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Document de Travail
Working Paper

Lemna

EA 4272

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2018/02

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Abstract

The rapid development in recent years of the Internet of Things has fostered the emergence of new models and services. Despite the numerous opportunities that the Internet of Things offers for services, there still remain major challenges to be addressed by companies. The aim of this paper is to provide a better understanding of antecedents of consumers' resistance to smart services. Our findings show that two categories of factors have a significant impact on consumer resistance: (1) functional barriers (unauthorized secondary use of personal information, perceived health risk, and perceived security risk) and psychological barriers (technology anxiety, need for human interaction, and consumer empowerment).

Keywords: resistance; innovation, Internet of Things, smart service, service technology.

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Introduction

Technological evolution continuously affects the way services are conceived, developed and delivered (Meuter et al. 2005). Such evolutionary change requires practitioners and researchers to take into account new practical and theoretical issues in terms of innovation (Storey et al. 2015) and consumer relations (Ostrom et al. 2015). In this context, the rapid development in recent years of the Internet of Things (IoT) has fostered the emergence of new models of so-called smart services (Allmendinger and Lombreglia 2005; Wünderlich et al. 2013; Wünderlich et al. 2015). Smart services are services that rely on the use of IoT devices. The IoT is thus viewed "*as the next evolution of the internet that (1) incorporates billions of internet-connected sensors, cameras, wearables, smart phones, and other smart IoT devices, and (2) IoT devices are capable of communicating and consulting with one another without human intervention*" (Georgakopoulos and Jayaraman 2016, p. 1043). With it, we move from a system based on the use of the internet allowing people to communicate at any time and in any place to a system using the IoT in which the physical world can now communicate with person-to-person, person-to-object and object-to-object relationships. In this context, smart services enable consumers to access services anytime, anywhere, and through any medium.

Despite the numerous opportunities that the IoT offers for services, there still remain major challenges to be addressed by companies. Smart services are characterized by the integration of intelligent, communicating and autonomous devices capable of carrying out actions without the authorization of the consumer and of collecting a large amount of data (Wünderlich et al. 2015). Given this situation, new issues need to be taken into account in the development of these new services, such as security, intrusion and privacy concerns. The challenge here for managers is to reduce the barriers that may give rise to consumer resistance

to smart services as innovation. Consumers may thus reject, delay or oppose the purchase, use and adoption of smart services because they consider that they "*pose potential changes from a satisfactory status quo or because [they] conflict with their belief structure*" (Ram and Sheth 1989, p. 6). Resistance to innovation is a reaction and form of behavior that can prevent innovations succeeding and thus reduce their adoption rate. Various studies point out that innovation in the services sector is as risky as it is for new products (e.g., Storey et al. 2015). Given the large sums invested in innovation and the stakes in terms of image, satisfaction and customer loyalty, it is essential for managers to take into account the factors that contribute to resistance to innovation. The challenge is to ensure the success of these innovations and to help companies successfully launch and disseminate them.

At the academic level, the existing literature suffers from at least two gaps. First, Ostrom et al. (2015) identify smart services as one of the priorities for future research. For these authors one of the main tasks is "*examining how the Internet of Things and smart services can enhance the customer experience and influence relationships between customers and service providers*" (Ostrom et al., p. 143). Smart services currently constitute an emerging field of research, and studies on the subject are in an embryonic state. However, the few existing studies are theoretical (e.g., Wünderlich et al. 2015) or are based on a qualitative methodology (e.g., Wünderlich et al. 2013). It is necessary to enrich the field with statistical research based on a quantitative methodology and by focusing on the B2C sector. Second, to our knowledge, there has been no research on resistance to innovation pertaining to smart services. Yet smart services are an innovation in the first stage of life cycle, and it is important to understand the factors that may prevent their initial acceptance by consumers (Wünderlich et al. 2015).

In order to respond to these various theoretical gaps and in view of the managerial issues presented above, our research proposes to answer the following question: What are the drivers of consumer resistance to smart services?

The remainder of the paper is divided into three sections. Section 1 offers, first, a literature overview and the hypothesis for the study. Section 2 depicts the methodology and presents the results. In section 3, theoretical and managerial implications are developed.

1 Development of the hypotheses

1.1 Resistance to innovation

In the marketing literature, resistance to innovation has been theorized and studied by several authors, who have attempted to analyze the factors that may account for the failure of a new product or service (e.g., Ram et Sheth 1989; Kleijnen et al. 2009; Heidenreich and Handrich 2015). Indeed, Consumers may express a resistance to an innovation in order to preserve their existing equilibrium (Heidenreich and Handrich 2015). In this respect, in the view of Kleijnen et al. (2009) and Szmigin & Foxall (1998), such resistance manifests itself in three reactions: (1) rejection (consumers may not accept the innovation), (2) opposition (consumers may view innovation as a threat and act to resist its adoption), and (3) postponement (consumers may not adopt the innovation because the circumstances are not appropriate).

In the field of services, research generally identifies two categories of resistance factors (Laukkanen 2016), corresponding to the typology proposed by Ram and Sheth (1989): functional barriers, and psychological barriers. Functional barriers arise "*if consumers perceive significant changes from adopting the innovation*" (Ram and Sheth 1989, p. 7). In other words, the consumer may see uncertainties in using a new service that are related to its complexity, its economic performance and the risk involved. Psychological barriers, on the other hand, arise when the new service upsets the consumer's entrenched beliefs. These barriers can be linked to the image of innovation and to tradition.

On the basis of Ram and Sheth's (1989) model, we propose testing two categories of barriers that promote resistance to innovation: (1) functional barriers (unauthorized secondary use of

personal information, perceived health risk, and perceived security risk) and (2) psychological barriers (technology anxiety, need for human interaction, and consumer empowerment).

1.2 Unauthorized secondary use of personal information

The massive diffusion of new technologies in the field of commerce and service has accentuated consumers' privacy concerns (Inman and Nikolova 2017). Indeed, to interact with the company, the consumer increasingly has to use virtual channels (e.g., internet banking, mobile shopping) that collect, store and use private information of various kinds (e.g., names, addresses, lifestyle characteristics) (Lwin and Williams 2003).

This requirement increases the risk of unauthorized secondary use, where "*information is collected from individuals for one purpose but is used for another, secondary purpose without authorization from the individuals*" (Smith et al. 1996, p. 171). In other words, this threat involves the unauthorized use by the collecting organization or an external party of information provided by consumers. The intensification of privacy concerns forces consumers "*to adopt counter measures to protect their personal information*" (Lwin and Williams 2003, p. 258) and negatively impacts their purchase intentions (Eastlick et al. 2006).

Similarly, smart services may present threats privacy with regard to the re-use of consumer data (Hsu and Lin 2016). For the IoT devices used have the capacity to continuously collect and store private and sensitive information (e.g., geographical location, financial data, consumption habits) (Mani and Chouk 2017). This information may be automatically transmitted to supply databases belonging to the company or to external parties without the consumer's consent. It can therefore be assumed that unauthorized secondary use constitutes a barrier that contributes to consumer resistance.

H.1. Unauthorized secondary use of personal information positively influences consumer resistance to smart services.

1.3 Perceived health risk

Health risk is a physical risk that the consumer may associate with the adoption of a new product or service (Ram and Seth 1989) and can promote resistance to it (Kleijnen et al. 2009; Wiedmann et al. 2011). In the area of smart services, the use of IoT devices may increase such perceived risk.

The presence of IoT devices close to or in contact with the body (e.g., wearable technologies), their proliferation in everyday life (e.g., in the home and at work) and the continuous exchange of data through wireless connections (e.g., Wi-Fi, RFID) give rise to health hazards for users, as a number of specialists have pointed out (e.g., Gayle 2013). These specialists refer to similarities between IoT devices and mobile phones. The latter are suspected of producing radiation harmful to the human brain (Burgess 2002), and the World Health Organization (2014) recently warned that this radiation can cause cancer in humans. Concerns about the hazards of IoT devices can therefore lead consumers to associate them with a physical risk related to their health and thus intensify their resistance to them.

H.2. Perceived health risk positively influences consumer resistance to smart services.

1.4 Perceived security risk

Perceived security risk refers to concern about losing control over personal and private information (Kleijnen et al. 2007) through the intrusion of potentially malicious individuals (e.g., piracy and theft of transaction and financial data) or fraudulent behavior by organizations (e.g., false declaration of intentions) (Miyazaki and Fernandez, 2001). Several studies have highlighted the scale of this risk in the context of virtual transactions (e.g., online shopping (Miyazaki and Fernandez 2001), mobile services (Kleijnen et al. 2007)). Thus, the absence of direct contact with the seller, the vulnerability of IT devices and the intangible nature of services (as opposed to products) accentuates this risk. With regard to smart services, security risks are heightened by the vulnerability of interconnected systems and the

lack of effective encryption protocols, as underscored in a recent report by Hewlett Packard (2015). According to this report, the hacking of an IoT device potentially gives access to all other devices connected to it and allows the theft and fraudulent exploitation of a large amount of private and confidential data.

Furthermore, various studies have investigated perceived security risk as an antecedent to use intent (e.g., Luarn and Lin 2005) of services based on technological innovations. Similarly, other studies have identified a positive link between perceived risk (which includes security risk) and resistance to services available through electronic channels (Laukkanen et al. 2008; Laukkanen 2016). Thus:

H.3. Perceived security risk positively influences consumer resistance to smart services.

1.5 Technology anxiety

The proliferation of technologies in all areas (e.g., private life, work, studies) raises the question of consumers' capacity and willingness to adopt and use these new technologies to achieve their objectives (Parasuraman 2000; Meuter et al. 2005). In this respect, technology anxiety is a psychological variable that measures "*users' state of mind regarding their ability and willingness to use technology-related tools*" (Meuter et al. 2003, p. 900). Anxiety may thus arise in service relationships based on new technologies because of the negative "hard-to-use" image associated with these technologies (Laukkanen et al. 2008). This state of mind can be predictive of consumers' use of self-service technologies (Meuter et al. 2003) and influence the adoption process of these technologies (Meuter et al. 2005). Furthermore, Evanschitzky et al. (2015) have identified technology anxiety as a variable that negatively impacts consumer trial of the service innovation.

In addition, since smart services are based on new technologies that allow consumers to access the service anytime, anywhere and through any device, technology anxiety may be greater than is the case with conventional services. Indeed, smart service requires the use of a

multitude of different IoT devices and the integration of new connection and communication functionalities. Thus, technology anxiety is manifested here by the consumer's feeling of psychological pressure linked, on the one hand, to the intellectual effort involved in grasping and mastering the functioning of the smart services, on the other, to the fear of failure of the transactional process with the company.

Under these circumstances, a high level of technology anxiety may lead consumers to avoid technological tools (Meuter et al. 2005), particularly the IoT devices used in smart services, and thus to express resistance to them.

H.4. Technology anxiety positively influences consumer resistance to smart services.

1.6 Need for human interaction

The need for interaction can be defined as "*the importance of human interaction to customers in service encounters*" (Dabholkar and Bagozzi 2002, p. 188). It thus reflects consumers' desire for human contact during their service experience. Indeed, for many consumers a commercial transaction with a service company is an opportunity to interact socially with sales personnel and with other consumers (Dabholkar 1996). Yet technological developments have considerably reduced human contact in the service sector, because the new technological tools are able to replace employees. Lack of human interaction may be perceived as a disadvantage by consumers and negatively impacts their decision to continue using service-related technology (Evanschitzky et al. 2015). Similarly, smart services involve IoT devices that are capable of performing tasks autonomously and without human intervention. The continuous collection and instantaneous analysis of data allows these devices to support consumers in relation to the service (e.g., sending instant notifications about information). In view of all this, IoT devices replace employees in various tasks and contribute to the lack of human interaction. Consumers are liable to perceive this lack of human interaction negatively and be thereby inclined to express resistance to these new services.

H.5. Need for human interaction positively influences consumer resistance to smart services.

1.7 Consumer empowerment

Consumer empowerment is defined as a subjective state in which consumers feel able to control and understand their environment and able to play an active role in it (Wathieu et al. 2002). It manifests itself in consumers' confidence that their skills and abilities can influence the company's decisions and choices. This empowerment has been strengthened in recent years by the development of the internet, which gives consumers access to information about companies and their offers and services (Harrison et al. 2006). It is thus assumed that consumers have greater power in relation to companies because they have more information and choice (Fuchs et al. 2010). Such research presupposes that consumer empowerment gives consumers more autonomy (Wathieu et al. 2002) and positively impacts their satisfaction (Hunter and Garnefeld 2008).

Along similar lines, a smart service is based on a system that allows consumers to manage the company's offer autonomously and adapt their options in accordance with their needs. In addition, the new service is based on devices allowing users to directly access information available on the internet (for example, through social networking applications). It can be assumed here that consumer empowerment is reinforced with smart services, which would tend to reduce consumer resistance.

H.6. Consumer empowerment negatively influences consumer resistance to smart services.

2 Methodology

2.1 Procedure and sample

Panel members of a French research company, representative for the French population in terms of gender and age, were asked to participate to a study. Participants received an email invitation to fill out an online questionnaire regarding smart services in the banking sector.

Indeed, smart banking service is an area with a high potential for development (Deloitte, 2015).

Before responding to the questions, the participants were shown a video (duration 2 minutes 46 seconds) presenting real examples of smart services (the video was developed by a consulting firm in new technologies): payment by means of a smart bracelet that recognizes customer individual heart rhythm, receiving automatic alerts on his smartwatch of any unusual expenditure compared to the customer's normal outgoings… The aim was to ensure that respondents to the survey clearly understood what a smart banking service may involve. We introduced filter questions to check the correct functioning of sound and image on the equipment used by the respondents. After watching the video, participants were asked to answer several sets of questions on three themes: their perception of the connected bank service, their perception of IoT devices in general, and their personality and socio-demographic characteristics

We collected 653 completed questionnaires. Respondents were located in different regions in France. 54% of respondents are women. Their ages range from 19 years to 67 years. The average age is 42 years. 27% are employees, 11% are retired and 6% are students. Other socio-professional categories were represented: farmers, business owners, unemployed… 11 % of respondents have a household monthly income under 1200 euros, 15% between 3000 and 3500 euros and 10% more than 4000 euros. 3% of participants have no diploma, 20 % have a college degree, 61% have an undergraduate degree and 16% have a postgraduate degree.

2.2 Measures

Participants responded to a series of multi-item 7 point Likert measures that ranged from 'completely disagree' (1) to 'completely agree' (7). Unauthorized secondary use of personal information was measured with the scale of Smith et al. (1996). To measure perceived health

risk, we used Zhang et al. (2012) scale. Perceived Security was measured using the scales of Luarn and Lin (2005) and Parasuraman et al. (2005). Regarding technology anxiety, we used the scale of Meuter et al. (2005). The scale of Dabholkar (1996) was used to measure the need of human interaction. To measure consumer empowerment, we used the scale of Hunter et al. (2008). Finally, consumer resistance to smart services was measured through items adapted from works of Wiedmann et al. (2011), Szmigin and Foxall (1998), and Kleijnen et al. (2009).

2.3 Psychometric quality of the variables

We evaluated psychometric quality of constructs by conducting an EFA and then a CFA. With regard to the EFA, the Kaiser-Meyer-Olkin index is greater than 0.5 (0.89) and the Bartlett sphericity test is significant (p=0.000). The final factorial solution explains 84% of the total variance. As expected, the results show 7 factorial axes corresponding to our variables. Cronbach's alphas were 0.87 or above and thus demonstrated good reliability. Second, we run a CFA. All factor loadings were significant (p<0.001), which supports the convergent validity. Moreover, we confirmed the discriminant validity since the square root of the average variance extracted (AVE) exceeded the correlations between constructs (table 1).

Table 1 Discriminant validity

Variables	M	SD	AVE	1	2	3	4	5	6	7
1- Unauthorized secondary use of personal information	5.39	1.57	0.88	**1**						
2- Perceived health risk	3.70	1.78	0.83	0.30	**1**					
3- Perceived Security	5.40	1.52	0.85	0.54	0.29	**1**				
4- Technology Anxiety	3.17	1.62	0.73	0.26	0.32	0.11	**1**			
5- Need for human interaction	5.41	1.41	0.69	0.30	0.12	0.30	0.14	**1**		
6- Empowerment	3.70	1.71	0.76	-0.31	-0.09	-0.23	-0.02	-0.05	**1**	
7- Resistance	4.12	1.70	0,71	0.48	0.30	0.40	0.43	0.23	-0.50	**1**

4 Results

To test our theoretical model, we used a structural equation modelling (AMOS). Results show acceptable indicators of fit. The RMSEA is 0.07 which could be considered as a reasonable error of approximation (Steiger 1990). CFI, TLI and IFI show an acceptable overall fit quality (CFI=0.94, TLI=0.93, IFI=0.94) and the chi-square value is 1118.12 (df= 246, p< 0.001). The results indicate that unauthorized secondary use of personal information has a significant negative impact on consumer resistance to smart services (β=0.12, CR=3.62, p <0.001). Hypothesis H1 is therefore supported. Moreover, perceived health risk has a significant positive impact on consumer resistance (β=0.18, CR=5.92, p<0.001). This result supports H2. Security has a significant positive impact on consumer resistance to smart services (β=0.15; CR=4.2, p<0.001). Our results confirm hence the hypothesis H3. Technology anxiety has a positive significant effect on consumer resistance (β=0.41, CR=10.93, p<0.001). This result supports H4. Need for human interaction has a significant positive impact on consumer resistance (β=0.10, CR=2.46, p=0.01). Hence, H5 is confirmed. Hypothesis H6 is supported since the effect of empowerment on consumer resistance is statistically significant (β=-0.54, CR =-13.79, p<0.001).

4 Implications and limitations

4.1 Theoretical implications

At a theoretical level, our work contributes to the literature in two ways. Firstly, it focuses on resistance to innovation in services. While there are many studies on resistance to new products, there are still very few on services (Laukkanen 2016) and none on smart services. To our knowledge, our study is the first to examine resistance to innovation in the field of smart services. It thus responds to the call made by several authors to take account of the new challenges in services related to the development of the Internet of Things (e.g., Ostrom et al.

2015; Wünderlich et al. 2015). For the IoT undeniably amounts to a revolution that will radically change the way services are designed and delivered (Wünderlich et al. 2013).

Secondly, our research enriches the literature on resistance to innovation (Ram and Sheth 1989) by empirically testing variables not studied in previous work: unauthorized secondary use of personal information, technology anxiety, need for interaction, and consumer empowerment. These variables make it possible to take into account the barriers induced by the proliferation of new technologies, in particular IoT devices. The development of these technologies requires taking account of issues linked to privacy (unauthorized secondary use) and consumers' technological readiness (technology anxiety) (Mani and Chouk 2017). Similarly, IoT devices in services need to factor in the new reality of consumer empowerment and the need for interaction with employees. In addition, although in existing research physical risk is often associated with danger to the body and the user's safety in using new products (e.g., Kleijnen et al 2009; Wiedmann et al. 2011), our work takes into account more specifically the problems related to the harmfulness of the radiation emitted by IoT devices used in smart services. This is a major health issue that academic research should take into consideration along with other physical risks.

4.2 Managerial implications

Our findings have managerial implications in three areas. First, the success of smart services will turn on addressing major security and privacy issues. An important concern is the implementation of an ethical strategy to help these new services develop. Such a strategy requires total transparency on the part of the company with regard to three crucial points: (1) management of the data collected by IoT devices, (2) application of measures to ensure the security of these devices and (3) ensuring that any radiation emitted is not harmful to the user. For example, the company could create an online information platform in which it presents the opinions of independent experts in response to questions raised. The second area concerns

an appropriate communication strategy. The objective here is to facilitate consumers' readiness to accept smart services and to reduce their technology anxiety. Advertisements in the conventional media (radio, television) emphasizing the practical and user-friendly aspect of these new services would reduce this psychological barrier. The third area is relational in nature. It is important for managers to take account of consumers' need to experience human interaction in the provision of the service. In other words, the development of smart services should not result in there being no employees involved in reception and contact. In this respect, customers should have a hybrid experience that alternates the use of new technologies and meeting contact personnel, who will need to be trained in the skills to provide technical advice on, for example, the use of IoT devices. Similarly, this relational domain must aim to enhance consumer empowerment. Companies can take advantage of the capabilities of the IoT to collect a large amount of data (big data) with a view to analyzing and better understanding the behavior and trajectories of their customers.

4.3 Limitations

As with all empirical research, our study has its limitations. First, the protocol of our study – based on a video scenario in which respondents were asked to imagine themselves in a situation where they are using a smart service – may introduce biases related to some respondents' lack of expertise (e.g., unfamiliarity with the technology) and the difficulty of putting themselves in such a situation. Second, other variables, such as perceived complexity or perceived utility, might account for consumer resistance to innovation in this context.

Acknowledgements

The authors gratefully acknowledge financial support from the Chair Finance, Banque Populaire - Caisse d'Epargne, of the University of Nantes Research Foundation.

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