

To own or not to own: How ownership impacts user innovation – An empirical study

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ABSTRACT

User innovation studies have mainly concentrated on markets in which users purchase products and, thus, both own and control the acquired good. However, users also use products that they do not own, in which case ownership and control are separated. Property rights theory predicts that the separation of ownership and control is a user innovation barrier. When innovating, users need to accommodate an additional actor: the owner. Separation of ownership and control thus induces uncertainty and complexity in the user innovation process, increasing users' costs to innovate.

The results of hierarchical regression analyses of data from 743 German rowers show that separation of ownership and control negatively impacts user innovativeness. Use experience positively moderates this relationship with regard to idea generation, but negatively with regard to idea realization. To remedy the negative impact, we propose approaches to manufacturers that employ co-creation-based innovation strategies (e.g. grant back clauses in use contracts).

Keywords: User innovation barrier, property rights theory, separation of ownership and control, use experience

1 Introduction

User innovation studies have been conducted in numerous markets, such as sports equipment, medical instruments, laboratory equipment, watches, games, toys, software, and many others (Franke et al., 2006; Franke and Piller, 2004; Herstatt and von Hippel, 1992; Hienerth and Lettl, 2011; Olson and Bakke, 2001; Schreier and Prügl, 2008). In most of these markets, users typically purchase products. For instance, it is common to practice sports, such as mountain biking, kitesurfing or motorcycling, with one's own equipment (Lüthje, 2004; Lüthje et al., 2005; Marchi et al., 2011; Schreier et al., 2007; Schreier and Prügl, 2008; Tietz et al., 2005). Following property rights theory (Berle and Gardner, 1932; Demsetz, 1967; Gedajlovic, 1993; Pejovic, 1976), prior studies have predominantly analyzed user innovation behavior in situations in which users have both product ownership and control.

However, ownership and control are often separated. In many situations, users exercise control over products that are owned by someone else. This applies oftentimes in the employer-employee relationship. Hospital doctors, for instance, use hospital-owned equipment (e.g. X-ray apparatus) and thus operate in a non-private ownership regime.

Moreover, we currently observe a servitization trend among manufacturing firms in various markets (Schultz et al., 2014; Sturm et al., 2007). These firms are increasingly offering functionality instead of selling products. Particularly product service systems, in which firms use own products to provide services, are becoming increasingly relevant (Dachs et al., 2012). An example is free floating car-sharing systems, which have become popular recently (Firnkorn and Müller, 2011). In Germany, the number of registered car sharing users (who do not own the cars) increased by 165% from 83,000 to 220,000 between 2006 and 2012 (bcs, 2013). In the same period, annual new car registrations, hence purchased vehicles, decreased by 11.4%, dropping from 3.5 million to below 3.1 million (KBA, 2013). Other examples include private practitioners leasing magnetic resonance imaging equipment, firms that offer cleaning services instead cleaning equipment, and "room temperature" instead of radiators (Mont, 2002; Neely, 2007; Neely et al., 2011; Tietze et al., 2013). Consequently, we ask the question: Does the separation of ownership and control impact user innovativeness?

The literature discusses different facets of property rights within the user innovation context. For instance, studies address the role of patents as incentives for users to innovate (e.g. von Hippel, 2005). Studies concerned with user based open source development discuss private and collective innovation models (e.g. von Hippel and von Krogh, 2003). However, the

literature insufficiently discusses how product related property rights impact user innovativeness.

To approach this question, we apply property rights theory. By doing so, we contribute to strengthening the theoretical foundations of user innovation theory. We further contribute to the debate on contextual factors that explain varying user innovation ratios in different communities, markets, or industries. Previous user innovation studies hardly mention ownership when discussing their choice of empirical fields. Hence, this study also contributes to the discussion about selection criteria for empirical fields that may be applied in future user innovation studies.

Our research question should be relevant to users and manufacturers alike. We show that the separation of ownership and control is an innovation barrier. This issue is relevant to manufacturers employing innovation strategies that rely on collaborations with users, for example scouting for innovative ideas. If not having ownership has a negative impact on users, this may also impact their innovation strategies. In an extreme case, to manufacturers that source of innovation might run dry. In fact, with an increasing number of firms following the servitization trend, fewer and fewer users will own products. Consequently, this issue is becoming increasingly relevant to firms.

In the next section, we introduce property rights theory into the user innovation literature and develop our theoretical framework. In Section 3, we apply property rights theory to the user innovation process and develop four hypotheses. Our research approach is presented in the fourth section, while section five reveals the results of our empirical study. In Section 6, we discuss our findings and derive implications for manufacturers. Section 7 summarizes the study, discusses its methodological limitations, and provides suggestions for future research.

2 Theoretical framework

2.1 Property rights theory

Property rights theory (PRT) is concerned with the impact of separated ownership and control (Berle and Gardner, 1932). According to PRT, ownership refers to owners' rights to exclude others from using their private property, from changing its physical properties, from benefiting from its use, and from selling it (Demsetz, 1967). PRT essentially questions the impact of aligned or separated ownership and control on behavior, and subsequently on

performance, largely examined on the firm level (Choi et al., 2011; Love et al., 1996; Ortega-Argilés et al., 2005). We argue that PRT can also be applied to the individual and product levels, hence questioning the impact of ownership and control on users' innovation behavior and, subsequently, on their performance.

Most prior user innovation studies have implicitly examined innovating users who acquire ownership rights through product purchases and thus both own and control their products. Consequently, they can decide whether or not to modify them. This situation is similar in owner-controlled firms (Gedajlovic, 1993). When a firm's owner also acts as its CEO, he or she has both ownership of and control over the company. The vast majority of user innovation studies is associated with this ownership-control situation, with very few acknowledging the distinction between ownership and control.

In contrast, the PRT literature also discusses cases in which ownership and control are separated, often labelled as "manager controlled firms" (Gedajlovic, 1993), for instance, corporations owned by multiple shareholders. In such firms, the CEO is an employed manager and may not own any shares in the company (Demsetz, 1967). Although this case has hardly been considered in the user innovation literature, it is quite frequently present in several domains, industries, and markets in which user innovation may take place. In certain markets (perhaps even in a gradually increasing variety of markets due to firms' servitization efforts), users hardly ever purchase the equipment they use and consequently do not own it. Hence, the producing firms continue to possess ownership along the product lifecycle while users exercise control when using products.

In order to contribute to a better understanding of user innovation behavior, we question whether the separation of ownership and control has an impact on users' innovation behavior. In both the above-described cases, users possess control. In a private ownership regime, users also possess ownership. In contrast, in the second case, users lack ownership, which results in a separation of ownership and control. In the following, we discuss PRT and user innovation in more detail and derive four hypotheses that we test in an empirical study. The results are reported in Section 4.

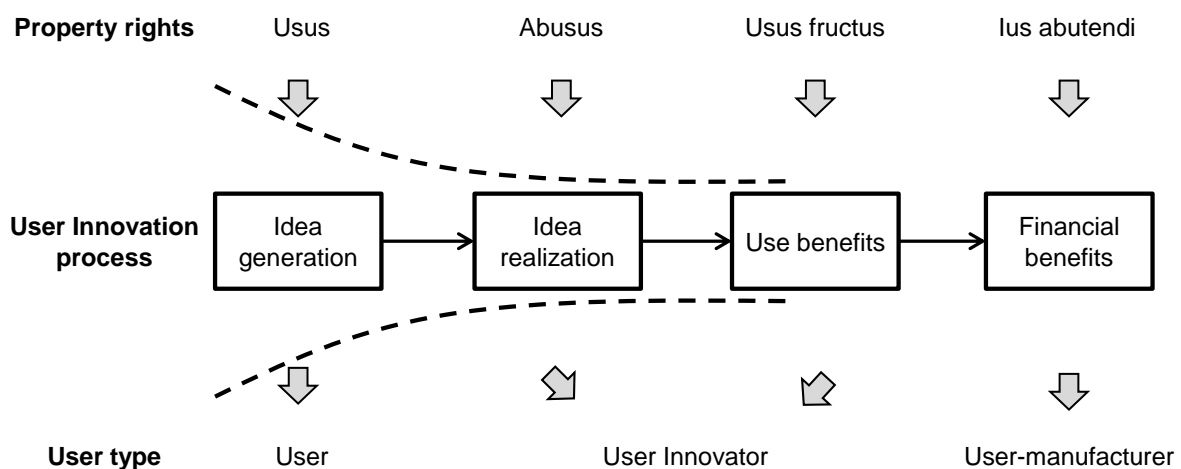
2.2 User innovation and property rights theory

According to Demsetz (1967), Gedajlovic (1993) and Pejovic (1976), PRT suggests four property right types: *usus*, *abusus*, *usus fructus*, *ius abutendi*. *Usus* is the right to use a specific object; *abusus* is the right to alter the shape and appeal of the object; *usus fructus* is the right

to benefits from using the object; and *ius abutendi* is the right to sell the object partly or even completely and to keep the revenues. We further detail the types below and show that the second and third types are particular relevant in the context of innovation processes in general and user innovation processes in particular. Both define an owner's rights to make changes to an asset and are often considered the fundamental components of ownership (Pejovic, 1976).

Previous user innovation studies conducted in sports markets are dominated by a private ownership regime, in which users have full control over the relevant property rights (see Appendix A for an overview of 20 studies). Examples include kitesurfing (Franke et al., 2006; Schreier et al., 2007; Tietz et al., 2005), windsurfing (Shah, 2000), basketball (Füller et al., 2007), mountain biking (Lüthje, 2004; Lüthje et al., 2005), tennis (Dahlin et al., 2004), kayaking (Hienerth and Lettl, 2011; Hyysalo, 2009), mountaineering (Parsons and Rose, 2009; Schweisfurth and Raasch, 2012), and selected sailing segments (Raasch et al., 2008). In all these sports segments, users predominantly purchase their equipment and thus both own and control it. There are only a few user innovation studies in which the ownership situation is unclear (Bilgram et al., 2008; Strandburg, 2009). Besides studies focusing on product development, recent studies that focus on service development have also not addressed this subject (Oliveira and von Hippel, 2011; Skiba and Herstatt, 2009). In the following, we first discuss the user innovation process for the standard case, that is, in which users possess ownership and control. We then compare this process to a situation in which ownership and control are separated.

Figure 1: Property rights along the user innovation process based on Tietz et al. (2005)



Applying PRT's four property right types, we can make the following assumptions about the user innovation process when users have ownership and control (see Figure 1): If users own a product, such as a mountain bike or a kayak, they possess the first property right type (*usus*). Pejovic defines *usus* as the "right to use that asset" (Pejovic, 1976, p.3) and Gedajlovic defines it as "the right to use your property as you see fit" (Gedajlovic, 1993, p.733). This property right can be interpreted as a fundamental basis for every user innovation. A user needs to be able to access a product and exercise control over it even to be called "user".

Second, by owning a product, a user also has the right to modify it. According to Gedajlovic, *abusus* is the "right to alter, modify or destroy your property" (Gedajlovic, 1993, p.733). Similarly, Pejovic defines it as the "right to change its form and substance" (Pejovic, 1976, p.3). Hence, *abusus* is the essential property right that allows a user to not only use, but also modify a product. Hence, *abusus* is an important prerequisite for any user to become innovative.

Third, if they possess ownership, users also have the right and freedom to fully exploit the benefits of their innovation. Various studies (Riggs and von Hippel, 1994; von Hippel, 1988) have found owners' ability to exploit use benefits to be a key driver for users to identify problems and develop solutions to them. According to the PRT, this relates to the third property right (*usus fructus*). Gedajlovic defines *usus fructus* as the "entitlement to enjoy and employ the fruits from your property" (Gedajlovic, 1993, p.733). Pejovic defines it similarly, but in more economic terms as the "right to capture returns from it" (Pejovic, 1976, p.3). While it has been argued that users' innovations are hardly ever driven by expected monetary returns (i.e. commercial exploitation), they are often motivated by the ability to capture performance improvements, often referred to as use benefits (von Hippel, 2005).

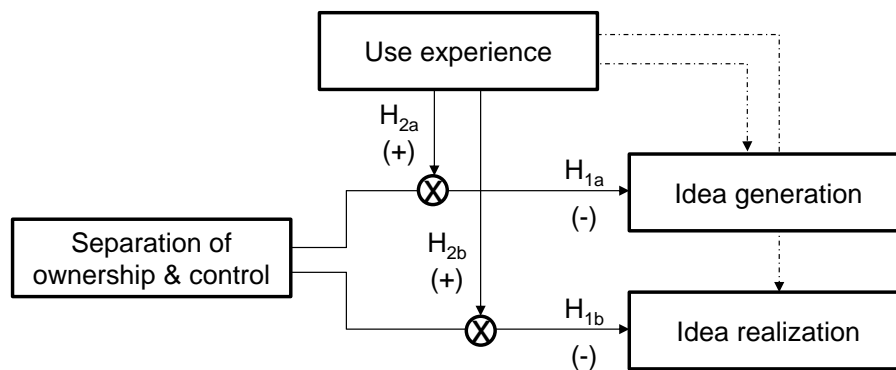
Fourth, some studies have argued that certain users become motivated to commercially exploit their innovations, referred to as "user-manufacturers". In particular, they have argued that, if users experience demand for their innovations (e.g. from friends, family, and acquaintances), they may become entrepreneurial and start manufacturing their innovation (Chandra and Leenders, 2012; Foxall and Johnston, 1987; Shah, 2000). For instance, in 1980, Phil Baechler invented the baby jogging stroller so that he could take his child with him when running. Owing to an increasing demand for his product, he turned his user innovation into a business (Debruyne, 2014; Shah and Tripsas, 2007). Users are thus entitled to exploit their innovations commercially. This is directly linked to the fourth property right (*ius abutendi*),

which Pejovic defines as the “right to transfer that asset to others at a mutually agreed upon price” (Pejovic, 1976, p.3).

3 Hypotheses

What implications does PRT suggest for user innovation processes (Figure 1) in which users have control but not ownership, for instance, when they rent products from firms? Figure 2 illustrates this study’s research framework. The model includes the separation of ownership and control as an independent variable. It includes idea generation and idea realization as dependent variables, which are relevant to user innovativeness, and use experience as a moderating variable. Direct effects of use experience on the dependent variables (illustrated by dashed lines) are included for model completeness only.

Figure 2: Research framework



3.1 Separation of ownership and control as user innovation barrier

When ownership is separated from control, users still have control over a product, because they act as the product’s temporary proprietor. A use contract commonly determines users’ access to the product, hence specifying their *usus* rights. However, not having ownership results in a lack of *abusus* rights. Use contracts hardly ever entitle users to modify or alter products. Consequently, if a user without *abusus* wants to modify a product to improve its performance, he or she needs to seek the owner’s permission. Seeking permission induces additional uncertainty and complexity to the user innovation process and must be considered an additional cost (i.e. transaction costs for engaging in negotiations) for innovative users (Caird and Roy, 2008). Moreover, if users consider becoming entrepreneurial in order to commercially exploit their innovation, they would again need the permission of the owner, who possesses the *ius abutendi*. Hence, owners can prohibit users’ commercialization efforts.

Moreover, users face additional uncertainty, because owners could claim ownership of the innovation, because it is a modification of their product. Innovating users would thus have to share the benefits of “their” innovation with the owner. To summarize, if users want to innovate in situations in which ownership and control are separated, they have to cooperate with an additional actor, which induces additional uncertainty in and increases the costs of the innovation process.

Instead of seeking the owner’s permission, users can also consider modifying products without permission. This however bears two risks: First, any unauthorized modification could constitute a breach of the use contract. The owner can then withdraw the *usus* right by terminating the contract. Consequently, users would lose access to the product and would not be able to enjoy the use benefits of their innovation (*usus fructus*). Second, any unauthorized modification bears the risk of damage claims. If the innovation fails but the original product is undamaged, the innovator will not be at risk of damage claims. Experimenting with product modifications could however lead to complete product failure. In that case, the owner may subject users to substantial damage claims. If users fear potential damage claims, they have to account for them when approximating their innovation costs before initiating innovation activities. Expected damages increase users’ innovation costs depending on the probability that the owner would claim damages and the expected amount of damages.

We can thus conclude that users’ innovation costs even increase when they avoid seeking the owner’s permission, putting additional demands on the user resources, which have been shown to be constrained in user innovation activities (Franke and Shah, 2003). Even if users are not primarily motivated by financial benefits, higher innovation costs lower their probability to expect positive returns on their innovation efforts also in terms of use benefits. Whether or not users seek permission from an owner, resource-based user innovation barriers impair user innovators (Braun and Herstatt, 2007). Consequently, additional costs increase their cumulated constraints during the innovation process and hence decrease their incentives to realize ideas.

A barrier to realizing ideas creates another problem. Lazarus’ stress management theory predicts that need identification is followed by an assessment of whether or not a person can change an observed situation. If people feel they have sufficient control, they will initiate innovative activities in the hope of improving the situation (Gebert et al., 2004; Lazarus, 1966, 1991). If, however, they feel less in control, their original aspiration to initiate change is subjectively reduced. As a result of this reappraisal, they may also no longer consider the

change necessary. Similarly, the theory of learned helplessness predicts that situations that users perceive to be uncontrollable hinder their confidence and reduce their desire to respond innovatively to observed inefficiencies (Abramson et al., 1978; Maier and Seligman, 1976; Mone et al., 1998; Peterson et al., 1993; Shepherd et al., 2013; Välikangas et al., 2009). Consequently, if users have little influence on the owner's decision to grant them permission to innovate, this perceived uncontrollability may discourage them from thinking about ideas to adapt the product. Hence, users may perceive a separation of ownership and control to be an innovation barrier if they receive negative feedback from the owner. This motivational deficit will lead users to refrain from developing ideas. The separation of ownership and control is thus a user innovation barrier to both the generation and realization of ideas.

H_{1a}: The separation of ownership and control negatively impacts user idea generation.

H_{1b}: The separation of ownership and control negatively impacts user idea realization.

3.2 Moderating effect of use experience

Studies have shown a positive relationship between use experience and user innovativeness (Lüthje, 2004; Lüthje et al., 2005; Magnusson, 2009; Schreier and Prügl, 2008). The common argument is that users with more experience have greater expertise. As such, experts are more aware of certain products' possibilities and limitations, but are also more critical of these products and experience more borderline situations. At the same time, their expectations of product' performance and quality become increasingly high. Hence, more experienced users have stronger incentives to improve product performance by means of developing and realizing innovative ideas. Below, we provide a number of arguments for why we expect the separation of ownership and control to become less of an innovation barrier the more experienced users are.

When ownership is separated from control, users lack abusos rights and thus require owners' permission to realize their innovative idea. Negotiations are eventually cost intensive and, if they fail, pose an additional cost risk. When pursuing negotiations, users and owners engage in bilateral collaborations. From the literature on cooperation and alliances, we know that trust is a proven determinant of successful cooperation. Trust is a dynamic concept that is influenced by cooperating partners' interactions (Inkpen and Currall, 2004). Unlike most economic commodities, trust increases with more interactions (Inkpen and Currall, 2004,

referring to Hirschman, 1984). When a relationship between partners ages, previous experiences contribute to establishing mutual trust through positive feedback effects (Lewicki et al., 2006). Certain users might be better positioned to establish trust than others and thereby are more likely to reduce negotiation costs more. We argue that use experience impacts the establishment of trust. Highly experienced users (HEUs) should be better positioned to establish a trusting relationship with owners than less experienced users (LEUs).

Occasions to meet owners are important opportunities for users to interact with owners. HEUs are more likely to meet owners than LEUs. For instance, HEUs are present in a rowing club during several days a week to practice rowing. Being at the rowing club increases their chances of running into owners (e.g. board members of the rowing club). HEUs are more likely than LEUs to participate in activities, such as weekend boat races in the rowing club example, where owners are regularly present to observe how users perform. In yacht sailing, for instance, it is common practice for owners to participate in important sailing competitions.

HEUs have at least five other advantages over LEUs in respect of effectively cooperating with owners. First, HEUs generally have lower access barriers (i.e. lower search costs) due to previous informal interactions and the development of social ties. If they want to present an idea to owners, they already know who the owners are and the owners know them. Second, HEUs' expert status increases owners' confidence in the satisfactory cooperation with the user (Das and Teng, 1998). That reputation also strengthens their bargaining power when requesting permission to innovate (Kale et al., 2000). Third, HEUs are more likely to have developed an understanding of the owners' behavior, preferences, norms, and decision logics (Doz, 1996; Lewicki et al., 2006). That knowledge enables them to pre-select only those modification ideas that the owner is likely to approve. Fourth, when approached by HEUs, owners actually have incentives to cooperate in order to not damage the mutual trust relationship. For instance, professional rowers might have an important marketing function as club stars. Owners might be dependent on them, hence have incentives to listen to and support them in order to prevent them from leaving the club and joining a competitor. Fifth, ideas proposed by HEUs may enhance the owners' reputation within the community. For instance, granting HEUs permission to modify rowing boats and equipment may lead to better results in rowing competitions, which may in turn boost the owner's public reputation.

Hence, with increasing use experience, the innovation barrier due to the separation of ownership and control becomes less severe. Additional innovation costs that results from separated ownership and control are lower for HEUs than for LEUs. Furthermore, if HEUs

are likely to receive the owner's permission to modify equipment, they will also have stronger incentives to develop innovative ideas despite lacking abusus rights. Consequently, the separation of ownership and control will have a weaker effect on HEUs than on LEUs.

H_{2a}: Use experience positively moderates the impact of ownership and control separation on users' idea generation.

H_{2b}: Use experience positively moderates the impact of ownership and control separation on users' idea realization.

4 Research approach

4.1 Data collection

We collected data in the rowing market because both joined and separated ownership and control situations are prevalent in it. While kite surfers, mountain bikers, kayakers, etc. largely own and control their equipment (private ownership), a substantial share of rowers do not own the boats or equipment they use. For various reasons, for example substantial upfront procurement costs, the equipment predominantly belongs to rowing clubs or sports federations (non-private ownership). Rowing boats cost from a few thousand Euro for a leisure boat up to approximately €50,000 for a professional eight. The rowing market has several similarities with, for instance, kitesurfing, kayaking, or professional mountain biking, thus ensuring our results' comparability to previous studies done in these markets. As in these sports markets, several technological innovations have recently impacted rowing equipment, for example, the use of carbon fiber for the boat's shell has made boats lighter and substantially improved their blades' strength. Similarly to other sports markets, rowers can be divided into professional and non-professional users. Professional rowers generally have much higher performance demands of their equipment.

Most of the approximately 78,000 rowers in Germany are members of rowing clubs (Deutscher Olympischer Sportbund (DOSB), 2009). In August 2011, following explorative semi-open interviews to understand the specifics of the empirical field and a pre-test of a questionnaire, we distributed a survey to the members of 410 of the 554 clubs listed in the German Rowing Federation's roster at the time. We excluded 144 clubs because we were not able to find their contact details via a web-search. These were predominantly small micro-clubs with very few members. We contacted the clubs' board members via web-based contact

forms or e-mail and politely asked them to forward the link to the 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 contacted directly. Through this approach, our survey reached professional, former professional, and non-professional rowers.

The approach yielded 743 overall responses. The geographical respondent distribution across all 16 German states is comparable to the German rower population (Landessportbünde der Bundesländer (LSB), 2011), with three exceptions. The age distribution of participants is also comparable, although marginally biased towards younger rowers (Deutscher Olympischer Sportbund (DOSB), 2009). While the share of rowers in the age group from 16 to 26 years is above the expected share, the share of participants above 60 years is slightly lower. We screened the responses for incomplete, inconsistent or non-habitual data as well as outlier data. A variance analysis was also performed to filter out respondents with little variance, hence homogenous response pattern (Müller and Freytag, 2005; Richards, 2009). Our final sample thus contained 607 responses that remained for further analysis.

4.2 Measures

The research model includes two dependent variables measuring user innovativeness, an independent variable representing status of ownership and control and an independent moderating variable representing the users use experience. A set of control variables is implemented to control for field-specific and individuals' effects.

4.2.1 *Dependent variables*

We used two dependent variables to operationalize users' innovativeness. The first dependent variable (idea generation) was based on an ordinal scale measuring the number of ideas (zero, fewer than three, three to five, more than five) a user has had to improve the functionality of existing products and product parts or to create completely new solutions. Based on previous user innovation studies (Franke et al., 2006; Lüthje, 2004; Lüthje et al., 2005), we asked participants: "How many ideas did you come up with for technically improving boats or complementing equipment in 2010?" The second dependent variable (idea realization) is dichotomous and was used to measure whether users have started development activities beyond the ideation phase by asking: "Did you actively try to realize one of your innovative ideas between 2000 and 2010?"

4.2.2 *Independent variables*

The independent variables are among this study's primary interests. We divided rowers into three categories in order to measure their status of ownership and control: "Private ownership" means the same person owns and controls the boat and equipment. "Non-private ownership" means that equipment is owned by a club or federation and is controlled by a number of users. The "quasi-private ownership" status refers to club or federation-owned equipment that is exclusively controlled by a specific rower. These three categories compose the nominally scaled variable "ownership," which is coded into three dummy variables.

The independent moderating variable "use experience" measures a user's expertise in his or her specific field of interest. The formative construct comprises two variables: the frequency and duration of use (Schreier and Prügl, 2008). The frequency is measured as 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." We used the duration of use to calculate the number of years a user had been practicing rowing without a major interruption.

4.2.3 *Control variables*

The results of explorative interviews conducted prior to the quantitative study indicated that we should control for four variables (i.e. the user group, individuals' or teams' use of boats, and users' age and gender), of which the first two require further explanation. In accordance with Parks and Quarterman (2003) as well as Kikulis et al. (1989), we define three user groups: professional, former professionals, and non-professionals. Professionals include users who had regularly participated in national or international competitions (e.g. German, European or World Championships or Olympic Games) and who still practiced rowing during the survey period (until August 2011). Former professionals 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 approach. The dichotomous variable "single/team usage" illustrates whether users predominantly use the equipment on their own (e.g. single scull boat) or if they practice sport in team boats with others members (coxless

fours, eight boats, etc.). It was important to include this variable, since users might be reluctant to engage in innovating activities if they will directly influence other users.

4.3 Data analysis

We employ regressions analyses to test the hypotheses. We also recoded the categorical dependent variable (idea generation) into a binary variable (1=one or more ideas; 0=no idea) to test ownership's direct effects on both innovativeness variables (Table 4). We expected to lose explanatory power, but wanted to run similar (logistic) regressions for both dependent variables in order to present comparable results. Owing to the uneven distribution of the three ownership categories in our dataset, it was necessary to check for robustness. Therefore, we also performed logistic regressions on a sub-sample whose ownership categories were evenly distributed. This sub-sample includes all users who both own and control the equipment (private) and an equal number of randomized cases from the other two categories in which ownership and control are separated (non-private shared use, non-private individual use).

We used a hierarchical (stepwise) procedure to test the full models that include the moderator effects and control variables (Table 5 and 6) (Dawson, 2013). We consequently computed ordinal regressions for the first and logistic regressions for the second dependent variable. With regard to idea generation, the preconditions for computing ordinary least squares (OLS) regressions were not met. The main reason for this is that the four categories (zero, less than three, three to five, and more than five ideas) are not equidistant and the empirical distribution is asymmetrically skewed to the left. In such cases, ordinal regressions are preferred (Agresti, 2010). SPSS employs a cumulative logit model originally proposed by Walker and Duncan (1967), which later also became known as the proportional odds model (McCullagh, 1980). In order to run ordinal regressions, we needed to test the assumption that the parameters are the same for each category (proportional odds), which was confirmed by the test of parallel lines (Long, 1997). All our models have chi-square values of above 0.05 and are significant; we were thus unable to reject the null hypothesis. Hence, the proportionality of odds was confirmed and the chosen model appears to be appropriate. In addition, all models show increased model fit when additional variables are included. We selected a log-log-negative link function for the ordinal model because of the skewed nature of the dependent variables' categories (Norušis, 2005). In our data, there is a bias towards lower categories (i.e. users tend to have few ideas rather than many). Owing to the binary nature of idea realization, we

employ logistic regressions to analyze its effects (Hosmer and Lemeshow, 2013; Menard, 2002; Peng et al., 2002).

The moderator effects were tested following the procedure proposed by Aiken et al. (1991), Frazier et al. (2004), and Baron and Kenny (1986). Accordingly, the variables were z-transformed and standardized in order to calculate the interaction term. We decided to include ownership as a dummy variable for each of the three user groups and not as a categorical variable. Thereby, we were able to calculate the moderator effects using regression analysis. Otherwise, we would have had to run an ANCOVA (Dawson, 2013).

5 Results

5.1 Descriptive results

Of the 607 survey participants, 30.5% were female and 69.5% were male rowers (Table 1). On average, respondents were 37 years old. A total of 58.8% were non-professionals, 27.2% were former professionals, and 14.0% were professional rowers. The majority of survey participants practiced rowing in a team (83.5%), while 16.5% practiced alone.

Table 1: Descriptive results for independent variables and ownership categories

Variables	Ownership			Total ^b
	Private ^a	Quasi-private ^a	Non-private ^a	
Use experience	5.0	3.6	2.5	2.9
Gender				
Male	20 (.047)	104 (.171)	298 (.706)	422 (.695)
Female	8 (.026)	56 (.184)	121 (.397)	185 (.305)
Age [average years]	40.4	25.5	40.4	36,5
User group				
Professional	5 (.059)	68 (.800)	12 (.141)	85 (.140)
Former professional	4 (.024)	60 (.364)	101 (.612)	165 (.272)
Non-professional	19 (.053)	32 (.090)	306 (.857)	357 (.588)
Usage				
Single usage	21 (.210)	37 (.370)	42 (.420)	100 (.165)
Team usage	7 (.014)	123 (.243)	377 (.744)	507 (.835)
Total	28 (.046)	160 (.264)	419 (.690)	607

Notes: ^a Percentages in parentheses for line totals; ^b percentages in parentheses for overall total

In total, 31.0% of the users in our sample practiced rowing either with their own equipment or with quasi-privately owned equipment, that is, equipment for which they possessed exclusive use rights. The other rowers practiced with equipment that is owned by a club or association. These rowers commonly shared boats with fellow club members. Of the rowers, 67.9% who

practiced with own equipment were non-professionals. Likewise, 73.0% of the rowers who used non-private, club-owned equipment were non-professionals. The share of privately owned boats was approximately equal among professionals (5.9%) and non-professionals (5.3%), but lower among former professionals (2.4%). A large share of private owners practiced rowing in single seat boats. The majority of rowers, who used club-owned equipment or exclusively reserved boats rowed in teams.

Table 2 cross-tabulates descriptive statistics for both dependent variables and the three ownership categories. Of the 607 users, 273 (45.0%) had at least one idea for technically improving boats or equipment. Professional users showed the highest ideation ratio (62.4%), followed by former professionals (48.2%), and non-professionals (39.4%). Only 6.8% of the users had started implementing an idea. Former professionals revealed the highest implementation ratio (7.3%) just above the realization ratio of professionals (7.1%), followed by non-professionals with an implementation ratio of 6.4%.

Table 2: Descriptive results for dependent variables and different ownership categories

Innovativeness	Ownership			Total
	Private	Quasi-private	Non-private	
Total sample				
Idea generation ^a	18 (.643)	93 (.581)	162 (.387)	273 (.450)
Idea realization ^b	7 (.250)	11 (.069)	23 (.055)	41 (.068)
Professional users	5 (.059)	68 (.800)	12 (.141)	85 (.140)
Idea generation	3 (.600)	45 (.662)	5 (.417)	53 (.624)
Idea realization	1 (.200)	5 (.074)	0 (.000)	6 (.071)
Former professional users	4 (.025)	60 (.370)	98 (.605)	162 (.267)
Idea generation	3 (.750)	34 (.567)	41 (.418)	78 (.482)
Idea realization	2 (.500)	4 (.067)	6 (.059)	12 (.073)
Non-professional users	19 (.053)	32 (.089)	309 (.858)	360 (.593)
Idea generation	12 (.632)	14 (.438)	116 (.375)	142 (.394)
Idea realization	4 (.211)	17 (.063)	17 (.056)	23 (.064)
Total	28 (.046)	160 (.264)	419 (.690)	607

Notes: Percentages are in parentheses; ^a idea generation measured in 2010, idea realization measured between 2000 and 2010

A total of 64.3% of the users who practiced rowing with own equipment had innovative ideas. Twenty-five percent of them had also further developed their ideas (Table 2). Of the users who practiced with exclusively reserved equipment, 58.1% indicated that they have had innovative ideas and 6.9% had started realizing them. Among users who practice rowing with equipment and boats that they do not own, 38.7% had innovative ideas and 5.5% had started implementing them.

A closer look at the innovativeness across the three user groups (professionals, former professionals, and non-professionals) reveals an interesting and rather consistent pattern: The share of users who had innovative ideas and started realizing them was always lower for users who did not have ownership (non-private) than for those with exclusive use rights (quasi-ownership). Moreover, both these user groups had a lower share of ideas and realized ideas than users who privately owned their equipment, with one exception: Professionals with quasi-ownership indicated a slightly higher idea generation ratio than professionals who privately owned their equipment. In general, these descriptive results strongly indicate that the separation of ownership and control has a negative impact on idea development and realization, with non-private ownership having a stronger negative impact than quasi-ownership. Although descriptive, the consistency of this effect already indicates support for Hypotheses H_{1a} and H_{1b}.

Table 3: Correlation coefficients and VIFs

	1	2	3	4	5	6	7	8	9	10	11	12
1 Idea generation	^a											
2 Idea realization	.351	<i>1.068</i>										
3 Non-private	-.212	-.077	^a									
4 Quasi-private	.144	.004	-.895	<i>1.679</i>								
5 Private	.166	.164	-.326	-.130	<i>1.277</i>							
6 Use experience (UE)	.184	.145	-.258	.172	.208	<i>1.279</i>						
7 Gender ^b	.116	.123	.045	-.049	.005	.054	<i>1.046</i>					
8 Age	-.030	.116	.351	-.393	.051	.260	.104	<i>1.755</i>				
9 Professional	.104	.009	-.477	.486	.032	.083	.019	-.356	<i>1.779</i>			
10 Former-professional	.024	-.031	-.115	.149	-.006	-.119	.029	-.343	-.241	<i>1.462</i>		
11 Non-professional	-.094	.022	.437	-.474	.032	.050	-.040	.558	-.478	-.737	^a	
12 Single/Team usage ^c	.039	.006	-.257	.109	.341	.094	.036	-.130	.104	.079	-.144	<i>1.189</i>

Notes: n=607; Pearson correlations, Variables 8 to 13 are control variables; Variables 1, 2 & 3; 5, 6 & 7; 10, 11 & 12 are related dummy variables; Numbers on the diagonal (shown in italics) are the variance inflation factors (VIF); ^a VIF not applicable for base variable; ^b base variable is “male”; ^c base variable is “single usage”

Table 3 presents Pearson correlation coefficients for the independent variables as well as the variance inflation factor (VIF). The VIFs indicate that the correlations are unproblematic. All VIFs are far below 10, which Cohen (2003) recommends as the cut-off point for unproblematic correlations. However, other research has criticized this threshold, suggesting that values between 3 and 5 are preferred (Hair, 2009). This study’s VIF values are below 2 (see Table 3). We also calculated the condition index (Belsley et al., 1980; Belsley, 1991).

Values above 30 are commonly considered to indicate collinearity. The highest value in our data is 10.069. Hence, the data does not indicate any multicollinearity.

5.2 Regression results

Table 4 displays regression results for the impact of quasi- and non-private ownership on user innovativeness compared to a situation in which users possess both ownership and control. In line with the descriptive results presented in Table 2, Table 4 reveals that non-private ownership has a significant negative effect on idea generation and realization. This effect is present in both the complete dataset and the sub-sample. Non-private ownership has a significant negative impact on idea generation with p-values below 0.05 in Model 1a and below 0.01 in the sub-sample (Model 1b). The negative effect is significant for idea realization with $p < 0.001$ in the complete dataset (Model 2a) and is below 0.05 in the sub-sample (Model 2b). The coefficients are substantial with correspondingly low standard errors in all models. Hence, the revealed direct effect of the separation of ownership and control on user innovativeness supports Hypotheses H_{1a} and H_{1b}. Users are less inclined to develop and realize innovative ideas if they do not own the equipment they use. The results in the sub-sample validate this finding's robustness.

Table 4: Logistic regression results for ownership effects on idea generation and realization

	Model 1a	Model 1b	Model 2a	Model 2b
	Idea generation ^a	Idea generation ^a	Idea realization ^a	Idea realization ^a
	β (Stand. error)	β (Stand. error)	β (Stand. error)	β (Stand. error)
Constant	0.558 (0.394)	0.558 (0.394)	-1.099 * (0.436)	-1.099 * (0.436)
<u>Independent variables</u>				
Equipment ownership				
Non-private ^b	-1.049 * (0.407)	-1.686 ** (0.588)	-1.747 *** (0.486)	-2.197 * (1.108)
Quasi-private ^b	-0.260 (0.426)	-0.300 (0.549)	-1.507 ** (0.537)	-1.022 (0.751)
<u>Model fit</u>				
Cox & Snell R ²	0.036	0.114	0.017	0.069
Nagelkerke R ²	0.048	0.152	0.043	0.128
χ^2	22.149	10.169	10.313	6.029
p-value	0.000	0.006	0.006	0.049
n	607	84	607	84

Notes: All models are logistic regressions; standard errors 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 "Private"

Users with quasi-ownership show negative coefficients across all models. However, they are

less negative than for users without ownership. Hence, they are less likely than private owners but more likely than users who completely lack ownership to develop and realize ideas. The delta in the coefficient size indicates that giving users exclusive use rights seems to reduce the negative effect of absent ownership on idea generation by an average of 79% (75% in Model 1a; 82% in Model 1b). Compared to idea generation, giving users quasi-private ownership reduces the negative impact on idea realization. Users with quasi-private ownership are, on average, only 34% more likely to realize ideas than users without ownership (14% in Model 2a; 53% in Model 2b). However, this negative effect is only significant in Model 2a ($p < 0.01$).

We can conclude that the results presented in Table 4 support Hypotheses H_{1a} and H_{1b}. Users who neither own nor control the equipment they use are less likely to innovate than users who operate their own equipment. However, compared to the likelihood that users who own their equipment will innovate, the innovation results of users who possess exclusive use rights but do not own the equipment will innovate are slightly ambiguous. In line with the first hypothesis, the coefficients are consistently negative across all models, indicating that quasi-private owners are less innovative than private owners, although to a lesser extent than users who do not own the equipment they use. However, this effect appears to be significant only in one of the four models.

Tables 5 and 6 present results of hierarchical regressions. In both tables, the first model solely includes control variables. The second model also includes both the independent variables: “ownership” and “use experience.” The third model adds the interaction effects “ownership” and “use experience,” which operationalize the moderator effects (Cohen, 2003).

Table 5 displays results from ordinal regressions, revealing the effects of ownership and control on users’ idea generation. Model 3b reveals that both non-private and quasi-private ownership have a significant negative impact on users’ likelihood to develop innovative ideas, compared to situations in which users own and control their equipment. Consistent with the results in Table 4, non-private ownership has a stronger effect on idea generation ($\beta = -1.006$) than for quasi-private ownership ($\beta = -0.648$).

Table 5: Ordinal regression results for effects on idea generation

		Model 3a	Model 3b	Model 3c
		β	β	β
		(Stand. error)	(Stand. error)	(Stand. error)
Dependent variable				
	<i>Threshold</i>			
Idea generation ^a	[0]	0.912 *** (0.239)	0.029 (0.373)	0.448 (0.442)
	[1]	2.853 *** (0.272)	2.003 *** (0.391)	2.440 *** (0.461)
	[2]	4.606 *** (0.407)	3.767 *** (0.493)	4.221 *** (0.552)
Independent variables				
Ownership equipment				
	Non-private ^b		-1.006 *** (0.288)	-0.538 (0.376)
	Quasi-private ^b		-0.648 * (0.292)	-0.132 (0.388)
	Use experience (UE)		0.090 ** (0.029)	0.081 ** (0.030)
	Use Experience x Ownership			
	UE x Non-private ^b			0.230 * (0.096)
	UE x Quasi-private ^b			0.244 * (0.101)
Control variables				
	Gender ^c	0.393 ** (0.144)	0.409 ** (0.144)	0.416 ** (0.145)
	Age	-0.001 (0.005)	-0.006 (0.005)	-0.007 (0.005)
	User group			
	Professional ^d	0.589 ** (0.202)	0.215 (0.225)	-0.158 (0.227)
	Former professional ^d	0.266 (0.163)	0.172 (0.168)	-0.136 (0.168)
	Single/Team usage			
	Single ^e	-0.102 (0.170)	-0.347 † (0.185)	-0.306 † (0.184)
Model fit				
	Cox & Snell R ²	0.034	0.079	0.087
	Nagelkerke R ²	0.040	0.094	0.103
	χ^2	20.816	49.451	54.704
	p-value	0.001	0.000	0.000

Notes: n=607; All models are ordinal regressions with log-log-negative link functions; standard errors in parentheses; Model 3c'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 the base variable is "Private"; ^c the base variable is "Female"; ^d the base variable is "Non-professional user"; ^e the base variable is "Team"; The parallel lines tests of all models are not significant.

User innovation research has shown that use experience predicts a higher probability of lead users and, consequently, increases the probability that users will be innovative (Franke and Shah, 2003; von Hippel, 1988). The results shown in Table 5 support this finding. Models 3b and 3c reveal that use experience has a significant positive effect on idea generation (p<0.01).

Model 3c reveals a significant interaction effect for both ownership categories, with $p < 0.05$. The coefficients of both interaction effects are positive, hence supporting Hypothesis H_{2a}.

To check the results' robustness, we ran a number of different regression models. First, we computed ordinal regressions, employing a logit-link function instead of the preferred log-log-negative link function. The results revealed higher values for Nagelkerke R² and Cox and Snell R² (e.g. 0.109 and 0.093 for the full model). Moreover, the coefficients are stronger and the significance levels improved. For instance, the coefficient of the interaction effect "use experience x non-private" increased from 0.230, with $p < 0.05$, to 0.336, with $p < 0.01$. Second, despite the better model fit of the ordinal regression, we calculated OLS regressions assuming the categorical dependent variable to be metrically scaled count data and, thus, log-transformed. The results revealed similar effect directions, although slightly inferior significance levels. For instance, the interaction term "use experience x non-private" is also positive ($\beta = 0.151$) with an even higher significance ($p < 0.001$). The corrected R² of the full OLS model is 0.093.

The control variables, consistent with our descriptive results, reveal that there are no significant differences between professionals', former professionals', and non-professionals' likelihood to develop innovative ideas ($p > 0.1$). Male users appear to be significantly more likely to develop ideas than females ($p < 0.01$). Single users appear to have a lower likelihood to develop ideas than those who use equipment in teams. Age did not significantly impact the likelihood to develop innovative ideas.

The results displayed in Table 5 suggest that a separation of ownership and control negatively and significantly impacts users' idea generation. This finding supports Hypothesis H_{1a}. Moreover, we find that ownership positively moderates the relationship between use experience and idea generation. This finding supports Hypothesis H_{2a}.

Table 6 displays the results and includes users' idea realization as a dependent variable. Model 4b reveals that non-private ownership has a significant negative effects on users' likelihood to realize innovative ideas ($p < 0.01$). Users who lack ownership ($\beta = -2.110$) are less likely to realize ideas than users with quasi-private ownership rights ($\beta = -1.617$). The latter group is also significantly less likely to realize ideas than users who possess both ownership and control ($p < 0.05$).

Table 6: Logistic regression results for effects on idea realization

	Model 4a	Model 4b	Model 4c
	Idea realization ^a	Idea realization ^a	Idea realization ^a
	β	β	β
	(Stand. error)	(Stand. error)	(Stand. error)
Constant	-5.626 *** (0.809)	-3.984 *** (1.004)	-6.226 *** (0.927)
<u>Independent variables</u>			
Ownership equipment			
Non-private ^b		-2.110 ** (0.639)	-0.894 (0.995)
Quasi-private ^b		-1.617 * (0.662)	-0.276 (1.023)
Use experience (UE)		0.102 (0.070)	0.041 (0.079)
Use Experience x Ownership			
UE x Non-private ^b			-0.463 * (0.229)
UE x Quasi-private ^b			-0.461 † (0.248)
<u>Control variables</u>			
Gender ^c	1.291 * (0.539)	1.418 * (0.553)	1.708 ** (0.624)
Age	0.039 ** (0.012)	0.035 * (0.014)	0.036 * (0.014)
User group			
Professional ^d	1.178 † (0.621)	0.774 (0.677)	0.731 (0.696)
Former professional ^d	0.869 † (0.473)	0.904 † (0.490)	0.831 † (0.502)
Single/Team usage ^e	0.093 (0.447)	-0.694 (-0.540)	-0.745 (0.575)
<u>Model fit</u>			
Cox & Snell R ²	0.035	0.061	0.069
Nagelkerke R ²	0.090	0.154	0.176
χ^2	21.578	37.324	42.943
p-value	0.001	0.000	0.000

Notes: n=607; All models are logistic regressions; standard errors in parentheses; Model 4c's interaction variables are z-transformed; statistical significance †p<0.1, *p<0.05, **p<0.01, ***p<0.001; ^a the dependent variable is binary; ^b base variable is "Private"; ^c the base variable is "Female"; ^d the base variable is "Non-professional"; ^e the base variable is "Team"

In line with previous user innovation research, the models reveal a positive relationship between use experience and users' likelihood to realize ideas. Although, the effect does not appear to be significant (p=0.143) in Model 4b, Model 4c reveals that, compared to private-ownership, non-private ownership (p<0.05) and quasi-private ownership (p<0.1) have significant interaction effects with use experience. In contrast to Hypothesis H_{2b}, the results indicate a negative moderator effect.

To check the results' robustness, we created a sub-sample ($n=250$) with evenly distributed cases in which users realized their ideas and randomly selected cases in which users did not realize their ideas. The results revealed higher values for Nagelkerke R^2 and Cox and Snell R^2 (e.g. 0.136 and 0.229 for Model 4b). Moreover, the coefficients for this model were shown to be stronger and the significance levels improved for the direct effect. Despite a better model fit, the full model reveals a significance level of $p>0.10$ for the interaction effect.

The control variables in the full sample models ($n=607$) reveal a significant effect across the different user groups, although only for $p<0.1$. Former professionals are significantly more likely to realize ideas than professional and non-professional users. Moreover, male and older users also appear to be significantly more likely to realize ideas. Whether users used equipment alone or in a team had no impact on their likelihood to innovate.

The results displayed in Table 6 suggest that the separation of ownership and control negatively impacts users' likelihood to realize ideas. Although they have exclusive rights to use equipment, users who operate in a quasi-ownership situation are also significantly less likely to realize ideas than users with ownership and control rights. These findings support Hypothesis H_{1b} . Although we find a significant interaction term, which proves that there is a moderator effect, our results do not support the direction proposed in Hypothesis H_{2b} . Instead, the results suggest that use experience negatively moderates the relationship between a separation of ownership and control and users' likelihood to realize ideas.

To summarize, the findings displayed in Tables 4, 5, and 6 largely support three of the four hypotheses (H_{1a} , H_{1b} and H_{2a}). The effect of absent ownership is significant and negative in all models presented in Table 4 and both the relevant models presented in Tables 5 and 6. Quasi-private ownership also had a significant negative effect on innovation across all models. Considering the results that we observed in numerous robustness checks, we can conclude that Hypotheses H_{1a} and H_{1b} are supported. Hence, when ownership and control are separated, users are less likely to develop and realize innovative ideas than users who possess both ownership and control. Not having ownership thus has a negative impact on users' innovativeness. The results further support Hypothesis H_{2a} but not Hypothesis H_{2b} . We find that ownership moderates the relationship between use experience and user innovativeness. The moderator effect is positive for users' likelihood to develop ideas and is thus supports Hypothesis H_{2a} . The results however show that a separation of ownership and control negatively impacts the likelihood that users will realize ideas. Thus, Hypothesis H_{2b} is not

supported. This result and other managerial implications are discussed in the following section.

6 Discussion and implications

Our results show significant effects for all four hypotheses. However, the effect for H_{2b} is negative rather than positive. In this section, we discuss this result, providing an alternative explanation for why use experience might negatively moderate the relationship between ownership and idea realization. We also derive managerial implications for increasing users' likelihood to innovate when ownership and control are separated and suggest avenues for future research.

6.1 Why do users with higher use experience realize fewer ideas when ownership and control are separated?

The second hypothesis argues that trust between users and owners will increase with increasing use experience and that this would counteract ("cure") the negative effect that separated ownership and control has on users' idea realization. However, the results reveal that this is not the case. In contrast to what prior studies have suggested (i.e. with increasing experience, users are more innovative), we did not find the positive relationship between experienced users and owners to have a positive impact on innovativeness. More experienced users realized fewer ideas. There are at least four potential reasons for this result related to (i) innovativeness, (ii) innovation strategies, (iii) regulations and (iv) innovation type.

First, with increasing use experience, users tend to develop ideas with a higher degree of innovativeness (Garcia and Calatone, 2002; Schultz et al., 2013). LEUs may detect primarily small, superficial "cosmetic" (design) problems that require small modifications, which can be realized relatively quickly, easily, and inexpensively. With increasing use experience, HEUs become increasingly focused on product performance. They may steer away from incremental ideas that are not very important for performance. As prior studies (Lüthje, 2004; Schreier and Prügl, 2008) show, users gain expertise and develop capabilities to detect potential for substantial improvements (i.e. radical innovations) as they gain use experience. However, realizing radical ideas appears to be more complex and involve higher innovation costs in terms of resource consumption and it seems to require a stronger commitment. Higher innovation costs in turn reduce users' likelihood to realize ideas, particularly because their

resources are scarce (Braun and Herstatt, 2007). Accordingly, future studies should control for the ideas' degree of innovativeness that users develop and realize depending on their use experience.

Second, with increasing use experience, users tend to employ different innovation strategies to realize their ideas. Incremental innovations developed by LEUs often represent complementary functionalities that can be realized as attachable/ detachable “gadgets” (add-ons). These reversible innovations can be implemented without making substantial modifications to the product representing customization efforts (Desouza et al., 2007). These innovations actually may not require the owner's permission. Examples include the development of cushions for the sliding seats increasing the sitting comfort in a rowing boat. In contrast, complex innovation ideas developed by HEUs may require substantial modifications to the product architecture (Henderson and Clark, 1990). For instance, in 1980 a Cologne student Volker Nolte developed a sliding outrigger boat, employing a radically different product architecture, originally patented at the USPTO in 1876 (Blakeman, 1876). The boat was later produced by the German company Empacher and the design proved to be substantially more efficient and faster than the conventional boat design. Accordingly, future studies should control for the innovation strategies employed by users depending on their use experience.

Third, use experience implicitly distinguishes between user groups being affected differently by regulations (Kikulis et al., 1989; Parks and Quarterman, 2013). High use experience indicates that users are professionals. Our data shows a small, but significant positive correlation between use experience and the professional user group ($\beta=0.069$, $p=0.089$). Compared to hobbyists (amateurs), professional users have an additional innovation barrier. They need to adhere to strict rules and regulations. For instance, in professional rowing, the World Rowing Federation (FISA) imposes regulations on the boat and equipment designs. In fact, there are examples of breakthrough innovations being forbidden in professional competitions. For instance, sliding outrigger boats were used by the world's top scullers from 1981-83 but was then forbidden by the FISA in 1984 (Burmester, 2012; Nolte, 1981) in order to guarantee fair conditions between rowers from different countries. Regulations particularly limit HEUs' possibilities to experiment with equipment modifications (i.e. restricted design freedom) and reduce their incentives to realize innovative ideas. Recent research supports this argument in other segments. Raasch et al. (2008) show that regulations decrease user innovation ratios in the sailing market. Strict regulations are not limited to professional sports

markets. For instance, federal standards (e.g. German DIN norms) limit the components that can be used in industrial appliance products. Accordingly, future studies should control for the impact of regulations and standards in different markets.

Fourth, if regulations limit product modifications, HEUs may focus their attention on different types of innovation (Garcia and Calatone, 2002; Rowley et al., 2009). Instead of modifying the equipment (product innovation), they shift their attention to improving ways in which to use the product. We did not capture those technique innovations (e.g. Hinsch et al., 2014) in our survey. Like prior innovation studies (Hyysalo, 2009; Runde and Faulkner, 2009), we thus emphasize the need for additional research into this topic. Accordingly, future research should control for different innovation types.

6.2 Management implications

Our results show that separation of ownership and control is a barrier to user innovativeness, both in terms of idea generation and realization. The negative impact disappears for idea generation with increasing use experience. We can thus conclude that experienced users are potentially innovative even though they do not own the equipment. Further, our results show that users are increasingly less likely to initiate own development activities with increasing use experience. Particularly the latter finding has severe managerial implications.

First, firms that employ business models where ownership is not transferred to users should not draw the wrong conclusion that users are not innovative, just because they do not observe innovating users. Firms will hardly observe users developing prototypes, read about product modifications in newspapers or be able to identify user developed inventions in patent databases. Firms should be aware that despite absent observations of user developed innovations, users still possess innovative ideas. Hence, users can still be considered an external source of innovation. Consequently, the question arises how firms can identify users, who possess innovative ideas, if they cannot be observed?

In situations where users possess ownership, the lead user method is one proven approach to identify innovative users (Herstatt and von Hippel, 1992; Lüthje and Herstatt, 2004). If ownership is separated from control all users need to be surveyed. Due to the high resource demands, a mechanism for preselecting users would however be helpful. In business models where users use equipment without possessing ownership, users' usage behavior is often monitored. For instance, in rowing clubs it is common that users have to register every time they use a boat in a logbook. Similarly, firms that operate car sharing systems capture

individual use data for the purpose of billing users according to their exact usage. That data is a rich source for identifying users, if not frequent and lead users with special needs and high expected benefits, hence innovation potential (Franke and Shah, 2003; Schreier and Prügl, 2008). Firms can survey these preselected users to identify those actually possessing innovative ideas. After having done so they have at least two options to involve users in their innovation processes. The first approach aims at capturing user ideas thereby rendering the realization barrier obsolete, while the second approach aims at empowering users to initiate own development activities by reducing the realization barrier.

First, to capture user ideas, manufacturers can establish direct relationships with them. Due to the realization barrier, users may actually have strong incentives to share their ideas. It might be their only way to see ideas being realized. In order to enable idea capturing firms can create internet based ideation platforms combined with idea competitions in order to have the ideas peer-evaluated (Piller and Walcher, 2006). Alternatively, firms can invite preselected users to participate in lead user workshops (Lüthje and Herstatt, 2004).

Second, firms can reestablish favorable conditions for selected users and thus enable users with innovative ideas to pursue own development activities. Firms can then observe the outcomes to decide at a later stage which of these they want to use. This can be done by reallocating ownership rights to users (Demsetz, 1967). For instance, firms could sponsor equipment for selected users dedicated to innovation purposes. In an accompanying sponsoring contract, manufacturers shall explicitly allocate “rights to innovate” to the users. If modification efforts lead to product failure, manufacturers might want to offer replacement services. For additional support to efficiently modify sponsored equipment manufacturers can provide users with complementary tool kits (Prügl and Schreier, 2006). In exchange, manufacturers should claim a right in the sponsoring contract to use the innovations developed using the sponsored equipment in their future product generations. This approach would be similar to technology licensing contracts that include grant back clauses, which permit licensors to use subsequent inventions that licensees develop based on the licensor’s technology (Braun and Herstatt, 2007; Bogers et al., 2012; Leone and Reichstein, 2012, Granstrand, 2004). An alternative option might be to offer users access to experiment labs, in which they can test their ideas by using firm-provided equipment. These labs should be equipped with the necessary tools and materials to innovate similar to the currently emerging fablabs (Gershenfeld, 2008), such as the firm co-sponsored MakeSpace at the University of Cambridge.

Other approaches might aim at reducing users' risk of facing damage claims by the owner when (illegally) innovating on products they do not own. This threat can be lowered if a company provides an insurance scheme to selected users that covers such risk. Alternatively, users within a community can pool resources to jointly cover damages that an individual user would otherwise have to pay. Governments wishing to support user innovation due to their positive contribution to society's economic welfare (von Hippel et al., 2012) may also offer an insurance scheme. Alternatively, governments can adjust the law and limit damages that owners can claim from innovating users.

In order to maximize the impact of these approaches, they should be implemented preferably in markets in which the separation of ownership and control is exogenous to large user groups, that is, in markets dominated by a non-private ownership regime. Especially firms that are becoming more servitized (e.g. leasing medical equipment to hospitals and car sharing operators) should be interested in means to prevent and minimize the negative effects of the separation of ownership and control on user innovation behavior.

7 Conclusions and limitations

Our results support the predictions of property rights theory for user innovation. We show that the separation of ownership and control is a barrier to user innovation. Users who possess control but lack ownership are less likely to develop and realize ideas than users who possess both ownership and control. We furthermore find that use experience moderates this relationship. The negative impact of ownership and control separation was expected to have a smaller impact on more experienced users' likelihood to realize innovative ideas. The results however show that, with increasing experience, users' likelihood to realize ideas decreases for equipment they control but do not own. The results appear to be robust. They are consistent among a number of models and sub-samples.

Equation 1: Costs to innovate when ownership and control are separated

$$CI_{npo}^i = CI_{po}^i + TC^i + NPV(p * D^i)$$

To summarize, the arguments can be formalized as follows (Equation 1). The costs to innovate (CI) for any user innovation project i in a non-private ownership (npo) situation (separated ownership and control) are higher than the equivalent costs to innovate in a private ownership (po) situation for two reasons: First, a user has to account for the transaction costs

(*TC*) involved in negotiating with the owner to get permission to innovate. Second, before initiating an innovation activity, a user has to account for potential damages for which the owner may claim compensation. These can be calculated as the net present value (*NPV*) of the cross product from the probability p that the owner will claim damages and the expected amount D .

Our results contribute to explaining various user innovation ratios in different markets. The findings also provide an explanation of why only firms in selected markets have identified users as source of innovation. If users do not possess ownership and realize only very few of their ideas, firms find it difficult to observe their co-creation potential, although numerous users actually generate innovative ideas.

Our results should be alarming to firms that rely on employing innovation strategies employing co-creation approaches with (lead) users, particularly if these firms follow the servitization trend. We propose different means that firms can employ to remedy the negative impact of ownership and control separation, for example use contracts with grant-back clauses, experiment labs, and insurance schemes that cover damages.

Our results have to be interpreted with care and should be subject to future validation. The generalizability is limited by methodological constraints. The selection of the empirical field might be criticized. Rowing is generally seen as a traditional, and mature sport with a lower level of innovativeness than younger sports markets, such as kitesurfing or mountain biking. However, recently, major changes in the design, materials, and functionality (e.g. training apps) of rowing equipment have indicated that it is still undergoing developments and innovations. Future studies might aim to verify our findings in other empirical fields. Future studies, which should also try to estimate better its effect size. To enhance the generalizability, future studies should control for additional effects that we did not capture (see section 6.1).

Furthermore, we only focused on one model in which ownership is separated from control. Rowing clubs purchase equipment from manufacturers. Users then have access to this equipment. Future studies should rather distinguish between different ownership models, such as those described by Schultz and Tietze (2014). For instance, in contrast to intermediaries purchasing equipment, such as rowing clubs, manufacturers directly rent equipment to users, for example, OEM carsharing solutions. Owing to the servitization trend, these models are becoming increasingly relevant. Some of these models also imply that multiple users share equipment. We have controlled for single and shared use, but future studies might distinguish

different sharing patterns (Belk, 2009) such as sequential (one user after each other) and parallel (team) use. Access to shared equipment is often restricted to a number of selected users (e.g. club members). Future studies should consider economic conceptualizations for different goods, such as “club goods” (Cornes and Sandler, 1996).

Another limitation results from the construct operationalization. Although we aimed to achieve maximum comparability with previous studies, it was necessary to adjust certain variables (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 A

#	Study (chronological)	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 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 professionals
4.	Marchi et al. (2011)	Motorcycles	Definition of lead users in online communities	---	---	entire community
5.	Hyysalo (2009)	Rodeo and freestyle kayaking	Examination of micro innovation's on the industrial new product development	---	---	focus on several kayak studies
6.	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
7.	Schreier, Prügl (2008)	Sailplaning, Technical diving, Kitesurfing	Development of field-independent personality variables influencing lead usersness	---	129; 193; 139	entire community (no special focus)
8.	Raasch et al. (2008)	Sailing	Extension of the LU-model regarding the evolution of user driven innovations	---	53	participants World Championships
9.	Schreier 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)
10.	Füller et al. (2007)	Basketball	Innovations in online consumer communities and the integration in firms' innovation processes	---	---	entire consumer community
11.	Piller (2006)	Kitesurfing, Sport shoes	How manufacturers could use the users' innovative potential	---	---	entire consumer community
12.	Franke et al. (2006)	Kitesurfing	Relationship between the attractiveness of innovations and lead-user characteristics	30,9%	399	entire extreme sports community (no special focus)
13.	Hienerth (2006)	Rodeo kayaking	Low cost technics to innovate to be faster on the market.	---	16 cases	participants World Championships
14.	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
15.	Lüthje (2005)	Mountain biking	"Stickiness" of information	15,7%	106	"off-road" & "comfort" users
16.	Tietz 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
17.	Lüthje (2004)	Climbing, Hiking, Cross-Country skiing, Mountain biking	Characteristics of innovating users	9,8%	153	entire community (no special focus)
18.	Dahlin et al. (2004)	Tennis	Evaluation of differences between inventions of independent and corporate inventors	---	225	independent & corporate inventors
19.	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
20.	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"