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Consumer acceptance of a revolutionary technology-driven product: The role of adoption in the industrial design development

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ABSTRACT

Understanding how consumers adopt a state of the art product is important for the development and marketing of innovative products. The purpose of this study is to examine factors that affect consumer intentions to use a revolutionary technology-driven product (RTP). The research integrates two innovation adoption models, the Unified Technology Acceptance and Utilization Theory (UTAUT) and the Task-Technology Fit (TTF) model with two antecedents of consumer characteristics: consumer innovativeness and perceived value of a new product. The study examines consumer responses to an unfamiliar product, the TEASER which is a conceptual digital cookbook that offers taste sampling, thereby providing an online food-tasting experience. Consumers who are prone to innovativeness and who perceive value in a RTP's aesthetics are able to discern the conditions that support their intent to use such a product. The resulting model expands the UTAUT and TTF theories by showing that UTAUT variables mediate between the variables of TTF and adoption intentions. These results support the need for nonlinear industrial development processes involving consumers.

1. Introduction

Characteristics of consumers and of new technologies can influence online consumers' perceptions of whether they might adopt revolutionary technology-driven products (RTP). Industrial designers and marketing managers are challenged to understand how online consumers interpret the value of unfamiliar technology-driven products in order to adopt them for use. When technology features are matched with specific characteristics of target markets, marketers and designers can determine appropriate investments in design and appropriate levels of consumer involvement in design development.

Industrial design is "the activity that transforms a set of product requirements into a configuration of materials, elements and components. This activity can have an impact on a product's appearance, user friendliness, ease of manufacture, efficient use of materials, functional performance, and so on" (Gemser and Leenders, 2001, p. 29). In the process of new product development (NPD), industrial designers strive to relate innovative product development to the "dimensions, instinctive responses, and emotional needs of the user" (Walsh, 1996, p. 513). Industrial design is part of the broader NPD process, helping to advance consumer adoption by linking technical functionalities to value in a commercial product (Gemser and Leenders, 2001; Goffin and Micheli, 2010; Walsh, 1996).

This research examines the design and adoption of particular types of innovative products, termed Revolutionary Technology-driven Products (RTP). RTPs are defined as innovations that cannot be classified in terms of existing product categories and that are not new products, models or brands in existing categories (Gregan-Paxton and Roedder, 1997). Revolutionary products, like ipods, "shift market structures, represent new technologies, require consumer learning, and induce behavior changes" (Urban and Hauser, 1996, p. 47). The factors that affect their adoption are a concern because RTPs require substantial resources to develop, are subject to market and technological uncertainties and are situated in competitive commercial environments (Olleros, 1986; Min and Robinson, 2006; Urban et al., 1996).

This research focuses on the TEASER, which is an example of an RTP. TEASER is a digital cookbook that offers taste sampling, thereby providing online food-tasting experiences. The unit is made up of a portable touch screen display and a print system that dispenses edible flavor strips. TEASER incorporates ink-jet print technology utilizing 18 flavor cartridges and a role of dissolving strip. Flavor cartridges can be easily switched out to match the

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necessary ingredient required for the desired dish. The design is intended to extend the traditional cookbook to a digital peripheral that reproduces the content in a physical tasting experience.

Marketing and industrial design researchers are interested in the relationships between the characteristics of consumers, the characteristics of new technology-driven products, and the characteristics of consumer adoption intentions (Markus, 2004). Previous research examines processes related to adoption of really new products including consumer preferences (Hoeffler, 2003), cognitive processes (Moreau and Lehmann, 2001) and market entry strategies (Min et al., 2006; Urban et al., 1996).

This current research seeks to develop understanding about consumers' responses when faced with a new technology-driven product with which they have no previous experience. The purpose of the research is to examine the factors that affect intentions to use a RTP. The research examines the interaction of specific consumer characteristics with particular dimensions of adoption when presented with a technology product for which the consumers have no preconceived use.

This research integrates two innovation adoption models, the Unified Technology Acceptance and Utilization Theory (UTAUT) and the Task-Technology Fit (TTF) model with two consumer characteristic antecedents: consumer innovativeness and perceived value of a new product. The resulting model expands both theories by showing how UTAUT variables mediate between the variables of TTF and adoption intentions. This paper not only makes a contribution to theory about technology-driven product adoption but also consumer new product adoption which is not existing in the market, by presenting a conceptual model of the relationships between specific consumer characteristics, dimensions of perceived use, and adoption intentions. This research also provides an empirical examination of the application of the model with online consumers' perceptions of a specific RTP. Marketing and industrial design practitioners can use the model for clues about the preferences of consumers that may be likely to adopt RTPs.

The rest of the paper is organized as follows: The next section outlines the theoretical background and related literature. Section two presents the elements of the study's conceptual model. The third section describes the research methodology, applying a structural equation modeling method to empirically test the proposed model. The fourth section presents the results of data analysis. The final section discusses limitations, further research, and managerial implications of the key findings.

2. Theoretical background

2.1. Consumer adoption and innovation process

A variety of theoretical models in different disciplines are used to explain consumers' adoption of innovative RTPs. Models include Rogers (2003)' innovation diffusion theory, the Technology Acceptance Model (Davis, 1989), and the Theory of Reasoned Action (Ajzen and Fishbein, 1980). These models are used as the basis of examinations in marketing (Mahajan and Bass, 1990; Peres and Mahajan, 2010), in social psychology (Ajzen and Fishbein, 1980), and in information technology (Davis, 1989; Rogers, 2003).

Innovation adoption is defined as the consumer's decision to make full use of an innovation (Rogers, 2003). Adoption intention and actual purchase behavior are treated as distinct dependent variables, thereby recognizing how consumers may present different characteristics (Davis and Warshaw, 1989; Jamieson and Bass, 1989; Karahanna and Chervany, 1999; Rogers, 2003; Tornatzky and Klein, 1982). In particular, researchers note that the evaluative criteria used by consumers in adoption intention and adoption behavior are different (Arts and Bijmolt, 2011). Arts et al. (2011) found that consumers show higher levels of adoption intention for innovations that are more complex, better match their needs and involve lower uncertainty. This current research focuses on adoption intention and refers to it as a consumer's expressed desire to purchase a new product in the near future (Rogers, 2003).

The innovation adoption literature describes how consumer characteristics and perceived characteristics of innovative design are drivers of adoption (Rogers 2003; Tornatzky and Klein 1982). Researchers examine how individual consumers respond differently to stimuli and how individual preferences and innovation motivate many purchase decisions (Bloch, 1995; Bloch and Arnold, 2003; Manning et al., 1995). Individual preferences affect how a product's value is interpreted and how different individuals react differently to dimensions of its value. Innovation adoption research investigates many different variables related to adopter characteristics including socio-demographic characteristics like consumers' age, level of education and income and psychographic characteristics including innovativeness, opinion leadership, media proneness, and involvement (Arts et al., 2011; Rogers, 2003; Tornatzky and Klein, 1982). Theoretical descriptions of consumer responses to design are focused on the cognitive and behavioral effects of design (Bloch, 1995; Crilly and Clarkson, 2004) and link design and consumer outcomes (Crilly et al., 2004).

2.2. Task-Technology Fit (TTF)

The Task-Technology Fit (TTF) theory (Goodhue and Thompson, 1995) examines the interactions between tasks, technologies, and an individual's capabilities. The theory purports that the fit between task requirements and technology functionality influences utilization and performance (Goodhue and Thompson, 1995). Furthermore, the theory suggests that individual performance is affected by how well technology options "fit" task requirements, that fit is based on the technology's impact on task processes, and that individuals evaluate fit and choose technologies on that basis of their evaluation of fit (Goodhue and Thompson, 1995). The theory provides support for the notion that a technology will be used well if the functions of the technology can support the needs of users (Cane and McCarthy, 2009; Dishaw and Strong, 1999).

In order to provide a better explanation of users' technology choices, the TTF model is extended with attitude/behavior models. Goodhue and Thompson (1995)'s empirical testing of the general TTF model includes the fit between individual characteristics and the technology being used. Lin and Huang (2008)' study combines TTF with social cognitive theory. Both studies find TTF to be important for users' acceptance of information technology and for perceived usefulness and advantage.

In order to further explain the factors related to consumer perspectives about technology utilization, previous research has extended TTF with the Technology Acceptance Model (TAM) (Cane and McCarthy, 2009; Dishaw and Strong, 1999; Gebauer and Gribbins, 2010; Klopping and McKinney, 2004; Kositanurit and Osei-Bryson, 2007; Schrier and Brewer, 2010). Davis developed the Technology Acceptance Model (TAM) to explain how perceived usefulness and perceived ease of use of a technology helps to establish an individual's attitude toward the technology, their intention to use it and the resulting use behavior (Davis et al., 1989). TAM has been adopted by many researchers to explain user acceptance of new technologies (Davis, 1989; Davis et al., 1989).

Dishaw and Strong (1999) extend the TTF model by examining users' technology acceptance behaviour and integrating the TAM with the TTF model. They find that the combination of TTF and TAM provides a more complete explanation of adoption intention than TTF model alone. The combination provides an explanation of intention to use technology that is perceived to be appropriate for use.