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Factors affecting late adoption of digital innovations☆

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ABSTRACT

Despite extensive research on diffusion and adoption of innovations, late adoption of digitized products has received little attention. This study explores the determinants of late adoption of digital innovations and selects five variables: a) attitude toward a technology, b) negative word of mouth about the technology, c) global brand image, d) consumer innovativeness, and e) lead-user profile.The results of a binary logistic regression with late adopter as the target variable show that with exception of *negative word of mouth*, all the variables have a negative effect on the probability of moving on the adoption scale from late to early adopter. Furthermore, increasing the positive attitude of consumerstowarda technology (i.e. reducing consumers'skepticism) could be more effective to accelerate the rate of adoption than projecting the global image of the company. Understanding the determinants of late adoption will allow companies to develop technologies that diffuse faster and will help them to follow NPD, marketing, and sales strategies, which could accelerate the rate of adoption of digital innovations.

1. Introduction: Diffusion of digital innovations

Diffusion of innovation is the process of acceptance of an innovation over time among members of a social system (Rogers, 1962). Firms' new product development practices aim at developing innovations that diffuse at a higher pace, in order to ensure larger market shares and high profits. However, despite such efforts, a significant percentage of customers are late adopters. As technologies spread faster and product life cycles get shorter, late adopters are becoming a larger and more influential consumer group (Wells, 2016a, 2016b, 2016c). As regards adoption of technological innovations, Rogers (1962) considers that 16% of the customers are laggards and 34% are the late majority. Following the literature, this study refers to late adopters as the sum of these two adopter categories: late majority and laggards (Jahanmir & Lages, 2016). Thus, late adopters represent half of the potential adopters of any product, service, or technology.

Scholarly definitions of late adopters indicate that, compared to other users, they are slower to adopt a product, show higher levels of resistance to innovations, and are more sceptical toward new products. They purchase products when they are mature and prices are lower. They prefer simple products and are more interested in products' functionality rather than in design and brand (Jahanmir & Lages, 2016). Additionally, they have a negative attitude toward discontinuous innovations, are past-oriented, and have traditional values. They adopt an innovation only after the majority of users have already adopted as a “safety” measure. They lack opinion leadership in the diffusion process; therefore, their adoption relies widely on other users' opinions about technologies. Being resistant and critical users, their contribution to diffusion and adoption of technologies is often through negative word of mouth (Moore, 2014; Rogers, 1962).

Adoption of digital technologies is radically changing the nature of today's products and services. Yoo, Boland Jr, Lyytinen, and Majchrzak (2012) refer to digital innovations as the incorporation of digital capabilities into previously purely physical material. They define digital materiality as “what the software incorporated into an artifact can do by manipulating digital representations” (Yoo et al., 2012, p. 1398). They propose the example of running shoes. Standard shoes have merely physical materiality. They cannot carry any meaning or connote any sense of time and place. Running shoes with embedded microchips have digital materiality. They can record movements and transfer that information adding the elements of time and place (Yoo et al., 2012).

The digital materiality enabled by digital innovations offers firms new opportunities to create unique experiences. Our era is one of rapid digital transformation, with digital technologies quickly dominating

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products, services, and operations of organizations (Yoo et al., 2012). This transformation alters customers' perceptions of product or service innovations. With technologies' life cycle becoming shorter and products diffusing faster, firms turn to digital technologies to achieve their business goals. Scholars have illustrated that digital technologies enable firms to explore a vast potential for product and service innovations, which are particularly rapid and difficult to control and predict (Henfridsson, Mathiassen, & Svahn, 2014; Nylén & Holmström, 2015; Yoo et al., 2012; Yoo, Lyytinen, Boland Jr., & Berente, 2010). Additionally, scholars have pointed out difficulties in evaluating the value digital innovations generate (Grover & Kohli, 2012). To manage new types of digital innovations that emerge in this highly dynamic and unpredictable environment, firms need to understand deeply the diffusion of such innovations in order to make informed decisions.

Nowadays, digital innovations are increasingly dominating the business world, emerging at a rapid pace and reaching everyday products through embedded software. In a rapidly changing digital world, innovations can be outdated quickly. Additionally, fierce competition rules such business environments. Therefore, creating products with a high rate of adoption is crucial to guarantee firms' growth and profit. Lack of a clear understanding of the phenomenon of late adoption and the drivers of digital innovation diffusion might result in slow diffusion. Slow diffusion can consequently lead to losing market share to competitors and to negative financial results. Therefore, understanding the determinants of late adoption is necessary to develop digital innovations that spread faster and address a larger market segment.

This study explores the determinants of late adoption of digital innovations. Section two comprises an overview of the literature on the topic. The following section presents a short description of the factors under analysis and the method. After the discussion of the results, the last two sections deal with the theoretical and practical implications, and limitations and directions for further research, respectively.

2. Current understanding

This study explores attitude toward technologies, negative word of mouth, global brand image, consumer innovativeness, and lead-user profile and assesses whether each of these factors influences late adoption of digital innovations.

Understanding whether or why consumers adopt an innovation is critical knowledge for the theory and practice of innovation and new product development. Technology adoption researchers have widely applied the Diffusion of Innovation (DOI) theory (e.g. Karahanna, Straub, & Chervany, 1999). Building on DOI theory, scholars have developed models of adoption such as the Theory of Reasoned Action (TRA) (Ajzen & Fishbein, 1975), Technology Acceptance Model (TAM) (Davis, 1989), Technology Readiness Index (Parasuraman, 2000), or Technology Adoption Propensity Index (TAP) (Ratchford & Barnhart, 2012). The DOI literature mainly focuses on understanding reasons and likelihood of adoption. Rogers' five factors (i.e., relative advantage, compatibility, complexity, trialability, and observability) (Rogers, 1962) are among the attributes scholars use across various industries to demonstrate the likelihood of adoption (Bartl, Füller, Mühlbacher, & Ernst, 2012; Schwarz & Ernst, 2008).

Although consumers' reaction to innovations has been one of the main research topics in the field of diffusion and adoption of innovations, studies have not sufficiently explored the other possible response to digital innovations, that is, resistance to innovation which results in late adoption. Numerous studies have highlighted the need to understand why consumers resist to innovations and adopt late (Garcia, Bardhi, & Friedrich, 2007). Recent studies stress the importance of resistant consumers' input for developing new products (Lages, 2016), exploring scales to identify late adopters (Jahanmir & Lages, 2016), and proposing methods to involve lag-users and sceptic consumers in idea generation and thus develop products with a higher rate of adoption (Jahanmir & Lages, 2015).

Rate of adoption, which is "the relative speed with which an innovation is adopted by members of a social system" (Rogers, 1995, p. 221), is a key diffusion factor. Consumers' resistance to innovation results in a lower rate of adoption. Researchers have explored how to facilitate and accelerate the rate of adoption (Claudy, Garcia, & O'Driscoll, 2015) and how to overcome barriers to adoption of innovations (Talke & Heidenreich, 2014). However, literature on late adoption is scarce. This study explores factors influencing rate of adoption and leading to late adoption of digital innovations.

2.1. What could affect the rate of adoption?

TAM (Davis, 1989) builds on both theory of reasoned action (TRA) (Ajzen & Fishbein, 1975) and the theory of planned behavior (TPB) (Ajzen, 1991). On the one hand, TRA proposes that users' beliefs define their attitude toward innovations and consequently their intentions to adopt. On the other hand, TPB expands TRA with an additional construct of perceived behavior control. TAM stems from these two theories, exploring the use of technology in the workplace (Davis, 1989) and presents two elements as primary reasons for adoption of innovations: perceived usefulness and perceived ease of use. However, scholars have criticized TAM for exploring mainly the external factors of perceived usefulness and ease of use and not considering internal factors such as attitudes and emotions (Djamasbi, Strong, & Dishaw, 2010; Yang, Kim, & Yoo, 2013). To address this limitation, this study considers both external and internal factors that could influence rate of adoption of digital innovations. The study identifies five factors and analyses their effect on rate of adoption: a) user attitude toward a technology, b) negative word of mouth, c) global brand image, d) consumer innovativeness, and e) lead-user profile (Table 1).

2.1.1. Attitude toward technology

User attitude toward innovations is among the key elements driving technology adoption (Bhattacherjee & Premkumar, 2004; Rogers Everett, 1995). Attitude toward an innovation refers to users' assessment of the desirability of that product, which could predict the likelihood of adoption (Davis, 1989; Davis, Bagozzi, & Warshaw, 1989). Claudy et al. (2015) differentiate between reasons for and against adoption of innovations and find that consumers' positive attitude toward innovation influences their adoption intentions. In addition, user attitude embodies user evaluation of an innovation. Dodds et al. (1991) propose that price, brand, and store information determine users' perception of quality and value. Porter and Donthu (2006) extend the TAM model to understand which consumer beliefs explain attitude toward and use of technologies. They find that users' attitude toward technology adoption is positively correlated with their use of that technology. Yang and Yoo (2004) also find that attitude is a key variable in studying adoption. Thus, this study explores the influence of users' initial attitude toward digital innovations on the rate of adoption.

2.1.2. Negative word of mouth

Rogers (1962) defines diffusion of innovation as the process of acceptance of an innovation over time among members of a social system. In his words:

> "the diffusion process consists of a new idea, individual A, who knows about the innovation, and individual B, who does not yet know about the innovation. The social relationship of A and B has a great deal to say about the conditions under which A will tell B about the innovation and the results of this telling" (Rogers, 1962, pp. 13–14).

As such, diffusion is a social rather than an economic phenomenon, in which interpersonal communication plays a key role. Exploring word of mouth allows scholars to understand how interpersonal communication influences adoption. Martilla (1971) proposes that word of mouth gains more importance in a later stage of the adoption process.