# *Impacts of Hedonic and Utilitarian User Motives on the Innovativeness of User-Developed Solutions*



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# Impacts of Hedonic and Utilitarian User Motives on the Innovativeness of User-Developed Solutions


## Abstract

When individual consumers develop products for their own use, they in part expect to be rewarded by the use value of what they are creating (utilitarian user motives), and in part expect to be rewarded intrinsically by such things as the fun and learning experience derived from creating it (hedonic user motives). In this paper, we conduct first-of-type studies to understand the relationship between individual consumers' motives to innovate and the novelty and utility of the solutions they develop. The theoretical framework integrates self-determination theory and goal setting theory.

The major findings of this study are that utilitarian user motives positively affect the utility of user-developed innovations. In addition, we find that a strong utility motive is associated with reduced solution novelty—perhaps because if individual users really need something to function well, it may be wise to go with tried and true solutions. In contrast, hedonic user motives drive solution novelty; the more an innovator is "in it for fun," the more novel the solution developed. However, hedonic user motives also have an inverted U-shaped relationship with solution utility. When the dominant motive for developing an innovation is the joy of the creative process rather than use value, the utility of what is developed is negatively affected. The levels of utility and hedonic user motives driving innovators are variables that can be adjusted by the innovators themselves, and/or by third parties seeking to motivate individual innovators and affect the rate and direction of inventive activities.



**Keywords:** *user innovation; consumer innovator motives; self-determination theory; goal-setting theory; non-linear relationships; novelty and utility of the solution*

# Impacts of Hedonic and Utilitarian User Motives on the Innovativeness of User-Developed Solutions

## Introduction

In recent decades, the phenomenon of individual consumers developing products for their own use has been shown to be very large in both scale and scope. In the UK, a national survey of representative samples of consumers found that 2.9 million people (6.1% of the population) developed for their own use. Collectively they spent $5.2 billion in time and money annually on this innovation activity (von Hippel et al., 2012). In the US, 16 million people (5.2% of the US population) were found to collectively spend $20.2 billion for these purposes, and in Japan, 4.7 million people (3.7% of the population) collectively spent $5.8 billion annually on product modification and development (Ogawa and Pongtanalert, 2011). With respect to scope, consumer user innovators were found to be active in developing essentially every type of consumer product, ranging from software for personal use, to product innovations for personal medical needs, to household goods, to hobbies.

From a social welfare point of view, note that innovation by individual users is a very valuable activity. First, it produces direct value for the innovators themselves in terms of the personal utility they gain from what they create. Second, it provides those individuals with hedonic benefits from the joy and knowledge they derive from innovating. Third, many user-developed innovations produce value for others as well, after being dispersed through peer-to-peer and/or commercial production and sale on the marketplace. Fourth, user-developed innovations add to social welfare as opposed to a situation where only producers innovate (Raasch and von Hippel, 2012).

Given the importance of the phenomenon, researchers have recently begun to explore the motives underlying consumers' development of products for their own use. Quite predictably, a motive to use the product being developed has been found to be prominent: studies of user innovation by consumers tend to focus on samples of innovators who report developing a product in order to use it. But the studies also report that about half of consumers' motivation to develop products has to do with intrinsic rewards such as the fun and learning experience that consumers

derive from engaging in the innovation process itself (Heinerth et al., 2013; Raasch and von Hippel, 2013; Lakhani and Wolf, 2005).

In this article we take an important next research step and explore the impact of consumers' innovation motives on the innovativeness of the product solution that they develop. First, we deeply examine user innovation outcomes associated with different motives. Our major findings are that individual consumers' motives for engaging in development do indeed affect the innovativeness of the solutions they develop. Specifically, we find that utilitarian user motives positively affect the utility of user-developed innovations. We also find that a strong utility motive is associated with reduced solution novelty—perhaps because if individual users really need something to function well, they may find it wise to incorporate tried and true solutions. In contrast, hedonic user motives drive solution novelty; the more an innovator is "in it for fun," the more novel the solution developed.

Second, we are the first to explore the impact of differing proportions of utility and hedonic user motives on the utility and novelty of the innovations created by individuals. While extant research implicitly assumes "the more (motivation), the higher (the innovativeness)," this research reveals that hedonic user motives also have an inverted U-shaped relationship with solution utility. We find that when the joy of the creative process becomes the dominant motive for developing an innovation, utility is negatively affected. Thus, if one develops a boat, driven by the joy of the development process rather than by the functionality of the boat, one might be inclined to pay more attention to novelty and less to seaworthiness.

Third, we integrate self-determination theory (Deci and Ryan, 1985a, b) and goal-setting theory (Locke and Latham, 1990, 2002, 2004, 2006) to more deeply understand user innovators' core motives to develop new solutions. While self-determination theory helps us to identify particularly relevant user innovator motives, goal-setting theory sheds light on the specific behavioral outcomes of these motives. Our findings fit goal-setting theory as well as a basic assumption in economics that you tend to get what you pay for. In the case of user-developed innovations, the motivations of the users are forms of anticipated self-payment for engaging in the innovation process. Relying on goal-setting theory (Locke and Latham, 1990, 2002, 2004, 2006), we can expect that user innovators, as the parties in a position to set the terms of their self-imposed tasks, will set them so as to increase the type of payment they desire. This can reasonably be expected to affect the nature of the product attained. By more deeply examining

user innovation outcomes associated with different motives, we enrich economic considerations of user innovation research with insights from psychological research. We conduct two independent studies of individual consumers who have developed consumer products for their own use. In each, we explore the mix of utility and hedonic user motives that induced the users to innovate, and link these to the utility and novelty of the solutions created.

Findings from such a research stream will offer value to innovation practice. The levels of utility and hedonic user motives driving innovators are variables that can be adjusted by the innovators themselves, and/or by third parties seeking to motivate individual innovators and affect the rate and direction of inventive activities. Further refinements of the concept will increase the palette of options available to innovation task designers.

## Literature Review

In recent decades, motives why users innovate have been examined in various literature streams. In this section, we review selected literature streams which examined consumer motives to innovate. Specifically, we review (a) research on consumer innovators' motives, (b) research on co-creation with consumers, and (c) research on consumers' buying or product adoption motives. Research in these areas provides valuable insights from different perspectives to better understand why user innovators innovate.

### Research on Consumer Innovators' Motives

Motives inducing individuals to engage in user innovation are very rich and nuanced. Often, in the psychological literature, they are grouped into the two broad categories of extrinsic or intrinsic motivation to perform tasks or engage in activities (Davis, Bagozzi, and Warshaw, 1992; Deci and Ryan, 1985). Extrinsically motivated individuals "act with the intention of obtaining a desired consequence or avoiding an undesired one, so they are energized into action only when the action is instrumental to those ends" (Gagné and Deci, 2005, p. 334; see also Davis, Bagozzi, and Warshaw, 1992). With this definition, benefits associated with the output created—the innovation being used or sold—are extrinsic motivators. Intrinsic motivation "involves people doing an activity because they find it interesting and derive spontaneous satisfaction from the activity itself" (Gagné and Deci, 2005, p. 331; see also Davis, Bagozzi, and Warshaw, 1992; Deci and Ryan, 1985).

The distinction between extrinsic and intrinsic motives is in line with user innovation research. On the one hand, "the greater the benefit an entity expects to obtain from a needed innovation, the greater will be that entity's investment in obtaining a solution" (Franke, von Hippel, and Schreier, 2006, p. 302). On the other hand, users also are motivated to innovate because they enjoy the development situation and derive subjective well-being from it (Lakhani and Wolf, 2005; Raasch and von Hippel, 2013). "Subjective well-being is […] what makes experiences and life pleasant as opposed to unpleasant" (Münster Halvari et al., 2013, p. 275; Kahneman, Diener, and Schwarz, 1999).

In the case of user innovation, an important form of extrinsic motivation is specified. Those who create an innovation in order to use it are user innovators (von Hippel, 2005). The separable outcome they create is the innovation itself, and their extrinsic motivation is to benefit from using the innovation they create (Bin, 2013; Raasch and von Hippel, 2013; von Hippel, 1988). Additional extrinsic motives documented include expected reciprocity (Lakhani and von Hippel, 2003), social recognition (Bin, 2013; Franke and Shah, 2003; Kogut and Metiu, 2001), economic benefits (Hienert, 2006), and the building of social relationships via participation (Franke and Schreier, 2010; Franke, Schreier, and Kaiser, 2010).

User innovation research has also found a range of intrinsic motives to innovate. These include enjoyment of the innovation development task itself (Hienerth, 2006; Ogawa and Pongtanalert, 2011; von Hippel, de Jong, and Flowers, 2012), learning/skill improvement (Bin, 2013; Hienert, 2006; Lakhani and Wolf, 2005) and helping others (Kogut and Metiu, 2001; Lakhani and von Hippel, 2003).

Two recent studies have measured the relative importance of a short list of intrinsic and extrinsic motives known to be important for user innovators. User innovator respondents were asked to 'divide up 100 points according to relative importance' among a list of five possible motivations for engaging in that activity (Kuusisto et al., 2013; Hienerth et al., 2014). The relative importance of extrinsic motives asked about were: (1) expected benefits from using the output and (2) selling the output to others. Intrinsic motives asked about were: (3) enjoyment from creating the innovation, (4) helping others (altruism), and (5) learning from the process of creating the innovation. These studies found that extrinsic and intrinsic motives were about equally important for user innovators.

User innovation research has largely been focused on products generated by user innovators. Only a few articles have been published on user-generated services (Oliveira and von Hippel, 2011; Riggs and von Hippel, 1996; Skiba and Herstatt, 2009). Innovative services generated by user innovators are, for example, user-developed home banking services or specific nutritional advice (Riggs and von Hippel, 1996; Skiba and Herstatt, 2009). However, this research did not focus on motives why users engage in generating new services.

Further important insights come from creativity research, which can also be applied to the generation of ideas for new products and the creation of subsequent solutions. An important merit of this stream is the distinction between novelty and meaningfulness of creativity. While meaningfulness generally comprises the usefulness, value, advantage or appropriateness of the generated ideas to the target group, such as customers (e.g., Ford and Gioia, 2000), novelty refers to the newness, originality or uniqueness of ideas or their related outcomes within the domain of interest (Im and Workman, 2004). Although the two dimensions are conceptually distinct, both are part of the overarching concept of creativity.

The two-dimensional conceptualization of creativity has recently been applied to firm product development programs (Sethi and Sethi, 2009; Stock, Six, and Zacharias, 2012; Stock and Zacharias, 2013). *Novelty* "is defined herein as the degree to which the new product is different from competing alternatives" (Sethi and Sethi, 2009, p. 209). In contrast, *utility* "comprises the usefulness, value, advantage, or appropriateness of the generated ideas" (Stock and Zacharias, 2013, p. 4).

**Research on Co-Creation with Consumers**

Another research stream providing valuable insights for this study explores the motives for engagement of individual users or consumers into firms' innovation process as co-creators for products (Campbell and Cooper, 1999; Fang, Palmatier, and Evans 2008; Lau, Tang, and Yam, 2010) and services (e.g., Edvardsson et al., 2010, 2012; Edvardsson and Tronvoll, 2013; Matthing, Sandén, and Edvardsson, 2004).

In the context of co-creation as the extent to which producers involve their consumers during the development of new products (Carbonell, Rodríguez-Escudero, and Pujari, 2009; Fang, 2008; Kristensson, Gustafsson, and Archer, 2004), researchers revealed that consumers are largely driven by extrinsic motives, ranging from expected reciprocation and social recognition to

product-related benefits and rewards (Nambisan, 2002; Ogawa and Pongtanalert, 2013; Yim et al., 2012). Further studies revealed that intrinsic motives, such as fun, curiosity, and learning/skill development also matter in these co-creation projects (e.g., Fueller, 2006; Fueller, Faullant, and Matzler, 2010; Nambisan and Baron, 2010).

Two studies compare the creativity and feasibility of new product ideas created by users vs. ideas created by a firm's professional developers. Kristensson, Gustafsson, and Archer (2004) studied ideas for new mobile telephony services. They found ideas developed by ordinary users to be significantly higher in both creativity and value than those developed by telecom firm developer employees. They found ideas by professional developers to be significantly more realizable in terms of feasibility and practical implementation. Poetz and Schreier (2012) identified the same findings in a study of the quality of ideas for improved baby feeding products.

**Research on Consumers' Buying or Product Adoption Motives**

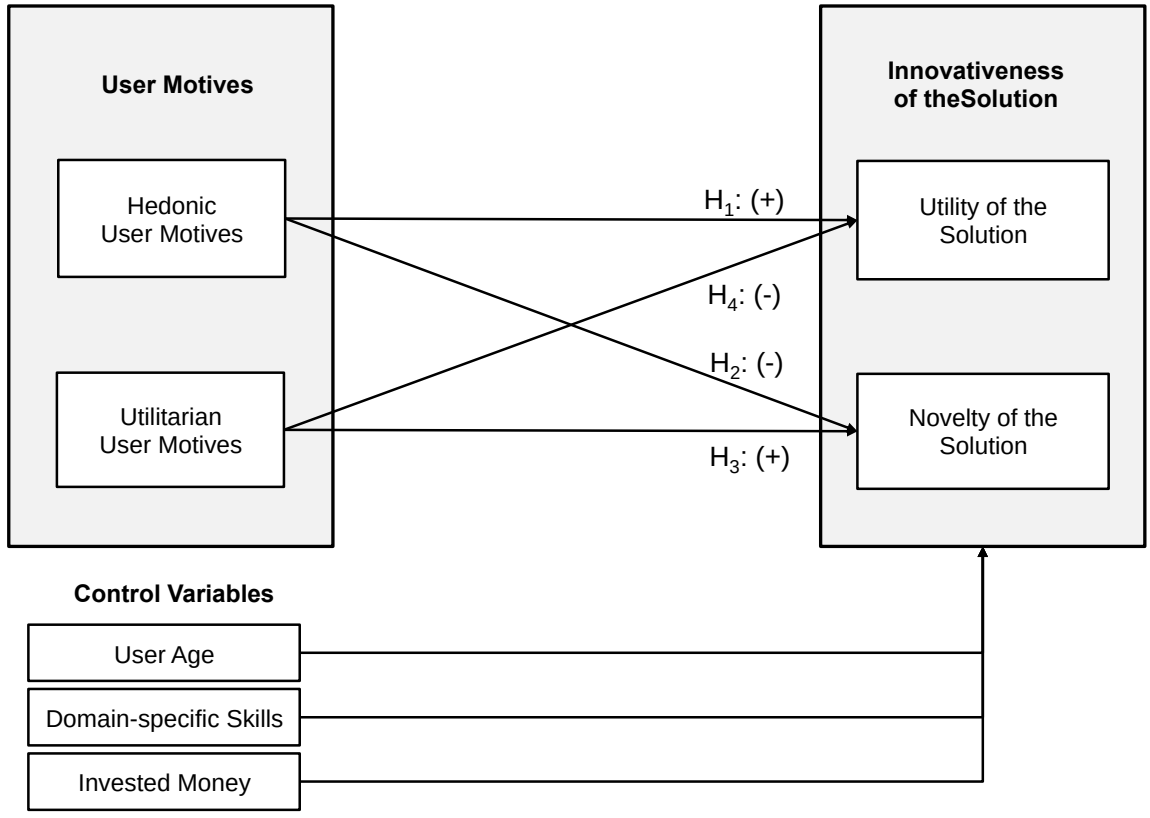
Further important insights come from consumer research on motives for a specific buying behavior or for adopting new products. Consumer research often classifies consumer motives or activities as hedonic or utilitarian (e.g., Dhar and Wertenbroch, 2000; Holbrook and Hirschman, 1982; Kivetz and Simonson, 2002; Okada, 2005; Sela, Berger, and Liu, 2009; Strahilevitz and Meyers, 1998). For example, in the case of a car, fuel economy is an economic benefit, whereas a sunroof and a luxurious interior are hedonic benefits (Chitturi, Raghunathan, and Mahajan, 2008). Accordingly, hedonic user motives are more affectively rich than utilitarian user motives (Botti and McGill, 2011, p. 1067): "Preferences for hedonic tasks and goods are emotionally driven, whereas those for utilitarian tasks and goods are cognitively driven."

Consumer research has been interested in the relative consumer preference for these two motives (e.g., Chitturi, Raghunathan, and Mahajan, 2007, 2008; Dhar and Wertenbroch, 2008; Okada, 2005; Voss, Spangenberg, and Grohmann, 2003). Several studies found that hedonic products are valued more than utilitarian products (Chitturi, Raghunathan, and Mahajan, 2007; Coelho do Vale, Pieters, and Zeelenberg, 2008; Dhar and Wertenbroch, 2000; Okada, 2005). Other studies have found that consumers attach greater weight to utilitarian benefits. A study by Chitturi, Raghanathan, and Mahajan (2008) focused on the interplay between these two dimensions to examine emotional and cognitive aspects of consumer behavior.

This research builds on previous knowledge on extrinsic and intrinsic motivation and integrates this perspective with work on hedonic versus utilitarian benefits from consumer research. While extrinsic motives are closely related to utilitarian consumer benefits, intrinsic motives capture hedonic consumer benefits. As this study strives to capture cognitive as well as emotional reasons for self-developed innovations by consumers, we further distinguish between utilitarian and hedonic user motives.

## Study Framework

The framework of this study is depicted in Figure 1. It contains innovativeness of the user-generated solution as dependent variable, and hedonic and utilitarian user motives as independent variables.



*Innovativeness of the user-generated solution* is the extent to which the solution (i.e., product or service), created by a user is novel and/or useful for the user. Therefore, it incorporates utility and novelty of the created solution (see Stock, 2011). *Utility of the solution* is defined as the usefulness, value, and advantage of the product generated by the user for the user and/or those who are closely related by social ties. Alternatively, utility can be labeled "product advantage" (Henard and Szymanski, 2001), "appropriateness" (Sethi and Sethi, 2009), or "value" (Ford and Gioia, 2000; Stock, Six, and Zacharias, 2013); these terms may be used interchangeably. *Novelty of the solution* is the degree to which the created solution is new and original to the individual developing it. Alternatively, novelty can be labeled "newness" (Szymanski et al., 2007). Innovativeness of the solution differs from the term creativity, which refers to the generation of ideas, which can be used to develop new products, processes, or other organizational outcomes (e.g., Amabile, 1988; Woodman, Sawyer, and Griffin, 1993). Innovativeness of the solution focuses on the outcome of the new product development, whereas creative ideas contribute to the new product development process.

An example of an innovation with high novelty and low utility drawn from our study data base is a clock with an electromechanical display of hours and minutes that imitates the displays used in antique Russian calculators. An example of an innovation with high utility but low novelty is an anti-tilt device for a baby chair: The device connects the baby chair to a dining table. This was done strictly for utility— a gain in safety for the baby sitting in the chair. An example of an innovation with both high utility and novelty is a "playful" lung pressure measurement device developed for a little boy suffering from cystic fibrosis. The child's parents created an inhalation device, which allowed their son to solve a computer game problem by breathing in and out. Simultaneously, the device measured the air pressure in his lungs. The utility of this innovation was increased willingness by the child to participate in lung function measurements; the novelty was making a game out of the measurement process.

A key aspect of our study framework is that the two dimensions of utility and novelty capture *different* facets of the innovativeness of a solution. Utility of a solution can be independent of novelty. Users may find incremental innovations very beneficial, even though they offer little novelty (Stock and Zacharias, 2013). For example, a user might generate a special filtering system for his or her garden pond that provides great utility for that particular individual,

yet differs only slightly from existing solutions. On the other hand, solution novelty does not necessarily ensure utility for the user. For instance, a conceptually new garden pond filtering system may not be any more useful than more traditional solutions. Thus, utility and novelty appear to be separate dimensions of solution innovativeness, as supported by the few existing studies that integrate these two dimensions (e.g., Calantone, Chan, and Cui, 2006). For example, Stock and Zacharias (2013) find that the utility of products positively affects customer responses, while novelty has a negative effect.

With respect to motives for product development, *utilitarian user motives* are extrinsic, referring to the functional, instrumental, and practical benefits of the product developed. In contrast, *hedonic user motives* are intrinsic, referring to the aesthetic, experiential and enjoyment-related benefits related to the process of developing the innovation (Raasch and von Hippel, 2013, Chitturi, Raghunathan, and Mahajan, 2008, Voss, Spangenberg, and Grohmann, 2003).

The study framework incorporates control variables that might affect the utility and novelty of the solution an individual develops. It is known that users' capabilities can affect the value of their creations. Thus, we control for the users' age, users' domain-specific skills, or the extent to which each individual perceives that he or she understands the subject to which the solution relates (Lüthje, Herstatt, and von Hippel, 2005). We also control for the amount of money and time users report investing in development of their solution. It is reasonable that solution utility (and novelty) will increase along with expenditures.

## Hypotheses Development

The development of hypotheses relies on self-determination theory (Deci and Ryan, 1985a, b, 2000; Ryan and Deci, 2000, 2002), which considers "the intrinsic propensities of people to engage in active, curiosity-based exploration and to integrate new experiences to the self" (Ryan and Deci, 2012, p. 4). The theory predicts that "people are assumed to be inherently active and thus to proactively initiate engagement with their environment" (Deci and Ryan, 2012, p. 87). The energizing basis for this activity is intrinsic and/or extrinsic motivation. In other words, both motives—hedonic and utilitarian—generate energy, which enables user innovators to conduct specific actions (Gagné and Deci, 2005). However, the goals of the invested energy are different.

Goal-setting theory (Locke and Latham, 1990, 2002, 2004, 2006) suggests that user innovators' goals or desired outcomes gained from the solution "direct attention, effort, and

action toward goal-relevant actions at the expense of nonrelevant actions" (Locke and Latham, 2006, p. 265). Specifically with respect to our context, this implies that as the focus on hedonic (or utilitarian) motives increases, goal-relevant action taken to enhance that dimension may result in less attention paid to the second dimension. In our study, we examine the relationship between the motives of innovators and the results of their efforts in terms of the novelty and utility of the created solution.

**User Innovation Outcomes from Hedonic User Motives**

Hedonic user motives are high for users who enjoy the creation of a new solution (see Davis, Bagozzi, and Warshaw, 1992). According to goal-setting theory, hedonically motivated user innovators will engage in activities they find original and stimulating: ones from which they derive spontaneous satisfaction. When developing a solution with high novelty, the user innovator is more likely to have a highly pleasurable experience. Thus:

*H1: Hedonic user motives positively affect the novelty of the solution.*

According to self-determination theory, user innovators essentially driven by hedonic user motives are primarily interested in the process of creating a new solution and in the joy they derive from the innovation process (see Deci and Ryan, 2012). Goal-setting theory indicates that this direction of attention, effort, and action toward novel solutions happens at the expense of nonrelevant (or less relevant) actions (see Locke and Latham, 2006). Thus, users with high hedonic user motives are likely to pay less attention to the utility of the products they are developing (see Noble, Griffith, and Weiberger, 2005). As a consequence:

*H2: Hedonic user motives negatively affect the utility of the solution.*

User innovators essentially driven by utilitarian or extrinsic motives perceive invented solutions as instruments for achieving valued outcomes that are distinct from the activity itself (Davis, Bagozzi, and Warshaw, 1992). Accordingly, they instrumentalize the new solution and direct their attention and effort toward increased utility (making one's own life easier or more efficient) or avoiding of something undesirable (i.e., contracting an incurable disease), see Locke and Latham (2006).

In line with this research, we argue that users are likely to direct their attention and effort toward those innovations that generate a benefit, i.e., ones that help them `to achieve valued outcomes (Raasch and von Hippel, 2012). In other words, users who are driven by utilitarian user motives are likely to develop solutions that are useful to them or people close to them. Thus:

*H3: Utilitarian user motives positively affect the utility of the solution.*

Regarding the novelty of the solution, we argue that utilitarian user motives are related negatively to the novelty of the solution created by a user innovator. Again, goal-setting theory indicates that the direction of attention, effort, and action toward useful solutions happens at the expense of non-relevant (or less relevant) actions (see Locke and Latham, 2006). Specifically, user innovators, when essentially driven by utilitarian user motives, will have more interest in the utility of the outcome, and therefore less interest in enhancing the hedonic value of their innovation development activities via increased novelty. Thus:

*H4: Utilitarian user motives negatively affect the novelty of the solution.*

## Data and Construct Measurement

### Data Collection and Sample

We studied two independent samples of consumer innovators. The first sample consisted of students at the first author's university ("student sample"). The second was a broader sample of consumers drawn from outside of the university ("consumer sample"). The same sample and data collection process was used for both.

*Student sample:* The data collection was organized in three steps. In the first step, we randomly encountered 1,700 graduate and undergraduate students from the first author's university. The study was described to them as serving a scientific purpose and designed to gain detailed insights into why users invent new solutions. The second step included a screening process in which we asked the contacted individuals whether they had developed a new consumer product to solve a consumer problem they or their close social ties had experienced. As we were focused on the development process as the user perceived it, it was only required that the innovation is new in the view of the consumer at the time of development. To familiarize respondents with the term "user innovation," we provided verbal examples and showed pictures of exemplary user innovations (for a similar procedure, see Meuter et al., 2000). If the individuals

indicated that they had not developed a consumer product for themselves, the questionnaires were not distributed.

Via the procedure just described, 213 user innovators were identified (12.5% of the individuals contacted). As a third step, we asked all of these individuals if they would participate in the study. Due to the personalized approach, we think, 187 user innovators agreed to fill out the questionnaire (87% response rate). Thirty-eight questionnaires were returned without essential items completed, which left 149 questionnaires available for further analyses. All participants were between the ages of 18 and 36.

*Consumer sample:* The sample identification and data collection process, which focused on newly developed products only, also involved two steps: In the first step, 400 individuals were contacted, who discussed or depicted their ideas in the Internet and 400 individuals were personally approached. Based on this procedure, we identified 221 user innovators, of which 29 user innovators refused to participate. In 28 cases of individuals identified via the Internet, the email addresses available were found to not be valid, so those individuals could not be contacted. The participating user innovators had to confirm that they have created an innovation on their own, using the previously mentioned process of describing and defining user innovation to interviewees. In a second step, we asked each confirmed user innovator to fill out a questionnaire as well as to provide extensive descriptions and pictures of their newly developed solution. In the case of the sample recruited for the 'consumer study', we gathered 164 questionnaires (a response rate of 74%), of which 17 were incomplete and had to be removed from the sample.

In terms of age, the user innovators participating in our study ranged from 18-24 (11%), 30-34 (20%), 35-44 (12%), 45-54 (19%), 55-64 (28%), and 65 and above (10%). About half of the surveyed user innovators held a high school degree (18%) or a college or university degree (35%). Eighty-two percent of the user innovators were employed or self-employed, 11% were students and 7% were retired. As was noted earlier, we had identified and recruited individuals for our consumer sample both personally and via the Internet. We therefore tested whether these two groups differed in terms of important characteristics. Comparisons of demographics and personality variables, such as extraversion and need for social recognition, did not reveal significant differences among the two groups. Thus, we amalgamated the data for further analyses.

**Measurement Procedure**

Previously used and validated scales from existing literature were used, with modifications as required to fit our specific study research issues. The operationalization mainly used reflective multi-item measures, as the observed variables are interchangeable manifestations of the underlying construct. All items, including the sources used for the scale development, appear in the Appendix.

Utilitarian user motives were measured with a reduced scale from Voss, Spangenberg, and Grohmann (2003). The items "effective," "helpful," and "functional" had to be removed during the item purification process. Instead, the item "The solution was invented because it solved a problem" was added, because solving a problem constitutes the core of utilitarian needs. Hedonic user motives were captured with three items from the scale developed by Voss, Spangenberg, and Grohmann (2003). The item "The solution was invented because it was enjoyable" was added as a core characteristic of hedonic user motives.

Additional scale development related to our dependent variables: utility and novelty of the solution. We elected to adapt scales from Im and Workman (2004) to capture these constructs. *Utility* of the solution was measured with a four-item scale. The language of each item was adjusted to reflect the fact that the solution being developed was for the personal use of the developer instead of for the use of a customer. Specifically, the Im and Workman item "The developed product is relevant to customers' needs and expectations" changed to "The solution I invented is relevant to my needs and expectations (or the needs and expectations of relatives or friends)." The item "The product is considered suitable for customers' desires" changed to "The solution I invented is considered suitable for my desires." The item "The developed product is appropriate for customers' needs and expectations" became "The solution I invented is appropriate for my needs and expectations (or the needs and expectations of relatives or friends)," and the item "The product is useful for customers" changed to "The solution I invented is useful."

The Im and Workman (2004) scale to capture the novelty dimension included five items that were also adapted to our specific research setting and question. Specifically, the item stem "The product" changed to "The solution you invented." Four items otherwise remained the same: "… is really 'out of the ordinary'," "… can be considered as revolutionary," "shows an unconventional way of solving problems," and "… is stimulating." The fifth item, "… provides radical differences from industry norms" changed to "… provides radical differences from

existing solutions." Finally, we excluded the item "The product reflects a customary perspective in this industry," because we did not want to capture industry issues.

We focus on innovating users' own perceptions regarding the utility and novelty of their creation and other variables described previously. With respect to novelty, we focus on whether to the individual's knowledge the innovation he or she developed was new. Objective assessments of the actual novelty of an innovation to the world at large are not incorporated. Similarly, with respect to utility, the assessment of the individual user-innovator is the perspective taken, rather than the perspective of an outside observer.

Scale development was also conducted for the two control variables. Users' domain-specific skills were measured with an adapted scale by Füller, Matzler, and Hoppe (2008). The item "I consider myself very knowledgeable and can contribute to product development" changed to "Before I developed the solution, I was very knowledgeable regarding the problem which had to be fixed." The item "I possess profound know-how (e.g., concerning technology, materials, market understanding, product design) relevant for virtual new product development" changed to "Before I developed the solution, I possessed profound know-how about the problem the solution was for." The item "I fully understood the problem the solution was for" was developed for this study.

The initial draft of the questionnaire was pretested and refined. Respondents were asked within a pretest to comment on a first draft in which most scales came from existing literature. Their feedback led to minor scale refinements in the questionnaire. The finalized scales appear in the Appendix.

Tests of the reliability and validity of the scales came from exploratory and confirmatory factor analyses. For all constructs, the Cronbach's alpha values exceeded the recommended minimum of .7 (Nunnally, 1978), indicating a high degree of internal consistency. The composite reliability for all constructs was greater than .7 (Fornell and Larcker, 1981); for most constructs, the average variance extracted fulfilled the threshold value of .5 (Bagozzi, Yi, and Phillips, 1991). Furthermore, Fornell and Larcker's (1981) rigorous criterion as the test for discriminant validity was fulfilled (Anderson, Gerbing, and Hunter, 1987).

Table 1 depicts the correlations among the variables included in our analyses of the relationship between motive and innovation attributes. The diagonal elements represent the

square roots of the average variance extracted, which were greater than the off-diagonal elements. Thus, discriminant validity was not a problem in this sample.

**TABLE 1: Descriptive Statistics, Reliabilities, and Intercorrelations among Refined Measures (Study 1 and Study 2)**

| Variables | M | S | α | CR | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Study 1 – student sample* | | | | | | | | | | | | | |
| 1 Novelty of the Solution | 3.48 | 1.37 | .76 | .77 | (.68) | | | | | | | | |
| 2 Utility of the Solution | 5.24 | 1.46 | .86 | .86 | .10 | (.78) | | | | | | | |
| 3 Utilitarian User Motives | 5.56 | 1.33 | .70 | .71 | -.18* | .41* | (.69) | | | | | | |
| 4 Hedonic User Motives | 4.67 | 1.87 | .85 | .86 | .29* | .12 | .00 | (.78) | | | | | |
| 5 User Age | 23.47 | 5.79 | -- | -- | .22* | .19* | .16* | -.03 | (--) | | | | |
| 6 Domain-specific Skills | 5.63 | 1.49 | .90 | .90 | .23* | -.18* | .19* | .24* | .07 | (.87) | | | |
| 7 Invested Money | 40.84 | 26.73 | .-- | -- | .23* | .12 | .04 | .11 | -.03 | .04 | (--) | | |
| *Study 2 – consumer sample* | | | | | | | | | | | | | |
| 1 Novelty of the Solution | 4.62 | 1.31 | .75 | .76 | (.67) | | | | | | | | |
| 2 Utility of the Solution | 6.17 | .97 | .84 | .84 | .11 | (.74) | | | | | | | |
| 3 Utilitarian User Motives | 5.46 | 1.33 | .68 | .70 | -.13 | .44* | (.65) | | | | | | |
| 4 Hedonic User Motives | 5.47 | 1.55 | .85 | .86 | .34* | .08 | -.12 | (.77) | | | | | |
| 5 User Age | 44.51 | 16.05 | -- | -- | .26* | -.10 | .08 | -.16* | (--) | | | | |
| 6 Domain-specific Skills | 4.33 | 1.83 | .91 | .92 | .28* | -.15 | -.12 | .38* | .13 | (.89) | | | |
| 7 Invested Money | 4,231.94 | 3,115.07 | -- | -- | .15 | .03 | -.04 | .07 | .06 | .12 | (--) | | |
| 8 Novelty of Solution, third rater[a] | 4.58 | .87 | .93 | .93 | .45* | .07 | .02 | .11 | .07 | .17* | .16 | (.89) | |
| 9 Utility of Solution, third rater[a] | 5.00 | .92 | .90 | .91 | .23* | .16 | .22* | -.11 | .16* | .01 | .19* | .74* | (.87) |

*Notes:* M = mean, S = standard deviation, α = Cronbach's alpha, CR = composite reliability.
Diagonal elements in parentheses are square roots of average variance extracted for multi-item constructs measured reflectively. a = only captured in the consumer sample;
*n = 149 (student sample); n = 147 (consumer sample).* * $p \leq .05$.

## Results

### Effect of User Innovator Motives on Innovativeness of the Solution Created

In our hypotheses, we proposed direct effects from hedonic and utilitarian user motives on the two dimensions of innovativeness of the solution, namely, the novelty and utility of the solution. To test for both proposed effects, we employed hierarchical regression analysis (Aiken and West, 1991). For both dimensions of innovativeness—novelty of the solution (Table 2) and utility of the solution (Table 3)—we ran separate regression analyses. First, for the dependent variables, we ran an initial regression with the control variables (Model 1) to avoid confounding the main effects (Irwin and McClelland, 2001). Afterward, we added the independent variables, namely, hedonic and utilitarian user motives (Model 2, Table 2 or Table 3).

**TABLE 2: Regression Results for Utility of the Solution as the Dependent Variable**

| | *Study 1 – Student Sample* | | | *Study 2 – Consumer Sample* | | |
|---|---|---|---|---|---|---|
| | *Model 1 (Control Variables)* | *Model 2 (Linear Effects)* | *Model 3 (Squared Effects)* | *Model 1 (Control Variables)* | *Model 2 (Linear Effects)* | *Model 3 (Squared Effects)* |
| *Control Variables* | | | | | | |
| User age | .13 | .11 | .08 | -.04 | -.01 | -.03 |
| Domain-Specific Skills | .10 | .08 | .07 | .07 | .06 | .06 |
| Invested Money | .54* | .49* | .51* | .16 | .18* | .20* |
| *Linear Effects* | | | | | | |
| Utilitarian User Motives | -- | .22* | .19* | -- | .37* | .22* |
| Hedonic User Motives | -- | .04 | -.02 | -- | .03 | .01 |
| *Squared Effects* | | | | | | |
| Utilitarian User Motives squared | -- | -- | -.07 | -- | -- | .01 |
| Hedonic User Motives squared | -- | -- | -.19* | -- | -- | -.26* |
| $R^2$ (Adjusted $R^2$) | .26(.24) | .31(.29) | .34(.31) | .17(.01) | .33(.27) | .36(.29) |
| F-Value | 9.51* | 16.44* | 10.47* | 3.05* | 10.83* | 7.82* |
| Incremental $R^2$ | .26 | .05 | .03 | .17 | .10 | .03 |

*Notes:* Standardized regression coefficients. *n = 149 (student sample); n = 147 (consumer sample).* * $p < .05$.

In Model 3, we created squared interaction terms to examine whether quadratic effects occur. For ease of interpretation, we mean-centered the constituent variables (Cohen et al., 2003; Echambadi and Hess, 2007).

**TABLE 3: Regression Results for Novelty of the Solution as the Dependent Variable**

| | *Study 1 – Student Sample* | | | *Study 2 – Consumer Sample* | | |
|---|---|---|---|---|---|---|
| | *Model 1 (Control Variables)* | *Model 2 (Linear Effects)* | *Model 3 (Squared Effects)* | *Model 1 (Control Variables)* | *Model 2 (Linear Effects)* | *Model 3 (Squared Effects)* |
| *Control Variables* | | | | | | |
| User age | .24* | .11 | .08 | .12 | .09 | .10 |
| Domain-Specific Skills | -.09 | .08 | .07 | .15* | .16* | .15* |
| Invested Money | .33* | .30* | .24* | .27* | .24* | .19* |
| *Linear Effects* | | | | | | |
| Utilitarian User Motives | -- | -.17* | -.22* | -- | -.22* | -.21* |
| Hedonic User Motives | -- | .23* | .29* | -- | .18* | .16* |
| *Squared Effects* | | | | | | |
| Utilitarian User Motives squared | -- | -- | -.12 | -- | -- | .10 |
| Hedonic User Motives squared | -- | -- | .10 | -- | -- | -.05 |
| $R^2$ (Adjusted $R^2$) | .17(.15) | .26(.23) | .28(.24) | .10(.08) | .35(.33) | .35(.33) |
| F-Value | 7.59* | 8.47* | 6.90* | 5.22* | 15.88* | 11.78* |
| Incremental $R^2$ | .17 | .09 | .02 | .10 | .25 | .00 |

*Notes:* Standardized regression coefficients. *n = 149 (student sample); n = 147 (consumer sample). * p* < .05.

The first set of regressions includes the test of H1 and H2, with hedonic user motives as independent variables. In line with H1, hedonic user motives positively affect the novelty of the solution (.23, $p<.05$, student sample; .18, $p<.05$, consumer sample), as can be seen in Table 2. Surprisingly, hedonic user motives exhibit a non-significant linear effect (.04, *ns*, student sample; .03, *ns*, consumer sample), but a significant squared effect on the utility of the solution (-.19, $p<.05$, student sample; -.26, $p<.05$, consumer sample), which contradicts our expectations of H2.

The results are depicted in Table 3. This inverted U-shaped relationship between hedonic user motives and utility of the solution indicates that hedonic user motives only increase the utility of the solution to a certain extent. Beyond a certain level of fun and joy of developing a solution, we suppose that the user may lose focus on the utilitarian purpose of the invention, which decreases the utility of solution.

The second set of regressions includes the test of H3 and H4, with utilitarian user motives as an independent variable (Tables 2 and 3). The findings support H3: Utilitarian user motives increase the utility of the solution (.22, $p<.05$, student sample; .37, $p<.05$, consumer sample). The results of this regression analysis are depicted in Table 2. Further support can be gained for H4. Our results reveal that utilitarian user motives reduce the novelty of the solution (-.17; $p<.05$, student sample; -.22, $p<.05$, consumer sample), which is in line with our theoretical consideration that users driven by utilitarian user motives are more reluctant to try unproven new things and prefer to invent a feasible and certain solution, which is not necessarily radically new. The related results are depicted in Table 3.

**Test of Common Method Variance**

The measures of hedonic and utilitarian user motives and their innovation outcomes relied on user innovators' self-reports, which included the risk of common method bias (Podsakoff et al. 2003). We conducted two tests to rule out this possibility.

First, we applied Harman's single-factor test (Podsakoff et al. 2003) to determine whether a single-factor model with all manifest variables fit significantly worse than our original model. We compared the chi-square value of the single-factor model with the measurement model and determined that the fit of the single-factor model was significantly worse than that of the model with all the constructs in the student sample. Therefore, the correlations between observed variables cannot be explained using a single factor.

Second, we included a common method factor in the structural model used to test the hypothesized model. It loaded in all items that we measured with user innovators' self-reports and thus enabled us to control for common method variance in our hypotheses tests. To achieve model convergence, we specified all the loadings of the method factor to be of the same size, reflecting the assumption that common method variance affects all items equally. In addition, the method factor was specified as uncorrelated with the other constructs, reflecting the assumption

that the degree of common method variance was independent of the true magnitude of novelty and meaningfulness of the solution (Homburg et al., 2011). The results remained stable, so common method bias was not a concern for either the student sample or the consumer sample.

To further reduce the likelihood of common method bias in the case of the consumer sample, we generated extensive information regarding the solution created by the user innovators. Specifically, we asked the user innovators to provide detailed descriptions and pictures of the solutions they developed. The solutions then were assessed based on these pictures and descriptions by two independent scholars of our team regarding novelty, using the same items, assessed by the consumers (see Appendix). We averaged their ratings, which strongly correlated with the user innovators' self-assessments for novelty (.45; $p < .05$; see Table 1). The relatively high correlations indicate that user innovators are able to accurately assess the novelty of their solutions. We further assessed the utility of the solutions by third raters, based on the following items: "The created solution could fulfill the needs of many users," "The created solution is useful for many users," and "The created solution could fill a market niche after being further developed." The correlation between utility as assessed by the consumers, and utility as assessed by third raters was non-significant (.16; *n.s.*). This is plausible, as the consumers rated the utility for themselves, while the third raters focused on the utility for a broader set of consumers.

## Discussion

In this study we have explored the impact of two innovation motives on the *nature* of the innovation output individuals create. By integrating self-determination theory (Deci and Ryan, 1985a, b, 2000) and goal-setting theory (Locke and Latham, 1990, 2000, 2002, 2006), we extracted two sets of user motives, utilitarian and hedonic, responsible for innovativeness of the user-developed solution. We then explored the role of utilitarian and hedonic user motives in the level of innovativeness of the solution, captured by the level of utility and novelty as perceived by the individual innovator. We applied psychometric measurement theory (e.g., Nunnally and Bernstein, 1994) to develop a new construct that taps the level of innovativeness of a solution and two main dimensions, namely the utility and novelty of the user innovation. Building on existing literature, we developed a set of reliable and valid items and scales for utilitarian user motives, hedonic user motives, and their impacts on the utility and the novelty of the user innovation. We

empirically tested these relationships in the context of user innovation, using a survey of respondents who had developed new products or services. Our proposed latent constructs are measured reflectively. We find that our multi-item measurement scales have sufficient psychometric properties of validity and reliability to be useful for theory building and testing.

**Suggestions for Further Research**

This research is first-of-type, and we suggest that further research would be valuable. Despite all benefits of user innovations, today only about 6% of citizens innovate. It will be important to understand why this is the case, and we propose that assessment of motivations will be an important matter to explore in this regard. It may be that affecting motivations by mechanisms such as contests and gamification can significantly increase rates of innovation by individual consumers at low costs. It may also be that factors independent of motivations may be important—for example, many citizens may simply be "not innovative" in some unchangeable way.

Historically, research findings on the motives inducing individuals to innovate and create have been used to adjust conditions that support and motivate innovators within organizations and firms. Today, it is becoming increasingly possible, via the Internet, to recruit and reward individuals working at home to participate in collaborative innovation projects, either by and for users themselves, or for firms. It is also becoming better understood how to use methods such as gamification to quickly and easily adjust the hedonic rewards offered to individual innovators. Given this, it becomes increasingly important to understand the impact of different combinations of incentives upon the utility and novelty of what individuals create.

In this study, we focused on hedonic and utilitarian user innovator motives to gain a first understanding of how innovativeness of the user-generated solution is affected by them. Future research should examine a broader set of motives and their effects on the innovativeness of the solution. We further propose that broad motives, when parsed, will reveal intensely-felt component motives that can also have a major impact upon innovation participation and innovation outputs, perhaps for specific types of innovation only. For example, it is a common understanding among programmers participating in open source software communities that some of the most expert participants place great emphasis on developing elegant code. It is not enough

for these individuals that the code they write does the specified job: it must do it elegantly—"beautifully"— if they are to experience pleasure in creating it.

Further research can also be motivated by the finding that the rewards associated with product development importantly include "process rewards" such as fun and learning. These can only be reaped by active participation in the innovation process. Importantly, process rewards are a form of *consumption* that reduces the cost of innovation development attributable to creation of the product itself for user innovators. For example, if a user innovator is consuming $500 worth of fun during the process of developing a novel kayak, the cost to the user of the development work that must be rewarded by use or sale of the kayak itself (the innovation output) is reduced by $500 (Raasch and von Hippel, 2013).

This study examines new physical goods and services, developed by user innovators. Extant innovation research has increasingly been interested in service innovations (e.g., Abramovici and Bancel-Charensol, 2004; Atuahene-Gima, 1996; Lievens and Moenaert, 2000; Nijssen et al., 2006). Some scholars even stress the unique characteristics of services and thus the need for concepts specifically designed for them (e.g., Atuahene-Gima, 1996; Zeithaml, Bitner, and Gremler, 2009). Future user innovation research thus, should examine services, generated by users, more extensively.

In sum, further study of the links between the motives driving individuals' participation and the output they create can open another path to understanding how to guide innovation effort towards desired types of innovation outputs, toward better hedonic and other process experiences for innovators, and toward reduced costs for innovation development.

**Implications for Practice**

If one understands individual motives to innovate and the impacts these may have on innovation outputs, one has an addition to the box of practical management tools for the innovation process. This toolbox can be especially useful for those attempting to attract many individuals to participate in larger scale crowd sourced innovation projects, such as open source software projects or crowdsourced innovation contests run by firms. Such individuals will be well served to anticipate and manage a range of motivations among potential participants, rather than just assume all will have the same motivations.

Recall that individuals developing innovations for their own use have a mix of utility and hedonic user motives for engaging in that activity. They have a built-in incentive to serve their personal needs, which may or may not be in alignment with the needs of many others. However, managers of innovation projects are interested in supporting the development of innovations that address a general demand. Firms and peer-to-peer innovation projects can move the utility component of potential participants' motivations toward those experienced by many others by, for example, creating or supporting user communities or activities that steer individual user innovation utilities onto common ground. Thus, a firm producing mountain bikes might wish to create communities or contests focused on activities that would generate useful user-developed improvements to activities of general interest, such as riding on rough terrain, rather than more idiosyncratic activities. Similarly, a firm that produces medical products might generate activities or contests intended to elicit user innovations with respect to needs that are common in an activity area or marketplace.

With respect to affecting outputs created by individuals via manipulating hedonic returns, those who would recruit user innovators to help them solve problems can follow a fairly recent practice, called gamification. This involves consciously applying intrinsic motivators found within online games, such as scoring systems, to enhance participation motivation for the performance of useful tasks (Franke, Schreier, and Kaiser, 2010). Recall, however, our finding that very high levels of hedonic rewards, as can easily be induced by gamification, can reduce the utility of innovators' creations. When fun is an adequate or more-than-adequate reward for participation in an innovation activity, the additional reward offered by utility will have less importance to participants. Firms can control this factor by tying hedonic rewards closely to utility. For example, they can provide a contest scoring system that rewards bikers who demonstrably have created the sturdiest or most aerodynamic bike designs.

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## APPENDIX: MEASURES AND ITEMS

| Construct | Measure | Comments |
|---|---|---|
| *Utilitarian User Motives* | The solution was invented because it …<br>(1) … was necessary.<br>(2) … was practical.<br>(3) … solved a problem. | *Source:* adapted from Voss, Spangenberg, and Grohmann (2003) |
| *Hedonic User Motives* | The solution was invented because it …<br>(1) … was fun.<br>(2) … was exciting.<br>(3) … was enjoyable.<br>(4) … was pleasant. | *Source:* adapted from Voss, Spangenberg, and Grohmann (2003) |
| *Utility of the Solution* | The solution you invented …<br>… is relevant to my needs and expectations (or the needs and expectations of relatives or friends).<br>… is considered suitable for my desires.<br>… is appropriate for my needs and expectations (or the needs and expectations of relatives or friends).<br>… is useful. | *Source:* adapted from Im and Workman (2004) |
| *Novelty of the Solution* | The solution you invented …<br>… is really "out of the ordinary. "<br>… can be considered as revolutionary.<br>… is stimulating.<br>… provides radical differences from existing solutions.<br>… shows an unconventional way of solving problems. | *Source:* adapted from Im and Workman (2004) |
| *Domain-specific Skills* | Before I developed the solution …<br>… I was very knowledgeable regarding the problem which had to be fixed.<br>… I possessed profound know-how about the problem the solution was for.<br>… I fully understood the problem the solution was for. | *Source:* adapted from Füller, Matzler, and Hoppe (2008) |

*Notes:* Seven-point Likert-type scales, with 7 = "strongly agree" and 1 = "strongly disagree" as anchors.