or lack of control are deterrents for the use of a new ICT solution.

As no scientific investigation regarding user perceptions of the incipient NFC-based mobile payments was found in the literature available to date, the objective of this study is to conduct an empirical research to identify the most important positive and negative factors in the adoption equation. For that, a value-based model contrasting the gains to the costs of NFC mobile payments with smartphones is built. The model is then validated through an empirical quantitative research that involves surveying online 289 Canadians. This article first describes the NFC payments technology approach, then presents a theoretical background on perceived value and perceived risk and then develops an original value-based model. Finally, the methodology, main findings and discussion and conclusions are presented.

2 How Contactless NFC Payments Work?

The key feature of the contactless payments by smartphones is the combining of RFID technology with the mobile communication technology. With the incorporation of the RFID contactless card standards into the NFC standard, users are able to pay for their purchases by holding their smartphone next to contactless readers in various places such as stores or gas stations rather than using their credit cards (NFC Forum, 2012).

An NFC-enabled smartphone has a dedicated chip and an antenna for radio communication within a short distance. To use contactless mobile payment technology, consumers need to have a contactless RFID credit card from their bank, acquire a NFC-enabled smartphone and download a mobile payment application on their phone. Information about their contactless card will be encrypted and stored in a secure area in the phone’s memory. The smartphone uses NFC technology to communicate
with the merchant’s contactless payment-capable point of sale (POS) system, similar to the contactless payment credit cards.

Contactless mobile payment has a huge market potential and has already attracted the attention of telecom operators, banking institutions and ICT service providers worldwide (Japan, South Korea, Kenya, Europe and the US) (Zhu and Chen, 2011). In Canada, for instance, the Toronto-based lender Canadian Imperial Bank of Commerce, with operations in the US, the Caribbean, the UK and Asia, introduced the first NFC application for mobile payments for Visa and MasterCard in 2012 jointly with the cell phone manufacturer BlackBerry and the telecom operator Rogers Communications (Canada Newswire, 2012; Visa, 2012).

Contactless smartphone payment is hoped to become very popular in just a few years’ time due to the envisioned advantages in terms of convenience for consumers. However, a technology joining the benefits of credit card payments and the enjoyment of smartphones use may also combine user potentially negative views regarding the two elements - e.g., fears on privacy threats or anxiety of using an unknown service. These warrant the investigation of user perceptions on contactless mobile payments through an unbiased model considering both positive and negative factors of the adoption equation.

### 3 Theoretical Background

Investigating user acceptance of a new ICT has constantly been a key area of research in information systems with several theories and models being proposed and successfully validated (Venkatesh, Speier, and Morris, 2002). All of these have been taking into consideration a number of user factors, basically all being favourable antecedents to the intention of adopting a new ICT. Thus, a technology would be adopted by users if they expect a high performance and low effort associated with its use, if they see a positive influence on that use from significant other persons as well as general conditions facilitating the use (Venkatesh, Morris, Davis, and Davis, 2003).

In recent years, as new technologies and ICT services (such as contactless NFC payments) have been launched with increased frequency and, as these ICT artifacts have become more and more refined and complex, researchers have also conceptualized negative factors disfavouring the adoption of technology. These negative factors were called resistance to adoption (Lapointe and Rivard, 2005) or, more often, perceived risk (Featherman and Pavlou, 2003; Pavlou, 2003). Perceived risk sources from consumer behaviour research and expresses a potential loss as seen by individuals, hence not necessarily real (Lim, 2003), when seeking a purchase. Related to the use of a technology, perceived risk may capture fears of wasting time or money or of being exposed to physical or social discomfort with that ICT, even if these fears do not correspond to actual dangers.

Research demonstrated that such opposing factors cannot be ignored in a more complex investigation of the adoption of a new technology. Thus, perceived risk was usually appended as an antecedent to the constructs in ‘traditional’ adoption models like the Technology Acceptance Model or the Motivational Model and was proven to have a negative total effect on the intention to adopt a new ICT or ICT service (Cocosila, Archer and Yuan, 2009; Featherman and Pavlou, 2003; Kim and Han, 2008).

A more refined step into accounting for the negative factors of the technology adoption equation would be to consider them into an unbiased theoretical model at the same level of importance with the positive factors. A possible approach for doing that is to build a model based on the concept of perceived value. This construct is borrowed from consumer behaviour studies and expresses a tradeoff measure between the gains brought by an activity versus the cost of that activity (Zeithaml, 1988). Therefore, perceived value would consider as gain the factors favouring adoption and as cost the factors disfavouring that.
Perceived value in consumer behaviour usually contrasts the gain brought by using a product or service to its cost expressed in monetary units (i.e., what the price of that product or service is). In parallel to this concept, and similar to some of the previous research in consumer behaviour (Snoj, Korda and Damijan, 2004; Sweeney, Soutar, and Johnson, 1999), an innovative view of perceived value of an ICT service may consider perceived risk on the cost side since this factor captures a broader view of the cost than the purely monetary aspect of that service. This approach may be particularly suitable for newer ICT services when there may be some negative user perceptions that do not translate into immediate monetary consequences. This may be the situation of the adoption of contactless NFC smartphone payments that do not involve a fee but, if appropriate measures are not taken, may have negative consequences in other directions (e.g., security and privacy). Therefore, this study proposes the following research question:

What is the effect of perceived user value on the adoption intention of contactless smartphone payments?

4 Research Model and Hypotheses Development

This research proposes the use of perceived value to investigate consumer views on contactless payments with NFC-enabled smartphones. Stemming from the concept of perceived value in consumer behaviour research as discussed in Section 3 above, perceived value of an ICT service should have two sides - the gains brought by the service use and the costs associated with that.

Following the approach of Kim, Chan and Gupta (2007), the gain associated with the use of an ICT product or service use can be expressed broadly as a combination of an extrinsic and cognitive benefit on one hand and an intrinsic and affective benefit on the other hand. While the extrinsic and cognitive benefit is associated with the perception of the utilitarian value of a product or service (i.e., reaching some external goals through its use), the intrinsic and affective benefit is an expression of the hedonic or emotional value of that good or service. This broader view of the value rhymes with the two key sides of motivation in the Motivational Model first used in IS research to explain the adoption of a new technology by Davis, Bagozzi and Warshaw (1992) - i.e., extrinsic and intrinsic motivation. In addition to these, a third side that may be significant for the user views on an ICT relates to social aspects of the value. Thus, consumer behaviour and information systems literature show that, in addition to utilitarian and emotional sides, there is a social dimension of the value that captures the improvement of the image of self associated with the use of a product or service (Brown and Venkatesh, 2005; Sheth, Newman and Gross, 1991; Sweeney and Soutar, 2001). Consequently, it is hypothesized that:

H1: The utilitarian component of the value will have a positive effect on perceived value.

H2: The enjoyment component of the value will have a positive effect on perceived value.

H3: The social component of the value will have a positive effect on perceived value.

As an innovative approach, instead of costs, that have a more limited and predominantly financial meaning, this study uses perceived risk as a broader concept for the ‘give’ (i.e., negative) side of the value. Perceived risk construct originates in consumer behaviour research where it has been used to express the negative consequences perceived in several directions by consumers in association with a purchase of a product or service (Laroche, Bergeron and Goutaland, 2004; Lim, 2003): performance (the product or service may not work properly), financial (the purchase may be a waste of money), time (the purchase may be time consuming), health (the product or service may pose physical risk), social (significant other people for the buyer may disapprove the purchase), and psychological (general anxiety on the worthiness of the purchase).
When investigating user views regarding contactless payments with smartphones, theoretical reasoning indicates that only time, social and psychological sides of the risk worth consideration: consumers may fear wasting time if subscribing for the service, face disapproval from their family or friends when subscribing for an unknown service, and have a general feeling of anxiety regarding the decision of subscribing for the NFC-enabled mobile payments. As this service is in an incipient stage, there is not enough rationale to assess performance risk. Financial risk and health risk are not concerns as the service does not involve a fee and does not pose physical risk for the users.

On the other hand, an additional type of risk often reported in IS studies is expected to have a significant meaning for this research - perceived privacy risk. User concerns about the security of their personal and confidential data and fears about data becoming available to third parties, including wrongdoers, have been traditionally highly relevant for e-services, in general (Featherman and Pavlou, 2003; Grassie, 2007). It is, therefore, expected that privacy risks play an important role in the adoption of contactless payments with NFC smartphones too (Yu, Prybutok, Koh and Hanus, 2012).

Following the example of previous studies using perceived risk in technology adoption research (Featherman and Pavlou, 2003), the model built in this study captures risk perception as a second order overall risk construct encompassing the four meaningful facets: time, social, psychological and privacy. Therefore, it is hypothesized that:

H4a: Perceived time risk will have a positive effect on perceived overall risk.

H4b: Perceived social risk will have a positive effect on perceived overall risk.

H4c: Perceived psychological risk will have a positive effect on perceived overall risk.

H4c: Perceived privacy risk will have a positive effect on perceived overall risk.

H5: Perceived overall risk will have a negative effect on perceived value.

Theoretical reasoning indicates that the higher the value consumers perceive in an ICT product or service (hence there are more gains than costs) the more inclined they are to adopt that ICT. This relationship is strongly supported by empirical evidence too (Kim, Chan and Gupta, 2007; Turel, Serenko and Bontis, 2007; Turel, Serenko and Bontis, 2010). Therefore, it appears logical to hypothesize that:

H6: Perceived value will have a positive effect on adoption intention.

5 Methodology

A quantitative empirical study was conducted to validate the theoretical model proposed by this research. The experiment involved 300 participants across Canada recruited from several tens of thousands of consumers pre-registered with a market survey company. Including conditions asked participants to be at least 18 years old, be smartphone owners and credit card users.

Participants informed about the study conditions and consenting to participate were first asked to read details on contactless payments with NFC smartphones from a reliable source. Thus, half of the sample was directed to the web site of a major Canadian bank that was presenting information on mobile and contactless payments in a generally positive light whereas the other half of the sample was directed to the web site of an international media company displaying a rather cautionary view on the service. Participants were allocated randomly to the two half samples and the recruitment stopped when exactly 150 complete answers were recorded for each subsample. The two subsamples will be called ‘Pros’ and ‘Cons’, respectively, in the remaining of this study.

After reading the contradictory information on contactless payments with NFC smartphones, all participants were asked to complete the same online survey eliciting their views on this new mobile
ICT service. Questions targeted participant demographics as well as the items of the latent variables in the research model. Consistent with previous research examining the role of perceived risk in ICT adoption (Featherman and Pavlou, 2003), perceived overall risk was modelled as a second-order construct having the four significant risk facets mentioned in Section 4 above as first-order components. Since, as an innovative approach of this research, perceived overall risk was considered as a component of perceived value (together with the utilitarian, enjoyment and social sides), perceived value resulted as a third-order factor and this assumption is concordant with similar research on the role of perceived value in ICT adoption (Turel, Serenko and Bontis, 2010).

Items measuring the latent variables were adapted from questionnaires validated by previous research in information systems (Featherman and Pavlou, 2003; Kim, Chan and Gupta, 2007; Turel, Serenko and Bontis, 2010; Venkatesh and Davis, 2000; Venkatesh, Speier and Morris, 2002) and consumer behaviour (Laroche, Bergeron and Goutaland, 2004; Stone and Gronhaug, 1993). Responses were collected on 7-point Likert scales. Resulting data were analyzed with Partial Least Squares (PLS) modelling as this Structural Equation Modelling approach is appropriate for exploratory models (Bontis, Crossan and Hulland, 2002) including formative constructs (Thomas, Lu and Cedzynski, 2005) such as perceived overall risk and perceived value for this study. These two formative constructs were measured through the repeated indicators procedure (Lohmoller, 1989).

6 Findings

6.1 Demographic results

After eliminating the responses with uncommon pattern of the answers (e.g., same answer number for all item questions), a number of 289 valid cases out of the 300 complete answers were recorded. The 289 valid cases (148 coming from the ‘Pros’ subsample and 141 from the ‘Cons’ subsample, respectively) were retained for subsequent analyses.

Respondents were 50.17% female and 49.83% male, reporting an average age of 45.01 years. Their average experience with smartphones was 11.03 years. Participants reported using their smartphones 36.00 minutes per day for speaking or texting and 23.23 minutes per day for browsing the Internet, on average. The largest part of their daily activities on smartphones resulted to be for entertainment followed at a significant distance by banking, shopping and business at about the same level. Respondents were using 2.28 credit cards at the time of the survey and were having 21.12 years experience with credit cards, on average. The sum of their credit card bills for the previous month amounted to $1,679.03, on average.

6.2 Measurement model

Measurement model was assessed with PLS by running SmartPLS (Ringle, Wende and Will, 2005). After the first run of the program it became necessary to drop one item (pertaining to the Perceived Social Risk factor) out of the 25 of the measurement model because it displayed poor loading. SmartPLS was run again and this time the output revealed appropriate measurement outcomes. Thus, as Table 1 shows, all first-order constructs had Average Variance Extracted (AVE) values above 0.5 as well as Composite Reliability and Cronbach’s alpha values above 0.7. As indicated by Table 2, all factor loadings were above the 0.7 threshold, all standard errors were relatively small and all items were significant at a level better than 0.001. Therefore, results in Tables 1 and 2 led to the conclusion that the measurement model was appropriate in terms of reliability and convergent validity (Fornell and Larcker, 1981; Jarvenpaa, Shaw and Staples, 2004).
Construct & AVE & Composite Reliability & Cronbach’s Alpha \\
Utilitarian value & 0.696 & 0.901 & 0.852 \\
Enjoyment value & 0.864 & 0.950 & 0.921 \\
Social value & 0.918 & 0.978 & 0.970 \\
Time risk & 0.836 & 0.939 & 0.901 \\
Social risk & 0.806 & 0.892 & 0.759 \\
Psychological risk & 0.887 & 0.959 & 0.936 \\
Privacy risk & 0.872 & 0.953 & 0.926 \\
Behavioural intention & 0.963 & 0.981 & 0.962 \\

Table 1. Average Variance Extracted (AVE), Composite reliability, and Cronbach’s alpha values for first-order constructs.

<table>
<thead>
<tr>
<th>Item and factor</th>
<th>Factor loading</th>
<th>Standard error</th>
<th>t-Statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>USE1 ← Utilitarian value</td>
<td>0.754</td>
<td>0.191</td>
<td>3.946</td>
</tr>
<tr>
<td>USE2 ← Utilitarian value</td>
<td>0.863</td>
<td>0.212</td>
<td>4.077</td>
</tr>
<tr>
<td>USE3 ← Utilitarian value</td>
<td>0.789</td>
<td>0.187</td>
<td>4.211</td>
</tr>
<tr>
<td>USE4 ← Utilitarian value</td>
<td>0.921</td>
<td>0.223</td>
<td>4.123</td>
</tr>
<tr>
<td>ENJ1 ← Enjoyment value</td>
<td>0.941</td>
<td>0.189</td>
<td>4.983</td>
</tr>
<tr>
<td>ENJ2 ← Enjoyment value</td>
<td>0.937</td>
<td>0.187</td>
<td>5.013</td>
</tr>
<tr>
<td>ENJ3 ← Enjoyment value</td>
<td>0.911</td>
<td>0.182</td>
<td>5.000</td>
</tr>
<tr>
<td>SOC1 ← Social value</td>
<td>0.933</td>
<td>0.157</td>
<td>5.939</td>
</tr>
<tr>
<td>SOC2 ← Social value</td>
<td>0.970</td>
<td>0.169</td>
<td>5.745</td>
</tr>
<tr>
<td>SOC3 ← Social value</td>
<td>0.962</td>
<td>0.173</td>
<td>5.552</td>
</tr>
<tr>
<td>SOC4 ← Social value</td>
<td>0.966</td>
<td>0.167</td>
<td>5.774</td>
</tr>
<tr>
<td>PTR1 ← Time risk</td>
<td>0.896</td>
<td>0.035</td>
<td>25.351</td>
</tr>
<tr>
<td>PTR2 ← Time risk</td>
<td>0.941</td>
<td>0.015</td>
<td>61.126</td>
</tr>
<tr>
<td>PTR3 ← Time risk</td>
<td>0.904</td>
<td>0.024</td>
<td>37.556</td>
</tr>
<tr>
<td>PSR1 ← Social risk</td>
<td>0.907</td>
<td>0.025</td>
<td>35.840</td>
</tr>
<tr>
<td>PSR2 ← Social risk</td>
<td>0.888</td>
<td>0.041</td>
<td>21.770</td>
</tr>
<tr>
<td>PPSYR1 ← Psychological risk</td>
<td>0.909</td>
<td>0.031</td>
<td>29.359</td>
</tr>
<tr>
<td>PPSYR2 ← Psychological risk</td>
<td>0.962</td>
<td>0.012</td>
<td>81.543</td>
</tr>
<tr>
<td>PPSYR3 ← Psychological risk</td>
<td>0.955</td>
<td>0.012</td>
<td>77.603</td>
</tr>
<tr>
<td>PPR1 ← Privacy risk</td>
<td>0.930</td>
<td>0.018</td>
<td>52.494</td>
</tr>
<tr>
<td>PPR2 ← Privacy risk</td>
<td>0.954</td>
<td>0.012</td>
<td>82.551</td>
</tr>
<tr>
<td>PPR3 ← Privacy risk</td>
<td>0.916</td>
<td>0.025</td>
<td>36.160</td>
</tr>
<tr>
<td>BI1 ← Behavioural intention</td>
<td>0.982</td>
<td>0.006</td>
<td>159.557</td>
</tr>
<tr>
<td>BI2 ← Behavioural intention</td>
<td>0.981</td>
<td>0.007</td>
<td>150.817</td>
</tr>
</tbody>
</table>

Table 1. Factor loading and t-Statistic levels for first-order constructs.

The next test of the measurement model consisted in examining visually a matrix having the square roots of the AVEs for first-order factors on the diagonal and the correlation with the other first-order factors, calculated by SmartPLS, off diagonal (Table 3). As diagonal numbers were larger than all the other numbers on their corresponding rows and columns, we drew the conclusion that the measurement model manifested appropriate discriminant validity too, according to literature recommendations (Gefen and Straub, 2005). Since reliability together with convergent and discriminant (i.e., construct) validity tests met or exceeded the thresholds specified in relevant literature, the measurement model was considered appropriate, thus allowing the next step of the PLS analysis – evaluation of the structural model.

Table 3.  
Square-root AVEs (on diagonal) and correlation coefficients (off diagonal) for first-order constructs.

<table>
<thead>
<tr>
<th></th>
<th>intention</th>
<th>risk</th>
<th>value</th>
<th>value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enjoyment value</td>
<td>0.929</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behavioural intention</td>
<td>0.770</td>
<td>0.981</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Privacy risk</td>
<td>-0.167</td>
<td>-0.286</td>
<td>0.934</td>
<td></td>
</tr>
<tr>
<td>Psychological risk</td>
<td>-0.255</td>
<td>-0.360</td>
<td>0.742</td>
<td>0.942</td>
</tr>
<tr>
<td>Social risk</td>
<td>0.060</td>
<td>-0.029</td>
<td>0.315</td>
<td>0.373</td>
</tr>
<tr>
<td>Social value</td>
<td>0.424</td>
<td>0.383</td>
<td>-0.144</td>
<td>0.031</td>
</tr>
<tr>
<td>Time risk</td>
<td>-0.156</td>
<td>-0.238</td>
<td>0.412</td>
<td>0.524</td>
</tr>
<tr>
<td>Utilitarian value</td>
<td>0.807</td>
<td>0.746</td>
<td>-0.199</td>
<td>-0.283</td>
</tr>
</tbody>
</table>

6.3 Structural model

We ran SmartPLS with bootstrap with 200 re-samples to obtain path coefficients, their significance levels as well as the coefficients of determination. Relevant results are presented in Figure 1.

Figure 1.  
Structural evaluation of the theoretical adoption model. Significance levels: * = 0.05; ** = 0.01; *** = 0.001.
A visual inspection of Figure 1 shows all hypotheses proposed were supported. Significance levels were 0.001 or better with two exceptions: the influence of Social Value in the Perceived Value (significant at 0.01) and the influence of Overall Risk in the Perceived Value (significant at 0.05). The model had moderately high explanatory power capturing 61.7% of the variability of the intention to use NFC smartphones for credit card payments. As all of the paths in the model proved to be statistically significant and as the coefficient of determination of the endogenous construct was moderately high for the information systems domain, the model was considered to be reasonably good, according to relevant literature (Bontis, Keow and Richardson, 2000).

SmartPLS also calculated the total (direct and indirect) effects of the first-order factors on the behavioural intention, as shown in Table 4. Total effect coefficients confirm the positive influence of the ‘gain’ side of the value perception (utilitarian and enjoyment, especially) and negative influence of the ‘cost’ side of the value (psychological and privacy risks, in particular).

<table>
<thead>
<tr>
<th>Factor</th>
<th>Total effect coefficient</th>
<th>t-Value</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilitarian value</td>
<td>0.279</td>
<td>3.943</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Enjoyment value</td>
<td>0.265</td>
<td>4.384</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Social value</td>
<td>0.219</td>
<td>3.156</td>
<td>0.002</td>
</tr>
<tr>
<td>Time risk</td>
<td>-0.109</td>
<td>2.805</td>
<td>0.005</td>
</tr>
<tr>
<td>Social risk</td>
<td>-0.046</td>
<td>2.503</td>
<td>0.013</td>
</tr>
<tr>
<td>Psychological risk</td>
<td>-0.148</td>
<td>3.128</td>
<td>0.002</td>
</tr>
<tr>
<td>Privacy risk</td>
<td>-0.139</td>
<td>3.201</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Table 4. Total effects of first-order factors on the behavioural intention.

6.4 Control variables

All demographic factors measured were tested as potential control variables. These were included in the theoretical model in turn with paths to the Perceived Value and the Behavioural Intention. Possible changes in the measurement model and $R^2$ value together with the coefficient and significance values for the new added paths were recorded each time.

The potential control variable of main interest was the subsample the respondents fell in depending on the information they were offered before completing the survey – i.e., ‘Pros’ or ‘Cons’ the new ICT. This variable did not appear to affect the model – its paths to Perceived Value and Behavioural Intention were not significant at the 0.05 statistical level or better and the variable caused a minor change of the coefficient of determination from 0.617 to 0.619 without any alteration of the measurement model. The same variable capturing subsample type was also tested for a possible moderation effect of the Perceived Value over the Behavioural Intention. This effect was not significant either at the 0.05 level.

Control variable tests for gender and age, smartphone experience and pattern of use (i.e., time of speaking or texting, or browsing the Internet daily) and credit card experience and features of usage (i.e., number of credit cards used and sum of latest credit card bills) did not reveal any significant path to the factors of interest. A minor increase of the coefficient of determination, with less than 0.5%, was recorded in some cases and no changes in the measurement model were noticed.

7 Discussion and Conclusions

This study is an empirical investigation of the adoption of contactless mobile payments with NFC enabled smartphones through a perceived value approach. To investigate this issue the study proposed
the research question: *What is the effect of perceived user value on the adoption intention of contactless smartphone payments?*

In order to answer this question the study constructed an unbiased perceived value model contrasting the gain and the cost of using the ICT service. While the ‘gain’ side of the value is captured through utilitarian, enjoyment and social benefits, the ‘cost’ side is expressed through a second-order perceived risk factor. This captures consumer possible fears on wasting time, being disapproved by significant other people, having overall doubts and facing privacy threats if using contactless payments with NFC smartphones. With this approach perceived value resulted as a third-order factor being the sole antecedent of the behavioural intention to use the mobile service.

The model was tested in an empirical research through a cross-sectional survey conducted with 289 respondents in Canada. Results showed all ‘gain’ facets are significant for the perceived value, with the utilitarian and hedonic side having the largest weights (0.355 and 0.337, respectively, both significant at a level below 0.001, as Figure 1 shows). This is consistent with previous research investigating ICT adoption through a perceived value lens (Rintamäki, Kanto and Spence, 2006; Turel, Serenko and Bontis, 2007; Turel, Serenko and Bontis, 2010) or a motivational lens (Davis, Bagozzi, and Warshaw, 1992). Social side of the value, although still significant, has a comparatively lower importance that could be explained by the fact that credit card use is usually done in an individual context. These findings show that developers and promoters of credit card payments through NFC smartphones should reinforce consumer perceptions of utility and enjoyment in order to increase adoption and use.

The ‘cost’ side of the value represented through perceived risk had a negative implication on the value seen by consumers and, consequently, on the intention to use the ICT application, as Figure 1 shows. This is consistent with previous research that demonstrated that perceived risk is a deterrent to ICT adoption (Cocosila, Archer and Yuan, 2009; Featherman and Pavlou, 2003). As Figure 1 and Table 4 indicate, all four risk facets considered in the theoretical model were significant at a statistical level of 0.05 or better but all had a comparatively lower total effect on the intention to use the ICT than the ‘gain’ factors. Perceived psychological risk and perceived privacy risk proved to be the most important ‘cost’ factors (with a total effect of -0.148 and -0.139, respectively, on the intention to use, as Table 4 shows). These results indicate that consumers see more benefits than threats in the use of NFC smartphones for payments. However, to increase the adoption rate of this service, concerns on the justification for the service and possible privacy issues have to be mitigated.

We found that none of the demographic characteristics influenced consumer perceptions on the value of the ICT service and their intention to use. Remarkably, the initial contrasting information provided to the two subsamples of respondents (i.e., NFC smartphone payments have many advantages or may pose problems, respectively) did not have a significant effect on the results. The considerable experience of the respondents with both smartphones (11.03 years, on average) and credit cards (21.12 years, on average) may be an explanation for the lack of difference between the views of the ‘Pros’ and ‘Cons’ subsamples.

Like virtually any empirical research in information systems, this study had also some limitations. Participants were recruited from the tens of thousands respondents pre-registered Canada-wide with a market survey company. Participants self-selected and were admitted to the study until the quota of 300 complete answers was met. On the other side, the sample was considered to be realistic as it was drawn from the general population of a large country. However, the model proposed by this research should also be confirmed with other samples. Further research should investigate why none of the demographics, the contradictory information on a new and sensitive technology in particular, had an influence in the model. A more granular analysis considering the type of smartphone activity and credit card payment the respondents use more frequently may be necessary. Furthermore, a contrast between consumers who already used NFC smartphone payments and those who did not use yet may
be considered for future research. In general, it could be concluded that the limitations did not affect the validity of this study and, rather, offered ideas for future research.

Overall, this research is a first attempt to investigate consumer perceptions on the potential use of credit card payments with Near Field Communication smartphones. In order to reach this goal, as a major theoretical contribution, the study developed a research model integrating a multi-dimensional perceived risk construct into a multi-sided perceived value factor. Thus, this research proposed a broader view of the duality Gain-Cost in the perception of value of an ICT artifact that may be used in similar adoption studies.

References


