



# First adoption of consumer innovations: Exploring market failure and alleviating factors

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## ABSTRACT

Consumers innovate usually for non-commercial motives. They generally lack incentives to diffuse, and this is expected to hamper first adoption – even if consumer innovations are valuable to many other people. We confirm this market failure with survey data of 164 German consumer innovators. First adoption by others is unrelated with general use value, unless the innovator is highly willing to commercialize. Next, as classical diffusion theory does not explain when consumer innovations become available to others, we propose an individual-object-process (I-O-P) framework to study factors alleviating the market failure. The viability of the framework is explored by studying the moderating role of entrepreneurial experience (I), product newness (O) and community engagement during the innovation process (P). First adoption of generally valuable consumer innovations is enhanced when a community was involved. We also find tentative evidence for a moderating role of entrepreneurial experience and product newness.

## 1. Introduction

A consumer innovation is defined as a functionally novel product, service, process or application, developed by consumers at private cost in their unpaid discretionary time (von Hippel, 2017). Consumers occasionally innovate for commercial reasons. Much more often, however, consumers are driven by personal need or benefits derived from the innovation process itself (e.g., enjoyment, learning) (Raasch and von Hippel, 2013). Surveys done in various countries (summarized by de Jong, 2016) show that the frequency of consumer innovation in general populations is 4–6%.

Some consumer innovations are highly useful to others. General use value is the perceived utility of an innovation by others in a social system, apart from use or process benefits that the innovation offers to its creator. Compared to existing products innovations with high general use value deviate in terms of market-related factors. They address a problem or need that many others face, with the potential to address a sizeable market (Garcia and Galantone, 2002). Earlier work indicates that some consumer innovations have the potential to diffuse and advance social welfare. For example, micro-economic models show that consumer innovations can put price pressure on existing commercial products, or drive producers to improve the quality of those products. Consumer innovations may also complement existing producer offerings so that the aggregated use value increases (Gambardella et al.,

2017). Empirical observations shows that consumer innovations can become new products with better revenues than products obtained from traditional new product development (e.g., Fuchs and Schreier, 2011; Lilien et al., 2002). Consumer innovation can also result in start-ups at the edge of new industries (Shah and Tripsas, 2007).

Social welfare is the general well-being obtained by individuals in a society by an allocation of resources (products, services, processes, applications) that is suboptimal, i.e. not distributed to those who gain most utility to them (Feldman, 2008). Social welfare requires diffusion, referring to a process by which an innovation is communicated over time among the participants in a social system (Rogers, 2003). First adoption by others, or the act that other people start using the consumer innovation, is a necessary first step in a diffusion process.

In the case of consumer innovation first adoption is not self-evident. Von Hippel (2017) discusses that as consumers derive benefits from personal use or direct engagement in the innovation process, value to others is an externality to them. Consumer innovation differs from the traditional producer innovation model. For commercial producers diffusion of innovations is likely, as producers will have to sell their innovations in order to benefit. In general, a market failure is a situation in which the allocation of products, services, processes or applications is inefficient; in an alternative outcome (some) individuals can be better off without making others worse off (Krugman and Wells, 2006). Typically, market failures exist when individual pursuit of self-interest

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leads to results that can be improved from a social welfare perspective. Accordingly, lack of diffusion due to missing incentives has been proposed as a new type of market failure. Initial evidence for consumer innovators was reported by de Jong et al. (2015) based on survey data of Finnish citizens. The authors recommended to further study the circumstances that would alleviate lack-of-diffusion of consumer innovations. In this paper we address this research gap. (The market failure was also demonstrated in a study of American physicians (von Hippel et al., 2017), but in the current paper we are concerned with consumer innovators.)

Our contribution is twofold. First, compared to the consumer innovation study reported by de Jong et al. (2015) we provide more robust evidence for a market failure with regard to diffusion. A drawback in the aforementioned study is that consumers self-rated the general use value of their innovations. In the current paper we analyze data from 164 German consumer innovators, including detailed descriptions and visualizations of their innovations. We had independent coders to rate general use value in order to obtain an independent measure.

Second, we propose and apply a framework to analyze the circumstances in which first adoption is more likely. By doing so we also contribute to the diffusion of innovations literature. Diffusion studies assume that innovations are available to others, that is, some first adoption has occurred already. First adopters are typically cosmopolite and connected to other populations, enabling them to introduce the innovation into their social system (Rogers, 2003). Diffusion studies usually also identify a ‘change agent’ with an interest in diffusion (e.g., a business, government, or charity organization). In the case of consumer innovations, however, due to lacking incentives a change agent is missing, and the innovation may never become available to others to begin with.

Drawing on entrepreneurship, user innovation, and diffusion of innovation literature, we suggest to study individual (I), object (O) and process variables (P) that can moderate the relationship between general use value and first adoption. To explore the viability of the framework we analyze as moderating variables: entrepreneurial experience (I), product newness (O) and community engagement (P). We find that general use value and first adoption are positively related if a community of like-minded individuals was involved in the innovation process. We also find tentative evidence that prior entrepreneurial experience and product newness are circumstances in which market failure with regard to first adoption is alleviated.

## 2. Theory and hypotheses

In this section we elaborate on the relationship between general use value and first adoption, which is expected to be absent. The relationship is anticipated to be moderated by the innovator’s willingness to commercialize, but not by the innovator’s willingness to reveal. Next, we introduce our theoretical framework to study factors alleviating market failure, and develop hypotheses with regard to the moderating role of entrepreneurial experience, product newness and community engagement.

### 2.1. General use value and first adoption

The proposed market failure is due to a lack of diffusion incentives. Consumers may innovate for a variety of reasons, but the main ones are personal need and process benefits (engagement in the innovation process, like enjoyment and learning) (Hienerth et al., 2014; Raasch and von Hippel, 2013). Beyond individual consumers these motives apply to those innovating collectively in open-source projects (e.g., Hertel et al., 2003; Lakhani and Wolf, 2005). Consumer innovations originating from commercial motives are rare. For example, von Hippel (2017) reported that only nine percent of the innovators in a sample of consumers in Finland was driven by commercial considerations.

Von Hippel (2017) argues that being motivated by personal need or

process benefits, consumers see no mechanism in place to share any benefits that others would reap from adopting their innovations. Adopter benefits are seen as an externality, so that consumers fail to invest in diffusion:

“Investment in diffusion by [consumer] innovators can increase social welfare because it is often the case that even relatively small investments can greatly reduce search and adoption costs for [others]. For example, if I (...) would invest just a little extra effort to document my open source software code more clearly, I could greatly reduce the time that perhaps thousands of adopters would require to install and use my novel code. (...) System benefit is maximized at the point where an additional dollar of investment in diffusion by the innovator (...) reduces adoption costs by a dollar across all (...) adopters. (...) The problem is that innovators have to bear the costs of investments in diffusion, while adopters get all of the benefits and do not share those costs. There is no market link that would enable a more appropriate allocation” (von Hippel, 2017: p. 65–66).

This situation is what economists generally consider a market failure: consumer innovators’ pursuit of self-interest results in a sub-optimal allocation of knowledge. It should be pointed out that consumer innovators can obtain non-monetary benefits from adoption, such as increased reputation or self-esteem (Lakhani and Wolf, 2005). However, in previous studies such motives applied to very few consumers, and did not seem to offset a lack of monetary rewards (de Jong et al., 2015).

From a social welfare perspective, diffusion of consumer innovations is merited to the extent that these innovations have general use value: useful to others in the social system, addressing a problem or need that many other people face, with the potential to address a sizeable market. Recent household sector surveys brought to awareness that only a minority of all consumer innovations diffuse (de Jong, 2016), but this cannot be considered evidence of market failure: “Many or even most of the innovations [...] may have been of interest only to the innovating user. In such cases, non-diffusion is not evidence of a shortfall in investment in diffusion by the user innovator: it simply is a reflection of the expected lack of adopter interest” (de Jong et al., 2015: p. 1857–1858).

A first pattern we expect to see in the presence of market failure is that the general use value of consumer innovations is unrelated with first adoption by others. If consumers would do a significant diffusion effort the relationship would be positive and significant – as others would likely adopt innovations with high general use value. Because it is unusual to formulate a hypothesis with regard to a missing relationship, we formulate the research question:

**RQ1.** What is the empirical relationship between general use value of consumer innovations and first adoption by others?

The proposed market failure also implies that if consumer innovators are highly willing to commercialize, the relationship between general use value and first adoption should be positive and significant. We define willingness to commercialize as a consumer’s attitude of being open and receptive to sell the innovation for economic benefits. In general, a positive attitude towards a behaviour increases the odds of developing intentions and conducting the particular behaviour (Ajzen, 1991; Fishbein and Ajzen, 1975). The more consumer innovators are willing to commercialize, the better the odds that they will engage in diffusion behaviours like showing off their innovation to producers, documenting their innovation for the sake of knowledge transfer, or starting a venture. Willingness to commercialize would restore a connection between the innovator’s diffusion effort and adopter benefits. The innovator would partially appropriate those benefits via license fees or sales revenues (von Hippel, 2017). As a consequence first adoption is expected to be observed, provided that the innovation has high general use value – if not, adopters would simply not be interested. We hypothesize:

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