Technology and Innovation Management

Working Paper

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2013
Working Paper No. 73

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http://www.tuhh.de/tim/publikationen/arbeitspapiere.html

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Abstract

Prior research on user innovation has concentrated on markets in which products (e.g., mountain bikes, kitesurfing equipment, tools, etc.) are typically purchased by those users who modify them. However, in numerous markets, this is not the case, for example, those in which equipment is rented. Moreover, firms increasingly servitize, selling "functionality" instead of products. Thus, product ownership is being transferred to users less and less. Instead of purchasing products, users increasingly rent or lease equipment. Consequently, our research investigates the impact of product ownership on user innovation behavior. We question whether absent ownership is an innovation barrier, negatively impacting users' propensity to innovate. This should be particularly relevant to firms that collaborate with users, scouting for their ideas. This study was conducted in the German rowing community. In contrast with previously studied sports markets, equipment ownership in rowing often remains with sport clubs and not with individual users. Following a pre-study, we distributed a survey to the members of 410 clubs enlisted in the German Rowing Federation's roster. Our approach yielded 743 responses. We present results from multivariate ordinal and logistic regressions for two dependent variables (idea generation and realized ideas), differentiating between three ownership types (private, non-private with dedicated use, and non-private with shared use). Our results reveal that private ownership has significant positive effects on user innovation behavior. Users, who own their equipment develop significantly more innovative ideas and have a significantly higher probability to realize ideas than users who use equipment that is owned by a third party. We find that private ownership positively moderates use experience's impact on the development and realization of ideas. The results imply that manufacturers should be aware of the effect that ownership could have, particularly when offering services or in situations where ownership rights are not transferred to users (e.g., leasing models). We discuss measures to remedy the negative impact of absent ownership, such as equipment sponsorships complemented by specific use contracts, experiment labs, and insurances.

Introduction[1]

Previous research on user innovation has concentrated on markets in which products (e.g., mountain bikes, kitesurfing equipment, and tools) are typically purchased by those users who modify them. Purchasing products leads to a transfer of property rights from the manufacturer to the user. Hence, users commonly possess the ownership rights of such products. Currently, we observe a clear trend toward product-ownership no longer being transferred to users. In numerous markets, firms increasingly servitize, thus selling functionality instead of products.

[1] We would like to acknowledge the valuable comments of Tim Schweisfurth, Carsten Schultz, Christina Raasch, Ove Granstrand, and Eric von Hippel. We would also like to thank all the participants in the rowing community.

For example, they sell "flawless mobility" instead of vehicles, "cleaning services" instead of cleaners, and "room temperature" instead of radiators (Mont, 2002). Contractors of these services become users, not owners, of the products they use. For instance, when users sign membership contracts for car sharing services or doctors lease MRT equipment, the ownership rights of these products are not transferred to them. Ownership rather remains with a third party (e.g., the product manufacturer offering the products for use or a service operator). If the users are generally entitled to decide for themselves whether to acquire product ownership (e.g., by purchasing products) or not (e.g., by renting or leasing products), ownership is an endogenous variable. For instance, general practitioners who own a practice can commonly decide whether to purchase equipment or not (e.g., whether or not to lease it from the manufacturer). The same applies when users either decide to rent equipment (e.g., a car) or to sign membership contracts for product-service-systems (e.g., car or bike sharing systems).

In certain situations, however, users find it difficult to decide on whether or not to own the equipment that they (have to) use. This may be due to various reasons that still require further research. One possible reason relates to high upfront investment costs. For instance, the high acquisition costs of the boats in the rowing market have led to the development of a regime in which equipment is commonly owned by clubs or federations. Another possible reason relates to a separation of ownership and control in employment contracts. Employed users (i.e. embedded users) often find it hard to decide whether or not to purchase equipment if it collides with company policy or existing supply contracts. For instance, firms often sign long-term contracts with a specific OEM of computer equipment, wherefore their employees have to use notebooks of that specific brand. We suggest that ownership is exogenous in those situations.

If not only an individual user, but many users of a community (or sub-community) are barely able to impact the ownership decision, the exogenous nature of ownership could also be interpreted as the dominant ownership "regime". While a non-private ownership regime is dominant in the rowing community, the mountain bike or kitesurfing communities, for instance, are dominated by a private ownership regime. Moreover, within a community, different ownership regimes can coexist (e.g., in different market segments). For instance, it is common for taxi drivers in rural areas to own their own cabs (private ownership), while taxi drivers in cities are often employed by taxi companies and consequently use cabs that are owned by their employer (non-private ownership). Another example is the medical equipment market. General practitioners commonly operate in a private ownership regime and usually purchase the equipment that they require for their practice. In contrast, hospital doctors operate in a non-private ownership regime. They predominantly use equipment (e.g., X-ray apparatus) that is owned by the hospital. Therefore, we ask: Does the ownership of goods impact (lead) users' willingness and ability to innovate?

This question is not only relevant to users, but to manufacturers as well. Users may face damage claims from product owners when modifying the products they use but do not own. For them, ownership-absence can manifest itself in an additional innovation barrier, which negatively impacts their propensity to innovate. This question is thus relevant from the

manufacturers' perspective, especially in markets where they collaborate with users scouting for innovative ideas. If users become less innovative, this source of innovation might run dry. In fact, with an increasing number of firms following the servitization trend (Neely, Benedetinni, and Visnjic, 2011; Dachs et al. 2012), a further decrease in user innovation rates can be expected in future if fewer users own the products they use. From this study, we derive implications for how manufacturers can remedy such situations by incentivizing users to innovate even in markets dominated by a non-private ownership regime (e.g., by means of contract design). By providing empirical evidence, we further contribute to the debate on the contextual factors that determine varying user innovation ratios in different communities, markets or inustries (i.e. why the share of user innovations differs across markets). In which markets, communities, industries or domains users innovate and to what extent – i.e. which contextual factors determine users' innovation behavior – still remains to be answered. Hence, this study also contributes to the discussion on selection criteria for empirical fields, for future user innovation studies.

Hitherto, studies on how manufacturers can access users as sources of innovation were conducted in a number of markets, such as the medical instruments, laboratory equipment, watches, games, toys, software and many other markets (e.g., Hienerth, von Hippel and Jensen, 2011; Franke and Piller, 2004; Olson and Bakke, 2001). However, these studies surprisingly often focus on sports equipment markets, like kayaking (Hienerth, von Hippel and Jensen, 2011; Hyysalo, 2009; Hienerth, 2006), kitesurfing (Schreier and Prügl, 2008; Schreier, Oberhauser and Prügl, 2007; Franke, von Hippel and Schreier, 2006) or mountain biking (Lüthje, Herstatt and von Hippel, 2005; Lüthje, 2004). Very few prior studies motivate why they chose the markets they investigated. However, the markets in which previous user innovation studies were conducted are largely dominated by a private ownership regime.

In order to study the impact of different ownership situations on users' innovation behavior, we had to choose a market in which both private and non-private ownership situations can be found. While kite surfers, mountain bikers, kayakers, etc. largely own their equipment (private ownership), a substantial share of rowers do not own the boats or equipment they use. For various reasons (e.g., substantial upfront procurement costs[2]), the equipment predominantly belongs to rowing clubs or sports federations (non-private ownership). Consequently, a larger share of users in the rowing market operate in non-private ownership situations than those studied in most previous user innovation studies that were conducted in private ownership situations. Despite the large share of equipment that is not owned by the users, some users do own their own equipment. This observation allows for a research design that can contrast private and non-private ownership within a market. However, to ensure the results' comparability, it seems worthy to note that the rowing market shows a number of similarities with, for instance, kitesurfing, kayaking or professional mountain biking. As in these sports markets, numerous substantial technological innovations have recently impacted rowing equipment (e.g., the use of carbon fiber has made boats lighter and has substantially improved the strength of the blades). Similarly to other sports markets, the community of active rowers can be divided into professional and non-professional users, where particularly professional rowers have higher performance demands of their equipment.

[2] Rowing boats cost from a few thousand euro for a leisure rowing boat up to approximately €48.000 for a professional eight.

In the next section, we develop our theoretical framework, linking this study to previous user innovation research with a primary focus on studies conducted in sports markets. However we also look into other relevant studies of user innovation behavior as well as ownership in the context of innovation research that draws on concepts from property rights theory. Our research approach is presented in the third section. Section 4 reveals the results of the data analysis. In the final section, we discuss our findings, derive implications, and make suggestions for future research.

Theoretical framework

Previous user innovation research has proposed that, for users – in contrast to firms that aim to commercialize their R&D results – ownership (i.e. patent rights that allocate ownership for the output of innovation processes) is hardly an incentive to start innovating. Drawing upon concepts from property rights theory, we argue that ownership plays an important, albeit different, role in user innovation processes. In order to initiate innovation activities, it is important whether users own the products they use (private ownership) or whether others possess them (non-private ownership).

User innovation in private ownership regimes

Numerous user innovation studies have been conducted in sports markets. Our review identified 19 contributions in different (often several) sports markets that were published in the last decade (see Appendix 1) Of these, the majority (12 studies) investigated user innovation phenomena in watersports markets, such as wind or kitesurfing (6 studies), kayaking (4 studies), technical diving (2 studies) or sailing (1 study) markets. Sports markets related to mountainous environments, like mountain biking (3 studies), mountaineering (3 studies) or alpine disciplines (3 studies), such as skiing or snowboarding rank second. Other studies investigated user innovations in sports markets, like basketball, skateboarding or tennis. More than two thirds of the 19 studies' empirical fields can be allocated to the "extreme sports" sector.

Across all studies (listed in Appendix 1), the share of innovating users within a community ranges from 10% to almost 60%. For instance, Lüthje, Herstatt, and von Hippel (2005) found that 15.7% of mountain bikers who are members of clubs and online communities innovate. Franke and Shah (2003) even found that 32.1% of the members of "extreme" sports communities actually performed innovation activities. Shah (2000) shows that more than half of the major improvements in windsurfing (53%), snowboarding (67%), and skateboarding (67%) stem from users or user-manufacturers. While we can conclude that user innovations appear quite frequently among sports equipment users, we can also derive another conclusion from the 19 studies that has not yet been made explicit. According to our review, all studies were conducted in sports markets in which a private ownership regime dominates. In all the markets investigated by prior studies – i.e. in kitesurfing (Schreier, Oberhauser and Prügl, 2007; Franke and von Hippel, 2006; Tietz, Morrison and Lüthje, 2005), windsurfing (Shah 2000), basketball (Füller, Jawecki and Mühlbacher, 2007), mountain biking (Lüthje, Herstatt and von Hippel, 2005; Lüthje, 2004), tennis (Dahlin, Taylor and Fichmann, 2004), kayaking

(Hienerth, von Hippel and Jensen, 2011; Hyysalo, 2009), mountaineering (Schweisfurth and Raasch 2012; Parsons and Rose 2009), as well as in the selected sailing segment that Raasch, Herstatt, and Lock (2008) chose – users predominantly purchase their equipment.[3]

User innovation in non-private ownership regimes

In contrast to the private ownership regime in previously studied sports markets, in the rowing sports market, a different ownership regime is predominant. Professional as well as amateur rowers do not typically own the boats and the equipment they use. The equipment often belongs to rowing clubs or sports federations (e.g., due to high upfront procurement costs and the shared use among numerous members). Thus, in contrast to previous user innovation studies, this study is conducted in a market in which a non-private ownership regime is predominant.

While, in the private ownership regime, users possess the property rights of the products they use (private property) and upon which they innovate, the property rights remain with a third party in the non-private regime (Demsetz, 2002). In addition to the rowing market, there are numerous markets, communities or industries that are similarly dominated by a non-private ownership regime. For instance, truck drivers share vehicles owned by logistics firms, doctors working in hospitals jointly use equipment that is owned by the hospital, and scientists usually use computer equipment that is owned by universities. Furthermore, in several markets, firms increasingly servitize, whereby they transform from product sales dominated business models (private ownership regime) into service dominant models (non-private ownership). Despite the observation that increasingly more markets are dominated by non-private ownership regimes, the question remains whether ownership, in terms of property rights, has an impact on the innovation behavior of users within a community.

In innovation research, property rights are a widely discussed concept. However, in the producer innovation paradigm, most of the discussions on property rights take place on the firm level. Such discussions are mainly related to the allocation of property rights to the outcomes of innovation activities. For instance, a large number of studies are related to the role of the patent system, which was designed to allocate property rights to inventors in order to facilitate R&D investments for developing innovations (Granstrand, 2000). Another widely discussed topic relates to intellectual property rights' role in entrepreneurial ventures, where venture capitalists commonly only agree on co-financing, if a venture has secured intellectual property rights (e.g. patents) for its core technology in order to ensure a later appropriation of the resulting returns (Aghion and Tirole, 1994). Moreover, the role of property rights has been investigated for technology transactions where firms pursue open and distributed innovation processes (Tietze, 2012). Furthermore, there have been studies of property rights in research employment contracts, in which firms commonly want to control the property rights that result from their R&D engineers' innovation activities (Neumeyer and Stedman, 1971). In the user innovation paradigm, however, the "classical" role of property rights for the appropriation of R&D investments has been questioned.

[3] In some cases one could argue that, for example, professionals might use equipment sponsored by manufacturers acting as advertising agent. However, from pre-studies in the empirical field, it has become evident that this is not common practice in the German rowing market. In the above-mentioned studies, the overall share of those users is not made transparent.

Von Hippel and a number of other researchers have argued that property rights, and particularly patents, do not primarily serve as incentives for users to innovate. Rather the expected use benefits of their innovations primarily motivate users to innovate than the expected monetary returns thereof (Henkel and von Hippel, 2005; Lüthje, 2004; Shah, 2000; Riggs and von Hippel, 1994; von Hippel, 1976). A few authors have recently addressed property rights issues in the context of open source communities, where the results of collective user innovative activities become part of the public domain (e.g., von Hippel and von Krogh, 2003). We can conclude, however, that most of the property rights discussions in the user innovation paradigm also relate to innovation outcomes. One particular exemption should however be mentioned. Braun and Herstatt (2007) refer to absent property rights as a barrier to user innovation. We add to their argumentation that property rights play an important, albeit different, role in users' innovation behavior.

This role becomes clear when we consider that users hardly ever innovate "from scratch," but rather *upon* certain existing products. User innovations often improve existing products or modify independent product components, for instance scientific instruments, semiconductor and electronic subassembly manufacturing equipment, and pipe hanging systems (von Hippel 2007; Herstatt and von Hippel, 1992). Building upon an existing product, the user innovation process is often characterized by an iterative accumulation of incremental product modifications through a number of (trial and error) innovation cycles that build upon each other.[4] Having modified one product component after another, a resulting user innovation might have hardly any similarity to the original product. For instance, since the 1920s, sailing boats in the international moth class have been continuously modified by means of an accumulation of subsequent user innovations that resulted from repeated runs through the innovation process, so that today's sailing boats differ substantially from those in the 1920s (Raasch, Herstatt and Lock, 2008).

One might still argue that users sometimes innovate "from scratch," particularly in situations where they are not satisfied with the existing products that are available on the market. However, in such cases, one can argue that users' starting point for their innovations are also existing products. It seems reasonable to assume that users are aware of existing products' under-performance, because they have previously tested them. Otherwise they would not start innovating products that better suit their expectations. An exception might be cases in which existing solutions are too expensive for users to acquire them for conducting performance tests. For instance, users in developing countries might not be able to afford products commonly used in developed countries.

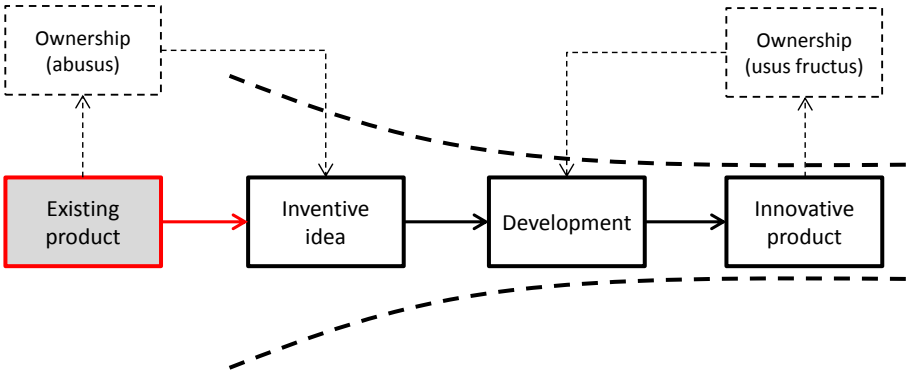
If we argue that users innovate in an interactive and cumulative way upon existing products, they may experience certain problems if they innovate upon products that they do not own. In this case, users could face damage claims from the product owners. For instance, users of leased cars could face damages from the car rental firm if they make substantial modifications to it (e.g., if they tune the engine). This risk is particularly high in cases where modifications are not successful in terms of performance improvements, but rather lead to product failure. Hence, one can argue that product ownership is a determinant for users to initiate innovation

[4] Tietz (2005), for instance, discusses the nature and preconditions of users' "trial-and-error" processes in the idea realization phase.

activities. Consequently, in the user innovation paradigm, one can expect that absent property rights to the users' products inhibit user innovation activities and consequently present a user innovation barrier.

We can summarize these arguments as follows (see Figure 2). In the producer innovation paradigm, ownership enables firms to appropriate their returns on R&D investments and thus serves as an incentive to innovate in order to commit R&D investments to develop innovations from which they can commercially benefit, for example, by means of product sales or licensing (see right side of Figure 1). In property rights-related literature (Gedajlovic, 1993; Pejovic, 1976; Demsetz, 1967), this ownership function refers particularly to the property rights type *usus fructus*. According to Gedaljovic (1993: 733), usus fructus is defined as the "entitlement to enjoy and employ the fruits from your property." Pejovic (1976: 3) defines it similarly, but in more economic terms as the "right to capture returns from it."

Figure 1: Ownership functions within the innovation process



While usus fructus is also important in the user innovation paradigm, it is not primarily related to intellectual property rights (i.e. patents) for the commercialization of innovation results. User innovation theory rather suggests that, for users, the expected use benefits that result from their innovative activities are an incentive to innovate (Shah, 2000). Hence, their use benefits are the *fruits* that users harvest from their innovations. Thus, in non-monetary terms, usus fructus should also be important in the user innovation paradigm.

In addition, we argue that ownership is important for users with regard to the property rights of the products upon which they innovate (see left side of Figure 1). In this sense, ownership is a precondition (antecedent) for users to initiate their innovation activities in the front-end of the innovation process. Ownership is thus required for enabling users to modify and entirely or incrementally change the properties of existing products. In property rights theory, this ownership function relates particularly to the property rights type *abusus*. According to Gedaljovic (1993: 733), abusus is the "right to alter, modify or destroy your property." Pejovic (1976: 3) defines it similarly as the "right to change its form and substance." Hence, abusus is necessary for users because it enables them to modify, alter or destroy the products they use and upon which they innovate. This right is only limited by legal restrictions, such as the impairment of others' rights, warranties[5] or regulations (Furubotn and Pejovic, 1972). For

[5] In the case of warranties, users possess the ownership of their products, but face the problem that they cannot claim support from the manufacturers if their innovation efforts caused the products to fail.

manufacturers, the right of abusus as a precondition is already included in their R&D activities. They innovate (in order to sell or license out their inventions) incrementally upon their own products or they innovate "from scratch" where the right of abusus is included per se, while users may get the urge to innovate upon third party products. As discussed, the rights of manufacturers can be limited in the next process stage when they start selling new products that affect the patent rights of others. In such situations, the right of usus fructus, and thus the firms' incentive to innovate, is limited.

To summarize, we argue that, in the producer innovation paradigm, property rights primarily have an ex-post ownership function (usus fructus) that focuses on the innovation process's results. In the user innovation paradigm, usus fructus is also important, although not primarily in monetary terms, but rather in terms of use benefits. However, ownership also serves an ex-ante function in the front-end of the innovation process (abusus). In the context of this study, we can therefore expect that users can are less likely to innovate if they do not possess the property rights to the products they use, i.e. in non-private ownership situations.

In addition to choosing markets in which users predominantly own the equipment they use, hardly any of the authors among the 19 studies we investigated (listed in Appendix 1) discuss the similarities and differences between the user groups in their samples. While it is common in the *economics of sport* to distinguish between different user groups, such as professionals and amateurs (Parks and Quarterman, 2003; Kikulis, Slack, Hinings and Zimmermann, 1989), only two of the previous studies mention differences between professionals and non-professionals (Tietz et al., 2005; Franke and Shah, 2003). Additionally, Franke and Shah (2003: 175) mention that manufacturers not only focus on professional users, but also on "fanatic non-professionals", because they expect that certain inventions by the professional users might be too extreme for ordinary users and hence might not be marketable. While 14 of the 19 studies investigate the entire community, without an explicit reference to differences in the innovation behavior of different user groups, only five of the 19 studies are conducted among professional users alone (Hienerth and Lettl, 2011; Parsons and Rose, 2009; Raasch, Herstatt and Lock, 2008; Hienerth, 2006; Shah, 2000). We can thus conclude that previous user innovation studies in sports markets coincidentally report findings about user groups and do not pay explicit attention to it. Thus, in our study, we also differentiate between different user groups' innovation behavior.

Research approach

In Germany, most of the approximately 78,000 rowers are members of rowing clubs (DOSB, 2009). Following a pre-study (i.e. a number of semi-open case interviews) and a pre-test in August 2011, we distributed a survey to the members of 410 clubs out of a total of 554 German rowing clubs that were listed in the German Rowing Federation's roster. A total of 144 were excluded because we found no contact data for them via a web-search. These were predominantly small micro-clubs with very few members. Addressing the clubs' board members through a web-based contact form or e-mail, we asked them to forward the link to our online survey to their members. Moreover, nearly all teams of the German National Rowing League and the whole German National Team received the survey. These teams were

addressed directly. Through this approach, our survey reached professional, former professional, and non-professional rowers alike.

Our approach yielded 743 overall responses. The geographical distribution of the respondents across all 16 German states is comparable to the German rower population (LSB, 2011), with three exceptions. The participation rate of rowers from the two states of Hamburg and North Rhine-Westphalia is above the population shares, while the participation rate of rowers from Bavaria is below the population share. The age distribution of participants is also comparable to the German rower population, although marginally biased towards younger rowers (DOSB, 2009). While the share of rowers in the age group from 16 and 26 years is above the expected population share, the share of participants above 60 years is lower than the corresponding population share. After screening the responses for incomplete, inconsistent or non-habitual data (e.g., age or time period), as well as outlier and data with hardly any variance[6], 607 responses could be used for our analysis (Müller and Freytag, 2005).

We operationalized users' innovation behavior, defining two dependent variables. The first dependent variable is ordinally scaled and assesses the number of ideas (zero, less than three, three to five, more than five) a user has had for improving the functionality of existing products and product parts or for creating completely new solutions. Based on previous user innovation studies (Franke, von Hippel and Schreier, 2006; Lüthje, Herstatt and von Hippel 2005, Lüthje, 2004), we asked our participants the following question: "How many ideas did you come up with for technically improving boats or complementing equipment in 2010?" The second dependent variable is dichotomous and measures whether users have started development activities beyond the ideation phase by asking: "Did you actively try to realize one of your innovation ideas between 2000 and 2010?"

The independent variable of primary interest categorizes the ownership of the boats and equipment that users predominantly used into three categories: "privately owned equipment," "non-privately owned equipment with shared use," and "non-privately owned equipment dedicated to personal use" (i.e. club or federation equipment specifically reserved for a professional user)[7]. As this variable is nominally scaled, it was coded into three dummy variables. The results from our pre-study indicated that, despite ownership, two additional variables might affect users' innovation behavior (i.e. user groups and use experience). In accordance with, for example, Parks and Quarterman (2003) as well as Kikulis, Slack, Hinings, and Zimmermann (1989), we defined three user groups (professional, former professionals, and non-professionals). The group of professional rowers includes users who had regularly participated in national or international competitions since 2000 (e.g. German, European or World Championships or Olympic Games) and who still practiced rowing during the survey period (until August 2011). Users in the former professionals group had also participated in at least one of the above-mentioned events between 2000 and 2010, but had already ended or interrupted their active career by the rowing season of inquiry. Non-professionals include all other users. They are generally hobbyists (amateurs) who practice rowing a few times a week during their leisure time, predominantly without a competitive

[6] A variance analysis was used to identify respondents with homogenous response pattern (Richards, 2009).
[7] In rowing, the shared equipment assigned for personal use is regarded as "personal" equipment for competitive rowers, but is owned by a third party. Thus it differs significantly from shared equipment jointly used by a user community.

approach (Hendrik and Beckmann, 2007). This nominally scaled variable was also coded into three dummy variables. The formative construct "use experience" measures a user's expertise in his or her specific field of interest. It comprises two variables: the frequency and duration of use (Schreier and Prügl, 2008). The frequency is measured by the number of days per week a user practices rowing. We used a four-point Likert scale with categories ranging from "less than one day per week" to "five to seven days per week." The duration of usage was used to calculate the years a user had been practicing rowing without a major interruption. Our pre-study results also indicated a moderating effect of ownership on the respective relationships between use experience and idea generation, as well as between use experience and idea realization. We control for "gender" and "age".

Results

Descriptive Results

Of the 607 respondents, 30.5% are female and 69.5% are male rowers[8]. In total, 14.0% of the participants are professional rowers, 26.7% are former professionals, and 59.3% are non-professionals. On average, professional users are 21 years old and practice rowing five to seven days per week. Former professionals are, on average, 27 years old and practice rowing three to four days a week. Non-professionals have an average age of 44 years and, on average, practice one to two days per week.

Table 1: Users' innovation behavior across user groups for different ownership situations

		Ownership				
		Private	Non-private (dedicated use)	Non-private (shared use)	mean (n_i)	
Sample share	Innovation behavior					
Total sample (n=607)						
	Idea generation	64.3%	58.1%	38.7%	45.0%	(273)
	Idea realization	25.0%	6.9%	5.5%	6.8%	(41)
Professional users (n_p=14%)		**5.9%**	**80%**	**14.1%**		
	Idea generation	60.0%	66.2%	41.7%	62.4%	(53)
	Idea realization	20.0%	7.4%	0.0%	7.1%	(6)
Former professional users (n_{fp}=26.7%)		**2.5%**	**37.0%**	**60.5%**		
	Idea generation	75.0%	56.7%	41.8%	48.2%	(78)
	Idea realization	50.0%	6.7%	3.1%	5.6%	(9)
Non-professional users (n_{np}=59.3%)		**5.3%**	**8.9%**	**85.8%**		
	Idea generation	63.2%	43.8%	37.5%	39.4%	(142)
	Idea realization	21.1%	6.3%	6.5%	7.2%	(26)
	mean	4.6%	26.4%	69.0%		
	(m_i)	(28)	(160)	(419)		

Overall, 45.0% of all users in our sample had at least one idea for technical improvements of boats or equipment in 2010 (see Table 1). On average, professional users have the highest ideation ratio (62.4%), followed by former professionals (48.2%), and non-professionals (39.4%). Besides questioning to what extent the different user groups developed innovative

[8] The official gender distribution in the German rowing community is 67.9% male and 32.1% female rowers (DOSB, 2009).

ideas, we were interested in understanding to what extent different users start to implement their ideas and develop them into innovations. The results show that 6.8% of all users had started implementing their innovative ideas within the period from 2000 to 2010. Non-professionals revealed the highest implementation ratio (7.2%); however, this result is almost equal to the realization ratio of professionals (7.1%). Former professionals have the lowest idea implementation ratio (5.6%).

Furthermore, Table 1 displays that, among all respondents, 4.6% own their equipment, 26.4% of all respondents practice in boats reserved for their specific use but which they do not own, while 69.0% use equipment owned by others (e.g., clubs and federations), which they share with other rowers. In total, 80% of all professional users fall into the second category. In contrast, 85.8% of non-professional users practice with equipment, which their clubs make available for everybody's (i.e. shared) use. The share of privately owned boats is approximately equal among professionals (5.9%) and non-professionals (5.3%). Less than 2.5% of former professionals use their own equipment. Hence, the majority of users practice rowing without having the equipment's ownership rights.

While just a small share of users own their equipment, 64.3% of them had innovative ideas and 25% of them had further developed their ideas (Table 1). Users who practice with reserved equipment indicated comparably lower ratios. While 58.1% of them still had innovative ideas, only 6.9% had started implementing these ideas. Among users who practice rowing predominantly with equipment and boats that they do not own, the ratios are substantially lower. Only 38.7% of them had innovative ideas and only 5.5% of them had started implementing them.

Within the three user groups, we observe a similar pattern. Professionals, former professionals, and non-professionals who do not own their equipment and have to share it with other users had and implemented fewer ideas than those who do not own their equipment, but use dedicated equipment reserved for their personal use. These individuals had and implemented fewer ideas than users who privately own their equipment.[9] The descriptive results thus indicate a negative effect of missing ownership on the ideation and implementation ratios on a continuum ranging from "private ownership" via "non-private dedicated use" to "non-private shared use" in the total sample as well as across the different user groups.

Regression Results

In line with the descriptive results, Table 2 reveals highly significant effects of private ownership on idea generation and, likewise, on realization.[10] The direct effect of ownership solely predicts a Nagelkerke R^2 of 4.8% as well as 4.3%. Private ownership has a significant effect on both idea generation ($p<0.05$) and on users' realization of innovative ideas ($p<0.001$). Reserved ownership also has a significant impact on idea generation ($p<0.001$),

[9] Despite this observable pattern, the data shows two exceptions. First, professionals with non-private ownership and dedicated use have a slightly higher idea generation ratio than professionals who privately own their equipment. Second, the implementation ratio of non-professionals who use equipment that they share with others and do not own is slightly higher than the ratio of non-professionals who use dedicated equipment that they do not own.

[10] The dependent variable of Model 1 is coded as dichotomous [any or more ideas=1, no idea=0] to ensure comparability with Model 2.

although this effect on the realization of ideas is not significant. In both models, the coefficient is substantial for private ownership. While the coefficient of the significant reserved ownership effect in Model 1 is smaller, it is still large.

Table 2: Logistic regression results for ownership effects on idea generation and realization

		Model 1 Idea generation [a] *β* *(Stand. error)*	Model 2 Idea realization [a] *β* *(Stand. error)*
Constant		-0.461 ***	-2.846 ***
		(0.100)	(0.214)
Independent variables			
Ownership equipment			
	Privately owned [b]	1.049 *	1.747 ***
		(0.407)	(0.214)
	Reserved [b]	0.789 ***	0.240
		(0.189)	(0.379)
Model fit			
	Cox & Snell R^2	0.036	0.017
	Nagelkerke R^2	0.048	0.043
	χ^2	22.149	10.313
	p-value	0.000	0.006

Notes: n=607; Models 1 and 2 are logistic regressions; standard errors are in parentheses; statistical significance †p<0.1, *p<0.05, **p<0.01, ***p<0.001; [a] dichotomous coded nominal variable; [b] base variable is "club owned"

Table 3 presents the results of ordinal regressions of effects on users' idea generation, where the control and independent variables are added stepwise. Model 1a includes only the control variables. Model 1b additionally includes the three independent variables "ownership," "user group," and "use experience". Model 1c further includes the interaction effects of "ownership" and "use experience", which operationalize the moderator effect on ownership in terms of the use experience's influence on idea generation (Cohen et al., 2003). In ordinal regression models, positive coefficients are associated with an effect towards a higher category of the dependent variable, whereas negative coefficients are associated with moving toward a lower category (Gerpott and Mahmudova, 2006). Model 1b predicts an overall

Nagelkerke R^2 model fit of 9.1% and model 1c of 10.4%. The χ^2-value is significant in all models. No violation of the assumption for the proportionality of odds was detected[11].

The results displayed in Table 3 are consistent with the descriptive results. The results reveal that private equipment ownership not only has a significant but also substantial (β=-1.264)[12] positive effect on users' idea generation ($p<0.05$). Users who own their equipment appear to develop significantly more innovative ideas than users who predominantly use equipment reserved for them or even equipment that they have to share with others and that remains owned by a third party (non-private ownership).

[11] The proportionality of odds is confirmed by the separate test of parallel lines (Long, 1997).
[12] The negative coefficient appears counter-intuitive. In ordinal regressions, the effects of dichotomously coded variables are computed for the zero case [=0]. Consequently, negative β values indicate positive effects (Gerpott and Mahmudova, 2006).

Table 3: Ordinal regression results for effects on idea generation

		Model 1a *β* *(Stand. error)*		Model 1b *β* *(Stand. error)*		Model 1c *β* *(Stand. error)*	
Dependent variable	*Threshold*						
Idea generation [a]	[0]	-0.284		-1.656	**	-1.123	*
		(0.208)		(0.511)		(0.565)	
	[1]	1.933	***	0.659		1.222	*
		(0.235)		(0.508)		(0.568)	
	[2]	3.724	***	2.492	***	3.142	***
		(0.382)		(0.508)		(0.652)	
Independent variables							
User group							
Professional [b]				-0.187		-0.136	
				(0.310)		(0.312)	
Former professional [b]				-0.121		-0.071	
				(0.222)		(0.223)	
Use experience				0.119	**	0.099	*
				(0.039)		(0.040)	
Ownership equipment							
Privately owned [c]				-1.264	**	-0.680	
				(0.395)		(0.471)	
Reserved [c]				-0.499	*	-0.581	*
				(0.234)		(0.241)	
Use Experience x Ownership							
Use exp. x Privately owned [c]						0.159	**
						(0.059)	
Use exp. x Reserved [c]						-0.019	
						(0.091)	
Control variables							
Gender [d]		-0.553	**	-0.549	**	0.058	**
		(0.018)		(0.186)		(0.187)	
Age		-0.009	†	-0.006		-0.006	
		(0.005)		(0.007)		(0.001)	
Model fit							
Cox & Snell R^2		0.020		0.077		0.089	
Nagelkerke R^2		0.024		0.091		0.104	
χ^2		12.077		48.166		55.494	
p-value		0.002		0.000		0.000	

Notes: n=607; Models 1a, 1b and 1c are ordinal regressions; standard errors are in parentheses; Model 1c's interaction variables are z-transformed; statistical significance †p<0.1, *p<0.05, **p<0.01, ***p<0.001; [a] the ordinal dependent variable is coded into 4 categories; [b][=0], the base variable is "non-professional user"; [c] [=0], the base variable is "club owned"; [d] [masculine=0]; The parallel lines tests of Model 1a, 1b, and 1c are not significant.

In line with user innovation research, where higher use experience predicts a higher probability of lead userness and, consequently, a higher probability to be an innovating user (Franke and Shah, 2003; von Hippel, 1988), our results prove a significant effect of use experience ($p<0.01$) on users' idea development ($\beta=0.119$). In Model 1c, we furthermore tested whether ownership moderates the relationship between use experience and idea generation. The interaction effect is significant ($p<0.01$) and has a strong positive impact ($\beta=0.159$) on the dependent variable, which, subsequently, improves the model fit. Thus, it can be concluded that ownership moderates the relationship between use experience and idea

generation (Cohen et al., 2003). The effect disappears when users use dedicated equipment that they do not own.

Consistent with our descriptive results, neither Model 1b nor Model 1c reveal significant differences in the idea generation ratios between professionals, former professionals, and non-professionals. None of the three groups (e.g., particularly professionals) stands out in terms of developing significantly more ideas ($p>0.1$). The control variables reveal that male users develop significantly more ideas ($p<0.01$) than females.[13]

Table 4: Logistic regression results for effects on idea realization

	Model 2a Idea realization β *(Stand. error)*	Model 2b Idea realization β *(Stand. error)*	Model 2c Idea realization β *(Stand. error)*
Constant	-4.595 ***	-5.518 ***	-5.523 ***
	(0.615)	(0.825)	(0.866)
Independent variables			
User group			
Professional [a]		0.271	0.110
		(0.653)	(0.671)
Former professional [a]		0.138	-0.058
		(0.504)	(0.530)
Use experience		0.094	0.029
		(0.068)	(0.077)
Ownership equipment			
Privately owned [b]		1.688 **	0.550
		(0.548)	(0.911)
Reserved [b]		0.559	0.751
		(0.496)	(0.527)
Use Experience x Ownership			
Use exp. x Privately owned [b]			0.209 *
			(0.101)
Use exp. x Reserved [b]			-0.047
			(0.074)
Control variables			
Gender	1.389 *	1.442 **	1.763 **
	(0.537)	(0.551)	(0.629)
Age	0.022 *	0.026 †	0.026 †
	(0.009)	(0.014)	(0.013)
Model fit			
Cox & Snell R^2	0.028	0.053	0.062
Nagelkerke R^2	0.070	0.134	0.158
χ^2	16.694	32.268	38.374
p-value	0.000	0.000	0.000

Notes: n=607; Models 2a, 2b, and 2c are logistic regressions; standard errors are in parentheses; Model 2c's interaction variables are z-transformed; statistical significance †p<0.1, *p<0.05, **p<0.01, ***p<0.001; [a] base variable is non-professional user; [b] base variable is "club owned"

[13] An OLS regression for which the dependent variable was assumed to be metric scaled count data, thus log-transformed, reveals similar direct and moderator effects.

Table 4 displays the logistic regression results for effects on users' idea realization. Model 2a includes only the control variables. Model 2b additionally includes the independent variables "ownership," "user group," and "use experience." Model 2c includes the interaction effect of "ownership" and "use experience." Model 2b reveals a Nagelkerke R^2 model fit of 13.4% that increases to a Nagelkerke R^2 of 15.8% in Model 2c. The χ^2-value is significant in all models.

Model 2b reveals only one significant effect: Ownership not only has a highly significant impact ($p<0.01$) but also a considerable effect size ($\beta=1.668$). Neither non-private ownership with reserved equipment nor use experience have a significant effect on idea realization. Model 2c also report the results for the moderator effect of ownership on the relationship between use experience and idea realization by including the interaction term. The results show a significant ($p<0.05$) effect ($\beta=0.209$) of the interaction term and an improvement of the model fit. Thus, ownership not only influences idea realization directly but also moderates use experience's influence on idea realization (Cohen et al., 2003). The variables "user group" and "use experience" show no significant effects. Thus, there is no significantly higher probability that users in the professional group will realize more ideas. A higher use experience also does not increase the probability that users will start realizing their innovative ideas. The control variable "gender" ($p<0.01$) shows a substantial significant positive effect. Male users are consequently more likely to start realizing their ideas than female users. To summarize, the results from different regression models prove the effects that the descriptive results already indicated. As the effects have shown to be stable across different models, we can conclude that they are robust. Users who own their equipment develop more innovative ideas and have a higher probability to start realizing their ideas than those who use equipment that is owned by a third party, regardless of whether the equipment is reserved for only their use or whether they have to share it with other users. Users, who use equipment that they do not own but that is reserved for their use, develop more innovative ideas than those users who have to share their equipment with others, but are not more likely to realize their ideas. With a higher use experience, users tend to develop more innovative ideas, while use experience has hardly any impact on users' probability to realize innovative ideas. Private ownership – and only private ownership – positively moderates use experience's impact on the development and realization of ideas. Furthermore, the results derived for our empirical field reveal that professional users per se do not tend to develop and realize more innovative ideas than their former and non-professional counterparts in our sample.

Discussion and implications

The analyses reveal three results that lead us to pose the following three questions, which are subsequently discussed: First, why does non-private ownership negatively impact users' probability to realize innovative ideas? Second, why do our descriptive results show a comparably lower idea realization ratio than those found by previous user innovation studies? Finally, what measures can be applied to remedy the effects of non-private ownership in order to facilitate user innovation?

A negative impact of non-private ownership on users' probability to realize innovative ideas

Our results show that users are only likely to realize their ideas and further develop them into "real" user innovations in private ownership situations. Consequently – whether the equipment is reserved for their dedicated use or whether they have to share it with others – users who do not own their equipment are less likely to realize their ideas. Why is this?

Only users in private ownership situations possess the abusus right entitling them to modify a product. In both other cases that we observed – even if the equipment is reserved for a user's dedicated use – the equipment owner can claim damages from a user if he or she substantially and irreversible modifies his or her product. In a worst case scenario, experimenting with product modifications could even lead to complete product failure. In that case, users could be subject to substantial damage claims from the product owner. If users fear such a threat of damages, they have to account for extra costs when approximating their innovation costs before initiating an innovation activity. Expected damages increase the user's innovation costs by a factor calculated as a cross product of the probability that an owner claims damages and the expected amount of damages depreciated to the time when the user wanted to initiate innovation activities.[14]

Users' assessment of owners' probability to claim damages depends on a number of antecedents that still remain to be investigated in future research. Possible antecedents include the equipment's value at the time of modification (i.e. age and condition), as well as the relationship between the user and the owner. One would expect that a closer relationship allows users to better assess the likelihood that an owner would claim damages. The quality of that relationship (i.e. trust) can also be expected to have an impact, allowing the user to assess whether the owner sympathizes with his or her modification efforts and, consequently, whether or not he or she might refrain from damage claims in case of product failure.

In economic terms, in non-private ownership situations, users face higher uncertainty of their total innovation costs than in private ownership situations, because they have to account for an additional cost factor. Moreover, users have to assess the probability and the amount of expected damages when innovating upon others' products. Particularly due to the limited resources that users have available for innovating (Franke and Shah, 2003), absent ownership in terms of missing ex-ante abusus thus reduces users' willingness to innovate.

Even if users are not primarily motivated by financial benefits, higher innovation costs lower their probability to expect positive returns on their innovation efforts in terms of use benefits.[15] Consequently, in non-private ownership situations, users have less incentive to innovate than users who privately own their equipment. Thus, in user innovation, ex ante abusus rights and ex post usus fructus rights are both related and relevant. We suggest that future studies look into whether or not users actually perceive (expected) damage claims as an innovation barrier and the effects thereof.

[14] This could be formalized as $CI^{i}_{npo} = CI^{i}_{po} + NPV(p * D^{i})$. Everything else equal, the costs to innovate (CI) for any user innovation project i in a non-private ownership (npo) situation are higher than the equivalent costs to innovate in a private ownership (po) situation by the net present value (NPV) of the probability p that the third party, who possesses the abusus right, will claim the amount of damages D.

[15] Use benefits could also be expressed in monetary terms. For doctors, an innovation that allows them to perform a surgery more efficiently simply means that they can perform more surgeries within a period with a positive impact on their earnings.

A lower innovation realization ratio than found in previous studies

In comparison to the results of previous innovation studies conducted in different sport markets (see Appendix 1), we observe a lower idea realization ratio of around 5.5%, which is similar across the different user groups. Other studies have found substantially higher idea realization ratios (>25%)[16]. Moreover, we expected a higher ratio among professionals as they are potentially the lead users (e.g., due to higher use experience) and thus have a higher probability of being innovating users. How can this finding be explained?

We suggest that two effects can explain this difference. First, as we have argued above, absent private ownership similarly decreases all user groups' incentives to innovate (see Table 2). This effect is substantial in our sample, due to the large share of users in the rowing community who do not own their equipment. It superimposes a similarly negative effect to all users within the rowing community, reducing their idea realization ratio.

While this first effect lowers the overall idea realization ratio, a second effect can explain the absent differences between innovation ratios across user groups. Compared to the first effect that symmetrically impacts all user groups, this effect rather asymmetrically and negatively impacts only the innovation ratio of professionals. In professional rowing, the World Rowing Federation (FISA) imposes strict regulations on the boat and equipment design. There are examples of even breakthrough innovations being forbidden in professional competitions in order to guarantee fair conditions between all rowers from different countries in international competitions.[17] The limitations of experimenting with boat and equipment modifications (i.e. restricted design freedom) reduce particularly professionals' incentives to innovate. It increases these users' uncertainty with regard to whether or not they will be able to benefit from their innovative efforts. Recent research has supported this argument. Raasch, Herstatt, and Lock (2008) show that regulations decrease user innovation ratios in the sailing market.[18]

More or less strict regulations are present in almost all professional sports markets (e.g., formula racing, ski-jumping or bobsledding)[19] as well as in various markets outside the sports industry. For instance, in industrial appliances, various standards (e.g., German DIN norms) limit the components that can be used in products. Building on this argument, we propose that regulations and standards in different markets (or market segments) should be subject to further research. Empirical evidence needs to substantiate to what extent regulations impact user innovation behavior.

[16] Our empirical field is also described by a comparably low collaboration ratio between users and manufacturers. Manufacturers hardly ever systematically integrate users into the fuzzy front end of new product development processes (1,8%). Merely 7.9% of the participants were involved in late process stages (e.g., prototype testing).

[17] For instance, the sliding outrigger boat was an innovation developed by the Cologne student Volke Nolte in 1980, and later produced by the German company Empacher, although it was originally patented at the USPTO in 1876 (#184,031 - William N. Blakeman Jr.). Nolte proved the design to be substantially more efficient and faster than the conventional boat design. He won a 10k time trial against German national team members in 1981. After the world's top scullers used the design from 1981-83, it was forbidden by the FISA in 1984 (Burmester, 2012; Nolte, 1981). While the design was prohibited, it still diffused into the non-professional segment, although it only gained a minor market share.

[18] Professional rowers might still be innovative, but not in a way captured in our survey. Instead of focusing on product innovations, professionals might rather focus on process innovations to improve their physical constitution and rowing technique.

[19] Formula racing cars are constricted, for example, in size, weight, tire equipment, etc.; ski-jumpers have to wear similar all-in-one suits, and bobsleds above a certain weight limit are excluded from competitions.

Together, both effects equalize the innovation ratios across different user groups and reduce it to a lower level than observed in prior studies. The first symmetrical effect negatively impacts the innovation behavior of all user groups in a similar manner. The second asymmetric effect negatively impacts the innovation behavior of, primarily, professionals. If we discriminate our sample into groups of equipment owners and non-owners (see Table 1) the idea realization ratio of 25% of equipment owners is in a comparable range to those of previous studies of (implicitly or consciously chosen) sports markets dominated by a private ownership regime.

Measures facilitating users' innovativeness in non-private ownership situations

Our results show that users are less likely to innovate (i.e. develop and realize ideas) in non-private ownership than in private ownership situations. Hence, we should be concerned with asking how more favorable conditions can be established to raise users' incentives to innovate when ownership is absent. However, as users still develop ideas under that condition, we should be primarily concerned with measures that remedy absent private ownership's impact on the realization of ideas, thereby creating "quasi" private ownership situations. We suggest three remedies to "cure" this market failure, enabling users to realize ideas.

One possibility is for manufacturers to facilitate users' idea realization by sponsoring equipment for the specific purpose of innovation activities. In an accompanying sponsoring contract, manufacturers can explicitly allocate their allowance to innovate to the user. If modification efforts then lead to product failure, manufacturers should offer to replace the malfunctioning products with new products. If manufacturers want to further enhance user innovation activities, they can provide users with "tool-kits" (see, e.g., Schreier and Prügl, 2006), thus supporting them in modifying the sponsored equipment. In exchange, manufacturers can claim a right in the sponsoring contract to use the innovations developed with sponsored equipment in their future product generations. This approach would be similar to technology licensing contracts, where licensors include grant back clauses, thereby allowing them to use any subsequent inventions that licensees develop, based on any licensors' invention (Granstand, 2000).

Another possible remedy for the market failure is to offer experiment labs, where users are invited to innovate. In such lab environments, users will find all the necessary tools and materials with which to innovate upon their equipment. These labs can be set up by local or federal governments, but can also be run in cooperation with manufacturers who want to co-create with users, or can even be set up by manufacturers. An example is the open source community "local motors" in the US. Another measure can be to establish a link between manufacturers and users, enabling a flow of user ideas to be channeled "back" to the manufacturers. For instance, internet platforms could be created, where users report their ideas, maybe combined with idea competitions.

The threat of damages that users face when innovating upon others' equipment could also be lowered through an insurance scheme. Such insurance would cover damages payable to owners if users can prove that products were damaged or destroyed while they had been used for innovation activities. A possible design for such insurance could entail all users pooling their resources to jointly cover possible damages that one of the users within their community would otherwise have to pay. This insurance would lower users' uncertainty and counteract

the increased costs of innovating, compared to private ownership situations. Manufacturers or governments may also offer such insurance.

Aiming to maximize the impact of these solutions, the measures should preferably be implemented in non-private ownership situation that are exogenous to large user groups, i.e. in markets dominated by a non-private ownership regime. Particularly those firms that servitize and that will, consequently, operate in such a regime in the future (e.g., leasing medical equipment to hospitals and car sharing operators) should be interested in implementing measures to prevent / remedy the negative effects of absent ownership.

Conclusions

Our results show that users are less likely to innovate in non-private ownership situations in which others remain the owners of the equipment the users use, i.e. if they lack abusus. The effect has more severe consequences for idea realization than for idea generation. Therefore, absent ownership can be interpreted as a barrier to user innovation. Furthermore, our research leads us to suspect that a minimum of two other barriers exist (i.e. regulations and damages), which should be investigated in future research. We have suggested solutions to this market failure. These include manufacturer sponsored equipment, modification tool-kits, experiment labs, idea platforms, and an insurance scheme.

Our results contribute to the increasing servitization trend, according to which more and more customers will become users, but not product owners. Our results furthermore contribute to the discussion about empirical fields, in which users develop innovations to different extents.[20] In other words, we contribute to the selection of empirical fields for future user innovation studies. A higher user innovation ratio can be expected in empirical fields that are dominated by private ownership regimes.

Our results are limited by certain characteristics of the research design. It could be questioned whether the results drawn from the empirical field of rowing can be generalized to be valid for other empirical fields. An argument against generalization would be that the chosen empirical field represents a rather old, traditional, and thus mature sports market with a lower innovation potential than younger sports markets, such as kitesurfing or mountain biking. Nevertheless, major innovative changes in the design, materials, and functionality of the rowing equipment were implemented quite recently, which illustrates that innovation potential is still present in this market. Moreover, the categorization of ownership into private and non-private ownership, dedicated and shared use, as well as the differentiation between user groups can be applied to a wide range of markets. Furthermore, the sample might be biased by the requirements of an online questionnaire. We cannot completely reject a self-selection bias. Our sample appears to be slightly biased toward younger respondents. Younger users might simply have a higher affinity with new media types, such as e-mail and web-based surveys, than middle aged respondents. However, compared with data on the population distribution,

[20] One could actually argue that users develop different innovations in private and non-private ownership situations. While in private ownership situations users might be more likely to make substantial product modifications, users in non-private ownership paradigms might rather develop complementary or modular user innovations (e.g. that can be temporary attached to and later be detached from products). This also remains for future research.

our sample appears to be a fairly good representation of the population. Although we aimed for maximum comparability with previous studies, it was necessary to adopt existing variables for the operationalization to fulfill specific requirements (e.g., the selection of relevant competitions for the categorization into user groups). Despite these shortcomings, we are confident that our results are valid and relevant.

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Appendix 1

#	Study	Sport markets	Scope	User innovators	n	Empirical focus
1.	Schweisfurth, Raasch (2012)	Mountaineering	Lead users as firm employees: how are they different and why does it matter?	---	149	all users employed in firms
2.	Hienerth, von Hippel et al. (2011)	Whitewater kayaking	Efficiency of innovation by consumers. User innovators are more efficient than business sector firms	73% of equipment innovations realized by users	155	independent & corporate inventors
3.	Hienerth, Lettl. (2011)	Kayaking	Exploring How Peer Communities Enable Lead User Innovations to Become Standard Equipment in the Industry.	---	3 sport cases	professional and former profesionals
4.	Hyysalo (2009)	Rodeo and freestyle kayaking	Examination of micro innovation's on the industrial new product development	---	---	focus on several kayak studies
5.	Parsons, Rose (2009)	Mountaineering, Bicycling	Exploration that lead user innovation in the UK since 1850 have played a vital role in product innovations	---	---	elite users
6.	Schreier, Prügl (2008)	Sailplaning, Technical diving, Kitesurfing	Development of field-independent personality variables influencing lead userness	---	129; 193; 139	entire community (no special focus)
7.	Raasch, Herstatt et al. (2008)	Sailing	Extension of the LU-model regarding the evolution of user driven innovations	---	53	participants World Championships
8.	Schreier, Oberhauser et al. (2007)	Kitesurfing, Technical diving	Link between consumers' leading-edge status and the adoption and diffusion of new products.	---	139 193	entire extreme sports community (no special focus)
9.	Füller, Jawecki et al. (2007)	Basketball	Innovations in online consumer communities and the integration in firms' innovation processes	---	---	entire consumer community
10.	Piller (2006)	Kitesurfing, Sport shoes	How manufacturers could use the users' innovative potential	---	---	entire consumer community
11.	Franke, von Hippel et al. (2006)	Kitesurfing	Relationship between the attractiveness of innovations and lead-user characteristics	30,9%	399	entire extreme sports community (no special focus)
12.	Hienerth (2006)	Rodeo kayaking	Low cost technics to innovate to be faster on the market.	---	16 cases	participants World Championships
13.	Piller, Walcher (2006)	Sport shoes	Development of a firm's web-based tool to gain innovative ideas from users by arranging idea competitions	---	136	entire consumer community
14.	Lüthje, Herstatt et al. (2005)	Mountain biking	"Stickiness" of information	15,7%	106	"off-road" & "comfort" users
15.	Tietz, Morrison et al. (2005)	Kitesurfing	How users innovate and development of a two stage approach (idea generation, idea realization).	26,1%	152	expert users & less-skilled practitioners
16.	Lüthje (2004)	Climbing, Hiking, Cross-Country skiing, Mountain biking	Characteristics of innovating users	9,8%	153	entire community (no special focus)
17.	Dahlin, Taylor et al. (2004)	Tennis	Evaluation of differences between inventions of independent and corporate inventors	---	225	independent & corporate inventors
18.	Franke, Shah (2003)	Sailplaning, Canyoning, Boardercrossing, Handicapped cycling	How user-innovators gather the information they need & how they share and diffuse the resulting innovations	20-30%	197	students, non-professional & extreme users
19.	Shah (2000)	Skateboarding, Snowboarding, Windsurfing	Cases of innovations showing that users are an important source of innovation	58% of major improvements realized by users	57 cases	sport "enthusiasts"