TO SHARE OR NOT TO SHARE

EXPLORING THE IMPACT OF SHARING BEHAVIOR ON USER INNOVATIVENESS

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To share or not to share – Exploring the impact of sharing behavior on user innovativeness

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We observe a rise of new business models that embed different forms of sharing. This topic has hardly been picked up by innovation research and particularly in the user innovation research community, except for online open-source communities. This paper sets out to link users' sharing behavior to users' innovation behavior. Prior user innovation studies mainly concentrate on markets in which users purchase products and, thus, both own and control a product. In sharing communities, where users have access to a pool of tangible goods, like cars or machinery, the separation of ownership and control induces uncertainty and complexity in the user innovation process, increasing users' costs to innovate. This paper therefore explores the relationship between users' innovativeness and users' sharing experience within sharing communities. Primary data was collected from a large German farmer sharing community with 50+ years of sharing experience. The survey yielded 1,064 responses. Our results show that sharing has a significant positive impact on the user's innovation behavior. Users' technical expertise positively moderates this relationship. With this paper we contribute (i) a new concept that we label "sharing experience" and its operationalization based on the well-established use experience concept, (ii) a first empirical analysis quantifying the impact of sharing on user innovativeness and (iii) a typology to categorize sharing types.

1. Introduction

We currently observe a rise of business models that embed different forms of sharing. Examples are numerous, such as the manufacturer operated car-sharing solution car2go offered by Daimler (Neely, Benedetinni, and Visnjic 2011; Tietze, Schiederig, and Herstatt 2013). Another popular sharing business model is airbnb, which enables renting private living space out to others over an online platform. Other examples range from the medical sector (e.g. telemetric health monitoring solutions) to complex service solutions in the B2B manufacturing sector (e.g. Rolls Royce power by the hour) and cloud based software as a service solutions (e.g. salesforce, google docs) (Schultz and Tietze 2014). In innovation research several studies focus on service innovation (Lightfoot, Baines, and Smart 2013), but hardly any contributes to the sharing debate and the impact of sharing on user innovativeness. This paper sets out to link users' sharing behavior to users' innovation behavior.

In a previous study we showed that even in regimes where ownership and control are separated (i.e. sharing communities) users develop innovations, although significantly less (Tietze, Pieper, and Herstatt 2015). Most user innovation studies prior to our work mainly concentrate on markets in which users purchase products and, thus, both

own and control a product. However, when innovating users need to accommodate an additional actor (a third party owner), we found that property rights theory predicts that separation of ownership and control is a user innovation barrier. Separation of ownership and control thus induces uncertainty and complexity in the user innovation process, increasing users' costs to innovate. This paper builds on the previous study focusing specifically on the sharing behavior of users within communities where ownership plays an important role as well. With this paper we contribute (i) a new concept that we label "sharing experience" and its operationalization based on the well-established use experience concept, (ii) a first empirical analysis quantifying the impact of sharing on user innovativeness and (iii) a typology to categorize sharing types.

The following section outlines relevant theoretical foundations on which we build throughout the paper and articulates our research questions. Section three presents the research approach, with the results being shown in section four. Section five concludes this paper and reflects on limitations of our study.

2. Theoretical Foundation

Since decades research has shown the considerable importance of users and their capabilities to develop new products, services or product modification of all kinds. Innovative products which are developed by a user who desires to benefit from using them are defined as user innovations (von Hippel 1988; von Hippel 1988). Users thereby can be defined as people (or firms), that benefit from using a product or demanding a service (von Hippel 2005). The occurrence of user innovations is not a small phenomenon. Various user innovation studies showed that a wide range of new products and processes in various fields are developed by users. In these studies 10 – 40% of the participants were identified to act innovatively by modifying products or developing new ones (see table in von Hippel 2005, 65f).

In the debate on user created innovations personal characteristics or traits of the innovative user seem to play a substantial role. The special abilities and characteristics a person tends to have as to be classified as a very innovative User, are highlighted in the literature as the Lead User characteristics. The literature on Lead User characteristics has substantially been shaped by Franke, von Hippel, and Schreier (2006), Bilgram, Brem, and Voigt (2008) and Schreier and Prügl (2008). von Hippel (1986) presented a way to identify Lead Users by stating two substantial characteristics: Lead Users are on the leading edge of a certain trend incorporating special product related needs and secondly expects to personally benefit highly from a solution that fulfils his needs (von Hippel 1986). These two major characteristics separate the 'ordinary' Users from Lead Users in means of capability and motivation. The first characteristic emphasizes that the User who faces new needs that cannot be satisfied by existing solutions on the market and that the User has not just the longing of novel solutions to fulfil his needs, but also the capability to initiate the development process and therefore is well-prepared to create innovations that differ substantially from existing market offerings. The second characteristic displays an intrinsic Lead User motivation to initiate the development of novel solutions if they can expect personal benefits from the innovation. This personal motivation spans all stages of an innovation process no matter if the user is supported by manufacturers that take on specific tasks of the development process or not (Lüthje and Herstatt 2004). Besides the above defined Lead User characteristics, other closely related abilities have frequently been discussed in the literature and were taken into account in other empirical studies User Innovations. One of these characteristics is use experience which is another factor that has be observed by individuals that have Lead User characteristics (Schreier and Prügl 2008). Use experience is the experience gained by an individual through acting out an activity (e.g. work) over a longer period of time, that leads to advanced knowledge about the environment (e.g. work experience) connected to the activity. It is assumed that through a frequently use of products, a User gains personal knowledge about the product and its features (Schreier and Prügl 2008). This thought can be adapted to other areas a User interacts with and is involved. Therefore for example a membership in a specific group or the involvement inside a community is most likely fostering the use experience and therefore the expertise of an individual within the environment.

2.2 Ownership and User Innovation

When users in a sharing community intend to innovate upon foreign products the owner would have to agree with those activities. Thus, discussing ownership in the context of user innovation has a high relevance for our study. But main focus of the User Innovations's research mainly lies on specific products, often used by users in a specific community, where a clearly defined group of people has a passion for activities and are on the leading edge of an evolving trend. Many studies on User Innovations focus on sports communities, e.g.: Rodeo kayak (Hienerth 2006), Rodeo and freestyle kayaking (Hyysalo 2009), kite surfing & technical diving (Schreier, Oberhauser, and Prügl 2007), sports equipment related to sailboats (Raasch, Herstatt, and Lock 2008) or sailplaning, canyoning, handicapped cycling and snowboarding (Franke and Shah 2003). Besides core sports related products, studies on User Innovations that are paying attention to other product categories exist, for example: Outdoor related consumer goods (Lüthje 2004) or self-customized watches (Franke and Piller 2004). Besides the different research areas and products that vary in research on User Innovations the great majority of research focuses on Users who make adjustments, modifications or create

complete novel ideas related to existing products where the User Innovator holds ownership to the product. Innovating on a product a User holds ownership to, is mainly unproblematic, because by the process of purchasing the product from a company, the product and all property rights to use and to control the product are exchanged between the two parties who interacted before (although obviously loss of warrantee may be an issue). The User and product owner can thus make adjustments to her products without fearing legal consequences by doing so.

On the other hand, with the trend towards servitization (Neely 2007), where companies sell services, which allow a temporarily access to products to accomplish a specific acquirement, rather than selling products to their customers, users not necessary are owners of products they use, but rather temporary proprietors. If more firms servitize the use of products instead of product purchase, hence where Users do not hold ownership is going to be more often the case. But when the User has innovative ideas about the product to which somebody else, no matter if a company or a private person holds ownership to and makes adjustments to the product he uses temporarily, he has to fear legal consequences when realizing them. The User who wants to make adjustments to the product for the sake of his benefit while using the product has three options: Firstly the User could ask the owner of the product for permission to make adjustments to the product. In case the owner agrees, the User can fulfil his need and make changes to the product. In case the owner disagrees, the need of the User stays unfilled (Tietze, Pieper, and Herstatt 2015). The second option for the User is to in-novate on the product without seeking the permission of the owner. By doing so legal consequences might occur, which can lead to the termination of the temporarily use contract and lead to costly damage claims from the owner, to undo the modifications or even replace the product as a whole (Tietze, Pieper, and Herstatt 2015). The third option the User has is to accept the situation while using the product to which somebody else is holding ownership to and not accomplish an adjustment or modification. This option might be very dissatisfying for the User, meaning having an innovative idea to a helpful adjustment in mind but not being able to realize this idea. In this case the stage of the User Innovation is not going beyond the point of idea generation and for the evolving of User Innovations has a loss of a promising product innovation as consequence.

The User Innovation research has given little attention to the situation where ownership and control of the product are separated. Our previous study that is regarding User Innovations brought up by members of rowing clubs, who share ownership on the rowing boats is one of the first in this field. We showed 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 the relationship between the separation of ownership and control and innovativeness. The negative impact of ownership and control separation was expected to have a smaller impact on more experienced users' likelihood to develop innovative ideas. The results however show that, with increasing experience, users' likelihood to realize ideas decreases for products they control but do not own.

However, while the previous study collected data from different communities where users share their products, it did not focus specifically on that. Following our previous study this study now focuses on the analysis of Users who share products and how sharing impacts their user innovativeness. The next section provides theoretical insights in sharing concept and thus the foundation of this study.

2.3 Sharing

So far, tangible goods' sharing has been hardly discussed in the user innovation literature, but refereeing to von Hippel (2005), the spreading of the internet enormously alleviated the way people can coordinate and combine their innovating efforts and exchange their knowledge over innovating communities. In addition to the early opportunities the internet opened up, later a variety of new and improved technologies and changed behavioral patterns by the User often titled as the Web 2.0 (Janzik, Herstatt, and Raasch 2011) . That opened up even more opportunities for Users to connect, interact and exchange their knowledge, share their experience and simplified the search for help to realize innovative ideas or concepts they have been thinking of. This exchange of experiences and information in online-communities that are used for private purposes, has steadily become more important for companies to focus on (Janzik, Herstatt, and Raasch 2011). But when concentrating on products apart from information and software we have to borrow theoretical background about user sharing behavior from other literature. Thus we concentrate predominantly on consumer behavior and sociology as well as consumer psychology. The following sections define sharing and look into theoretical foundations and conceptualizations of individual sharing behavior.

2.3.1 Defining Sharing

Belk contributed substantially to the conceptual understanding and classification of sharing in the literature on marketing and consumer behavior. For sharing is a fundamental consumer behavior and a communal interaction that links people to each other, based on the fundaments of trust and bonding. He defines the interpersonal exchange of sharing as "…the act and process of distributing what is ours to others for their use as well as the act and process of receiving something from others for our use" (Belk 2007, 127). This definition of the interpersonal connection between

two parties, shall be adopted to the meaning of the sharing exchange in the present study, but seen as a more general form of exchange between different parties in the sharing context, taking into consideration besides individuals (e.g. Users) also other market players (e.g. companies or market intermediaries).

Belk (2010) focuses primarily on connections of people within a family and people who are close to the person considered. He identified two main sharing types. These are income, respectively resource pooling within a family and "mothering". The latter refers to Sharing without any return expectations (e.g. milk for the own baby), whereas the forms of pooling refer to fulfilling the basic needs of the own family (e.g. housing, food, furniture use etc.). He further distinguishes sharing from gift giving and commodity exchange. Gift giving is connected to a certain kind of self-interested expectation of the individual who gives something to another person. Commodity exchange is understood as a commercial trade of products between individuals where a buyer and seller situation exists (Belk 2010). But exactly the sharing of products, where money is involved and the sharing of goods is not just a core unselfish process of providing other individuals with products or goods without any return services is in recent times meant when Sharing of products is articulated in the media for example and also is of interest in the pre-sent paper. Therefore Belk's sharing understanding is not appropriate for the purpose of this study. Although Sharing will stay a key concept of this paper, it is not used the way Belk defined it. Recent literature also discusses sharing as access-based consumption (Bardhi, Fleura, Eckharft, Giana M. 2012), commercial Sharing (Lamberton and Rose 2012) or collaborative consumption (Botsman and Rogers 2011). While sharing is often discussed in the context of online communities, this study focuses on Sharing systems for tangible goods (e.g. car sharing, bike sharing, or machinery sharing systems).

2.3.2 Sharing Behavior

As stated above, the focus of the present paper concentrates on product related sharing activities inside sharing communities, where a great number of members (or Users) have access to a pool of tangible goods, like cars or machinery to be used for personal need and for a certain limited time. When sourcing tangible goods through a sharing community users do not obtain product ownership. But in regard of some sharing communities (referred to as sharing models in the next section) this does not mean that Users do not hold ownership to other products that are available for use by other community members. Two types of sharing behavior can be distinguished that describe the options of how Users can participate in a community. The behavior of accessing a tangible good, owned by a second party through the Sharing community and the behavior of providing a tangible good into the pool of tangible goods to be used by others inside the Sharing community. Botsman and Rogers (2010) define Users who show the former sharing behavior as `peer users´ consuming the products and services available through a sharing community. Whereas Users who show the latter sharing behavior are considered as `peer providers´, who provide products to others (Botsman and Rogers 2010). The two behavior types described are not mutually exclusive, meaning a User can show both sharing behaviors. To describe the process of the sharing activity in a simpler way, the sharing behavior of accessing tangible goods through a sharing community will be referred in this study as the activity of inbound sharing or `sharing-in´ (West Joel and Bogers 2014), meaning somebody is taking something from outside into his personal sphere to make use out of it. An example for inbound sharing is the act of renting or lending tangible goods from others, like cars, bikes or machinery for the temporary use. The second type of sharing behavior, the process of providing products to be used by others will be labelled as an activity of outbound sharing (`sharing-out´), meaning persons take something out of the personal sphere for offering it to others. For instance, a community member provides tangible goods (e.g. technical products or machinery) that she owns and offers them through sharing communities to be used by others (including members that she knows and strangers, where no personal relationship exists). The distinction in these two categories is related to collaboration activities discussed in the open innovation literature. Collaboration activities that aim to source an external develop idea or technology are often described as inbound open innovation. In contrast, collaboration activities that aim to externally exploit an idea or technology owned by a company are often referred to as outbound open innovation (Huizingh 2011) (Chesbrough and Crowther 2006). Besides the sharing behavior of a User reflecting if he is accessing or providing tangible goods, the sharing behavior of a User can also be described to which extent he does so and what kind of tangible goods are shared.

But in the context of user innovation the kind of product which will be shared is from minor importance. As we know from literature user innovations may take place in almost all product categories. In contrast the possibility if a user may conduct innovative activities with shared products is from major importance. This possibility is closely linked to ownership and following to the fact if he shares in certain products not possessing its ownership or sharing out his own products. Thus we define sharing in the user innovation context as the "possibility for users to generate and transfer innovation ideas and implementation right in a community by sharing in and sharing out tangible goods".

2.4 Research Questions

In this paper we link the phenomenon of user innovation to the concept of product sharing. Therefore we concentrate on the relationship between users' innovativeness and their sharing behavior. When users share they have the ability to share-in or to share-out in different intensities. A person who might borrow several products from others because of possessing few of them might be reluctant to lend his own machines to others. In contrast a user who possesses lots of

products and shares them frequently might not have the need to share-in products. We explore if different user types exist, analyze their personal characteristics and link their sharing behavior to user innovation related properties like lead userness. We thus defined our first research question as:

RQ 1: *Which sharing types exist in user communities?*

When users do not possess products they need for their tasks they have the possibility to share-in products from others. By using this products they might be confronted with technical problems or with problems in operating it adequately according to their needs. Following, users might generate ideas to solve those problems but they might be reluctant to implement them due to the lack of ownership for the products they rented in. But, the more active they are in the sharing community and the more in contact they are with others sharing-out products the more the users might be allowed to implement the ideas they generate. On the other hand, users sharing out their equipment might also generate innovative ideas when having contact to others in their community. From the ownership perspective and in contrast to users who only share-in products they are able to implement those ideas directly. Thus, we ask in our second research question:

RQ 2: *How is users' sharing experience related to user innovativeness?*

3. Research Approach

To answer our research questions we conducted a survey among German farmers organized in machinery rings. We present out research approach in the following section. German farmers who are organized in German machinery rings (MR) constitute the empirical field of this study. Within the regional organization of MRs, farmers jointly share their agricultural equipment and machinery of all kind and technical complexity. The first MR was established in 1958 and up to date have shaped the German agricultural sector decisively in means of organizational access to agricultural machinery and technological innovations, agricultural community building and mutual support among members. The overall concept of the MR organization based on solidarity between members aims to find solutions for economical, as well as social matters to overall strengthen the agricultural sector and support the rural area. To achieve the objectives, the strategy aims to support their members by: Lowering the costs, offering and mediating further sources of income, optimizing the work conditions, helping out in social emergencies and optimizing agricultural farms. In total of 259 regional MRs are organized in which a total of 193.000 agricultural businesses hold membership in. The empirical research field has been chosen for following reasons: Sharing of goods is the core competency of the MR organization. Further, the German MR organization can be seen as a pioneer of the sharing trend. Lastly, the environment of the MR organization has been known to be a valuable source of innovation (Hinterberger et al. 2006). The data collection with the MRs was carried out in a time span of five weeks in 2015 via an online questionnaire. CEOs of the regional MRs, were contacted upfront by email or phone and asked to forward the survey's link to their members. This approach yielded 1,064 overall responses. After data cleansing (Müller and Freytag 2005) 563 responses remained for further analysis.

3.1 Measures

To answer our research questions we consider independent user related variables like lead userness, technical expertise and sharing experience. Those variables are the bases for describing the different user types (RQ1). In a second step we link those variables with our dependent variables idea generation and idea realization describing the user innovativeness (RQ2). The questionnaire also includes a number of variables that could be used as potential control variables, which have however been admitted for this initial exploratory paper.

3.1.1 Dependent Variables

We operationalized users' innovation behavior following (Tietze, Pieper, and Herstatt 2015) modelled after previous user innovation studies (Franke, von Hippel, and Schreier 2006; Lüthje 2004) defining two dependent variables. In addition however, because we focus on sharing, we further distinguish between owned and not owned (foreign) products. The first dependent variable assesses the frequency of ideas a user has for improving the functionality of existing products and product parts. We asked our participants the following question measured on a 7-point Likert scale: "How often do you generate ideas for improvement/modification of your own/ for foreign technical equipment?" The second dependent variable is dichotomous and measures whether users have finalized development activities beyond the ideation phase by asking: "Did you realize one of your innovation ideas with your own/ foreign technical equipment".

3.1.2 Independent Variables

Lead userness was measured reflectively using nine indicators. As explained in the literature study, lead userness is made up of two facets; being ahead of the trend and gaining a large benefit from innovating (von Hippel 1986). Empirical studies have, however, established a strong tradition of measuring lead userness using a single lower order reflective construct incorporating both facets (e.g. Franke and Shah 2003; Franke, von Hippel, and Schreier 2006; Schreier and Prügl 2008; Schweisfurth and Raasch 2014). This is due to the fact that the individual facets are found to be strongly correlated and it is therefore not necessary to measure them separately (Morrison, Roberts, and Midgley 2004). The nine indicators were based on a battery of questions that have been used in slightly altered form in all of the empirical studies quoted above. They were modified and added to, to reflect the specific context and focus of this study.

The reflective construct of technical expertise exists of seven items asking to give information about the technological knowledge of the respondent and his interest in technological related themes. The construct measures the respondents´ ability to actually make technical modifications or changes to his own products or help others by solving technical problems with their products or machinery and therefore has the capability to be innovatively active (Lüthje, Herstatt, and von Hippel 2005). The construct is not part of the Lead User construct but is closely related to the characteristics a Lead User shows and supports the innovative activities by supplying the person with personal technical resources and capabilities. This technical capability is necessary to physically create innovations so the User benefits by bringing up solutions to fulfil his unsatisfied needs (von Hippel 1986). We displayed the factor loadings of both constructs in the appendix.

Prior user innovation literature has shown that use experience is an important determinant for user innovativeness, because of learning effects. Similarly we suspect that sharing experience may also determine user innovativeness. However, no construct to measure sharing experience exists we developed it as a new construct modelled after the construct use experience (Magnusson 2009; Schreier and Prügl 2008; Lüthje and Herstatt 2004; Lüthje 2004; Lüthje, Herstatt, and von Hippel 2005). It is a two item construct measuring the respondents' timely affiliation to a certain agitation and the frequency he is currently engaging within the community. The first item was measured on a 7-point Likert scale (with five years interval, starting from `lower one year´ to `more than 25 years´), asking the respondent about the timely affiliation to the sharing community (MR) in years. The second item was measured how frequently users are sharing in and sharing out their products. For deeper analysis we divided sharing experience into two sub-variables: sharing-in expertise and sharing-out expertise.

3.2 Data Analysis

3.2.1 Exploring Sharing Types

Based on the distinction between in- and out-sharing we analysed the data to explore and define different sharing types. We linked those types to the extent of sharing experience in both in- and out- sharing. In our survey the questions regarding sharing behavior was not obligatory. Thus, when implementing the sharing types in our analysis we had to reduce the sample to N=248 due to missing values. Further, we included the extent of lead userness and technical expertise as well as control variables to describe the sharing types deeper.

3.2.1 Sharing Impact on User Innovation

We employed factor analyses to evaluate the quality of our measurement constructs. After inter-correlation checks we employed multiple regression models. We used a hierarchical procedure to test the full models that include the moderator effects. The moderator effects were tested following the procedure proposed by Frazier, Barron, and Tix (2004), and Baron and Kenny (1986). The results prove to be robust even when varying the operationalization of key constructs.

Figure 1 shows our conceptual model combining user innovation and sharing behavior. We distinguish user innovativeness similarly to our Technovation Paper (Tietze, Pieper, and Herstatt 2015) into idea generation and realization. Predominantly for the purpose of validating our dataset we include two personal traits (technical expertise and lead userness), both being established concepts in user innovation research. Given prior findings both variables are supposed to have a positive direct effect on user innovativeness and a positive moderating effect on the relationship between sharing experience and user innovativeness. It is important to note that due to the sharing nature we distinguish further if users have ideas / realize ideas, i.e. modify products they own or which they borrow, hence not own. We further control for effects that derive from MR characteristics (not shown in model). The following briefly summarizes our hypotheses.

We argue that users who are involved in sharing activities gain additional insights into existing products and their performance complementing the experience they make from using only their own products. This happens either directly through using other products they borrow or through exchange of knowledge in their sharing community. We thus hypothesize that that sharing experience has a positive impact on (a) idea generation and (b) idea realization.

When users engage in sharing communities one needs to distinguish between ideas and modifications that have / make for the products they own and those they borrow (not own). When using "foreign" products the products they user has no impact on the choice of features (customization) that he has when purchasing a product. Hence, foreign products may not be optimized to the user's personal needs. Thus, a user may generate ideas for this product how he could change the product properties towards his advantage. Thus, we hypothesize that sharing experience has a positive impact on (a) idea generation and (b) realization of for (i) own and (ii) foreign products.
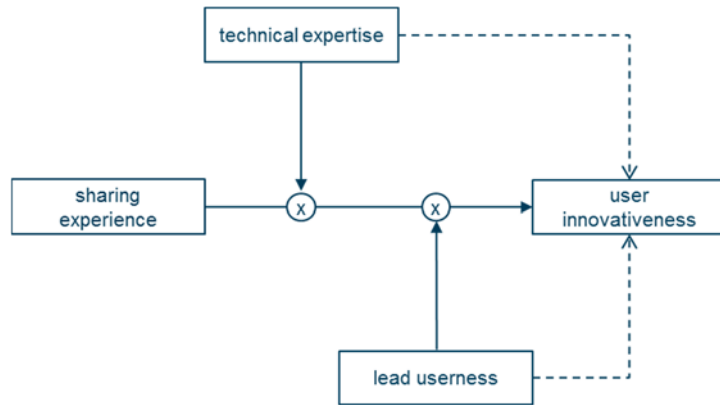

Figure 1: Conceptual model

4. Results

4.1 Sample Description

Members from ten of the twelve MR state associations in Germany took part in the survey. The two exceptions are "Landesmaschinenring Brandenburg-Berlin e.V." and "Landesmaschinenring Mecklenburg-Vorpommern e.V.". Two state associations "Kuratorium Bayrischer Maschinen- und Betriebshilferinge e.V." (216 responses) and "LV Niedersachsen e.V." (204), provided 74.5% of all responses. MR members are not equally distributed across Germany. In these two state associations (Bavaria: 95,224; Lower saxony: 22,500) together 117,724 members are organized, which equals 61.4% of all MR members (Kuratorium Bayerische MBR e.V., 2014). Overall, farmers from 98 of the 259 MRs participated in the survey (participation ratio of 37.8%). 95.3% of all participants are male farmers. That share corresponds roughly with data from the Statistical Office of Germany, according to which about 8% of the agricultural businesses in Germany are female led (Pöschl, 2004, p.1020). The largest group in the sample holds a medium level high school diploma (42.0%), followed by a group holding a basic (lower) school education (22.6%) and the group of respondents who achieved a university diploma (21,95%). The age of the respondents in the sample appears quite normally distributed with an average age of approximately 44 years.

Participants in the survey are highly experienced, with an average of approximately 18 years. 350 respondents (69.4%) have more than 20 years of job experience in agriculture and just 15 respondents (3.0%) have less than five years of job experience. 270 respondents (47.9 %) are MR members between six and 20 years. 224 respondents (39.7%) have more than 20 years of MR membership. 70 respondents (12.4%) are MR members for less than five years. Respondents concentrate mainly on three agricultural activity (multiple choices possible): 391 respondents mention of plain agriculture (69.3%), 181 mention dairy farming (32.1%) and 163 mention forage production (28.9%). The large majority of respondents run their agricultural enterprises by themselves (70.2%) or work in a small agricultural business with two to five employees (27.3%). Medium-sized businesses employing six to 50 people are represented by only 13 respondents (2.3%) and just one large firm with more than 50 employees is represented in the dataset. 36.7% of respondents work for very small enterprises with less than 50 hectare, followed by small enterprises (30.3%), medium-sized businesses (26.1%), enterprises with a large acreage (5. 7%) and just a few very large enterprises (1.2%) with more than 500 hectare.
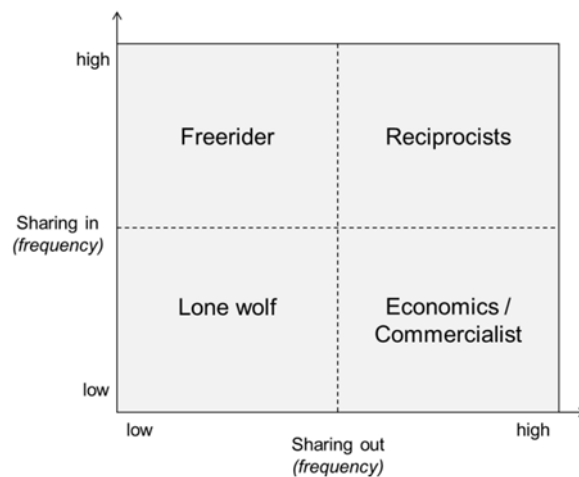
4.2 Analysis of Sharing Types

Figure 2: Four generic sharing types

Based on the distinction between sharing-in and sharing-out we find four sharing types as illustrates by matrix in Figure 2. If we discriminate sharing-in and –out as low (below or equal to 4) and high (above 4) on a 7-point Likert scale we find the following. Reciprocists are a small, but not the smallest group of members with only 10.9% in our data (n=27). These show high experience in both in- and out- sharing. The economists (9.7%, n=24) mainly out-share products, possibly to redeem their investments, thus enabling quicker pay-off for investing in innovative products for which they have to pay a price premium. Freeriders (22.6%, n=56) mainly use products from the community without contributing to it by out-sharing own products. A large group in our sample is in the fourth category, which we call lone wolfs (56.9%, n=141). These are 'passive' community members, who hardly participate in the sharing system. Possibly, the community has little incentives to exclude them, because they pay an annual membership fee.

The lone wolfs appear to be the oldest users and with the highest working experience (Figure 3). Among the long wolfs we find the highest share of users with a university degree. Commercialist seemed to be the youngest group with a slight left skewed age distribution. Freeriders have a slightly similar age distribution. Overall, it seems the recipocists have lower educational degrees than the other groups.
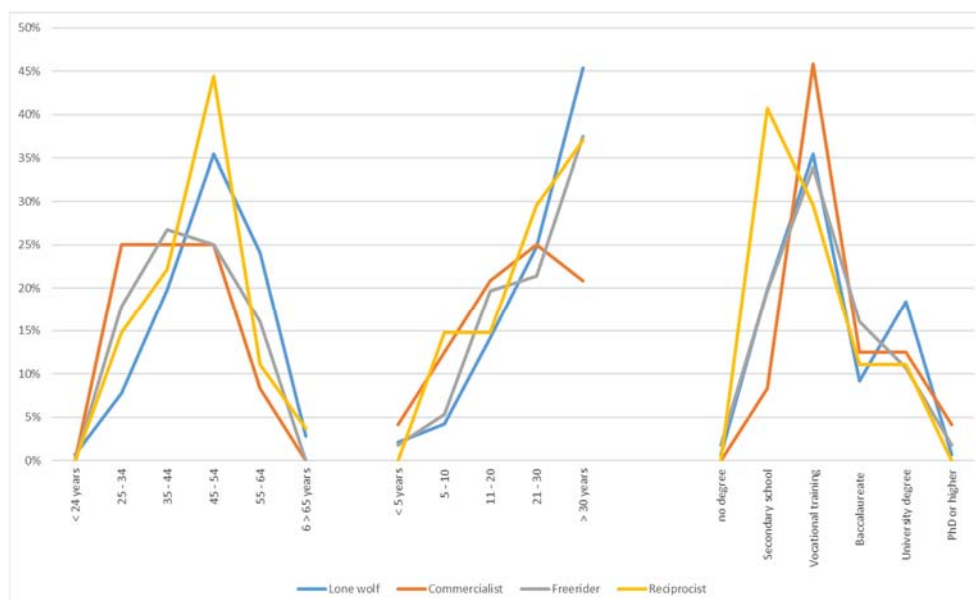

Figure 3: Age (left), working experience (middle) and education levels (right) of sharing types
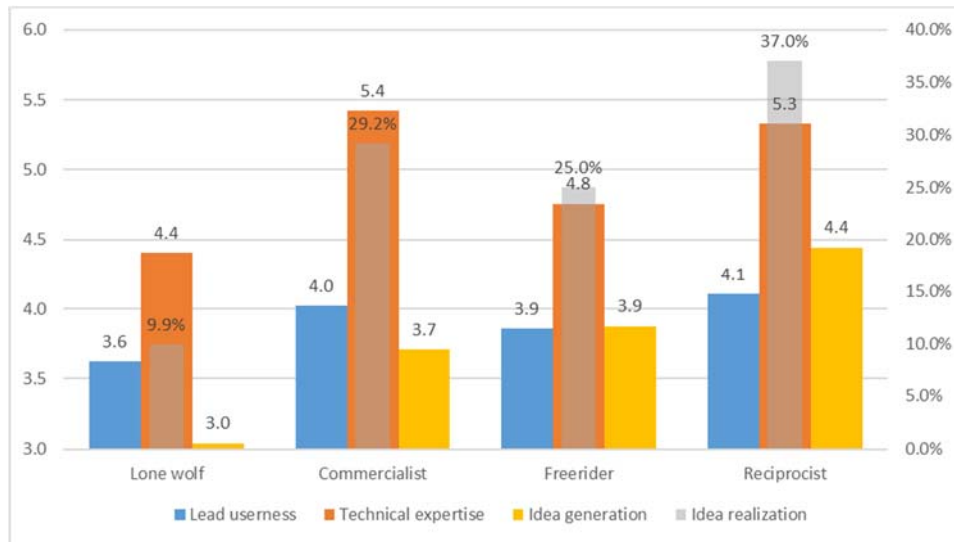
Figure 4: Characteristics of sharing types

Table 1: ANOVA of characteristics of sharing types

	Model 1				**Model 2**			
ANOVA	df	Mean Square	F		df	Mean Square	F	
Lead userness	1	5.336	4.935	*	3	2.702	2.588	†
Technical expertise	1	19.254	13.519	***	3	11.824	8.455	***
Idea generation	1	44.535	15.919	***	3	5.272	1.793	
Idea realization	1	1.665	14.621	***	3	.823	5.846	**

Notes: n=247; statistical significance †p<0.1, *p<0.05, **p<0.01, ***p<0.001

Figure 4 clearly shows that the worst performing group in terms of idea generation (3.0) and idea realisation (9.9% of those users have realized an idea) are the lone wolfs. The lone wolfs also have the lowest lead userness. In contrast, the reciprocists perform best with regard to idea generation (4.4) and realization (37.0%). Both the commercialists and freeriders perform better than the lone wolfs. Both groups have higher idea generation and realization ratios and both groups are characterized by higher technical expertise and lead userness that the lone wolfs. We also conducted an ANAOVA to test for significances regarding the group differences. Model 1 Table 1) shows the sharing type differences between lone wolfs and reciprocists and model 2 shows the differences between all four sharing types. According to model 1 reciprocists and lone wolfs differ significantly in lead userness, technical expertise and innovativeness. Model 2 rather shows significant differences for all groups regarding technical expertise and idea realization rate.

In summary, from the descriptive analysis comparing the four sharing types we find that compared to the other three member types the reciprocists have higher lead userness while the lone wolfs show the lowest ratio. Further, the reciprocists generate the most ideas for shared-in products and possess the highest idea implementation ratio. Nevertheless, the highest technical expertise ratio can be found in the group of economists. Further, they are the youngest community members but with a high technical expertise. The group of freeriders mostly sharing in products stuck in the middle between the other sharing types with regard to lead userness, technical expertise and idea ratio.

Table 2: Properties of sharing types

Sharing type	Properties from descriptive analysis
Lone wolf	- Highest age
	- Longest work experience
	- Lowest lead userness
	- Lowest technical expertise
	- Lowest idea generation
	- Lowest idea realization
Freerider	- Medium lead userness
	- Medium technical expertise
	- Medium idea ratio
Economist	- Lowest age
	- Lowest work experience
	- Highest technical expertise
	- Highest idea ratio
Reciprocists	- Highest lead userness
	- Medium technical expertise
	- Highest idea ratio
	- Highest idea implementation ratio

4.3 Sharing Impact on User Innovativeness

For exploring the dependencies in our model, we conducted analyzed six linear regression models with the two dependent variables idea generation and idea realization. Each model thus comprises two regression analyses: (a) one for idea generation and (b) one for idea realization.

Table 3: Regression results (significant relations) for own products

Dependent variable	Model 1a		Model 1b		Model 2a		Model 2b		Model 3a		Model 3b	
	Sharing				Sharing-in				Sharing-out			
	Idea generation		Idea realization		Idea generation		Idea realization		Idea generation		Idea realization	
Direct effects												
Sharing experience (SE)	-.025		.013		-.019		.022		-.013		.019	
Technical expertise (TE)	.506	***	.355	***	.499	***	.354	***	.502	***	.352	***
Lead userness (LU)	.214	***	.116	**	.215	***	.116	**	.217	***	.117	**
Moderating effects												
SE * TE	.108	**	.044		.095	**	.024		.067	†	.023	
SE * LU	-.027		.002		-.044		-.019		-.018		.015	
R²	.386		.174		.384		.173		.380		.173	
Adjusted R²	.380		.167		.379		.165		.375		.166	

Notes: n=563; b-values are standardized; all models are linear regressions; interaction variables are z-transformed; statistical significance †p<0.1, *p<0.05, **p<0.01, ***p<0.001

The first three models (1a&b; 2a&b and 3a&b) show the results for generating and realizing ideas for own products, thus products a user possesses. The last three models (4a&b; 5a&b and 6a&b) show the results for generating and realizing ideas for products not owned by the users (foreign products), thus products a user does not possess and has to share in. Model 1 and 4 show the effects of the overall sharing experience, while model 2 and 5 show the effects for the sharing-in expertise and model 3 and 6 for sharing-out expertise (see**Error! Reference source not found.**).

Consistent with prior studies Table 2 reveals significant positive effects for technical expertise and lead userness on both idea generation and realization across all six models. However, the results do not reveal any direct effect of sharing experience on user innovativeness. However, we find a consistent positive interaction effect across all models that is significant only for sharing-in and all sharing and idea generation. Thus, the participation in sharing communities and particularly the sharing-in seems to positively leverage the users' technical expertise. Hence, the more users share-in products, the more they learn to use a wider range of different products, which seems to have a positive effect on their innovativeness.

Table 4: Regression results (significant relations) for foreign products

	Model 4a		Model 4b		Model 5a		Model 5b		Model 6a		Model 6b	
	Sharing				Sharing-in				Sharing-out			
Dependent variable	Idea generation		Idea realization		Idea generation		Idea realization		Idea generation		Idea realization	
Direct effects												
Sharing experience (SE)	.442	***	.229	***	.466	***	.223	***	.284	***	.147	**
Technical expertise (TE)	.131	**	.144	**	.182	***	.171	***	.157	***	.154	**
Lead userness (LU)	.132	**	.034		.132	**	.033		.125	**	.033	
Moderating effects												
SE * TE	.038		.063		.101	**	.128	**	.059		.037	
SE * LU	.061		.009		.004		-.054		.039		.013	
R²	.296		.105		.324		.109		.179		.066	
Adjusted R²	.290		.096		.318		.101		.171		.057	

Notes: n=563; b-values are standardized; all models are linear regressions; interaction variables are z-transformed; statistical significance [†]p<0.1, *p<0.05, **p<0.01, ***p<0.001

Table 3 also reveals consistency with prior user innovation studies with regards to the effects of lead userness and technical expertise. Table 3 also shows a consistent and stable direct effect of sharing experience on both dimensions of user innovativeness for products not-owned by the user. Obviously, in-sharing seems to be a necessary precondition to be actually able to develop ideas and start realizing ideas for foreign products. Only in-sharing actually exposes the users to foreign products. Similar to Table 2 we also find a significant positive interaction effect of sharing experience with technical expertise.

5. Conclusions, Limitations and Future Research

Although sharing models are not entirely a new phenomenon (as the recent media coverage of the "sharing economy" may suggest), we see an emergence of more and more sharing based business models, not the least enabled through the digitization, not to say the internet and probably further facilitated through the internet of things (machine to machine communication, Industrie 4.0). As far as we know this paper is a first step towards a better understanding of how sharing of physical products (not knowledge) impacts how users innovate. This may not be entirely unimportant to companies that operate sharing based business models.

Our results strongly indicate that sharing and user innovativeness are related. It seems that higher sharing intensity is positively associated with user innovativeness. Accordingly, we propose sharing experience, as a new construct, to be included in future user innovation studies. Furthermore, we set out and propose to distinguish different sharing types, which we typologize based on the users' intensity of borrowing equipment (sharing-in) and intensity of lending equipment to others (sharing-out).

Even though the results about the insights into the relationship of sharing and user innovativeness seem to be stable and robust, this study is obviously subject to severe limitations. While the sample is large, the different sharing types are not normally distributed in our sample, which may potentially lead to biased results. Although this study was preceded by a pre-study with interviews of farmers and their sharing experience, the results presented here are based on a questionnaire answered by a single farmer only. Hence, studies that validate and build on our findings are more than welcome.

Obviously a lot remains to be done to fully understand the way how users share products and how this impacts their user innovation behavior. While a first step is done with this paper we look forward to run more differentiated analyses on the specific impact of in- and out-sharing. Further variables remain to be included in the analyses to also test the

impact of sharing through multi-level models. Obviously then the question remains to what extent the results from an analysis of users that share farming equipment apply to other sharing models, such as more modern approaches to travelling, such as AirBnB. It may seem very unlikely that users suddenly start to redecorate apartments they do not own, but only rent for a few days. However, users that often spend days and nights in flats they do not own may actually start using or even developing particular travel equipment which are handy for this particular lifestyle. Accordingly, more research remains then to be done on the innovation strategies users of shared equipment employ. While they may refrain from permanent modifications, they may however adopt an innovation strategy to develop products that can be temporarily attached, but then be detached to, respectively from products they do not own.

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Appendix

	Study key variables	Factor Loadings, Varimax, values < .30 omitted	
	(measured on 7-poit Likert scales: 1=total disagree;...; 7=total agree	1	2
Item	Lead Userness (AOT + HBE) Reference Franke et al (2006)		
1	Wenn es Neuigkeiten über innovative landwirtschaftliche Geräte bzw. Ausrüstung gibt, bin ich meistens der Erste, der dieses mitbekommt.		.881
2	In Bezug auf das Fachwissen über landwirtschaftliche Geräte bzw. Ausrüstung würden mich viele Leute so beschreiben, dass ich immer „Up to date über die neuesten Trends" bin.		.915
3	Ich habe ein umfangreiches Fachwissen auf dem Gebiet der landwirtschaftlichen Geräte bzw. Ausrüstung.		.862
4	Währen ich meiner landwirtschaftlichen Tätigkeit nachgehe, sehe ich mich häufig mit Problemen konfrontiert, die ich mit dem handelsüblichen landwirtschaftlichen Gerät/ der technischen Ausrüstung nicht lösen kann.	.673	
5	Ich bin unzufrieden mit einigen landwirtschaftlichen Geräten/ technischer Ausrüstung, die kommerziell angeboten wird.	.690	
6	Mir ist es bereits passiert, dass ich b ei der Ausübung meiner landwirtschaftlichen Tätigkeit mit Problemen konfrontiert wurde, die ich mit den landwirtschaftlichen Geräten/ der technischen Ausrüstung, die momentan von den Herstelllern der Technik angeboten werden, nicht habe lösen können.	.827	
7	Meiner Meinung nach gibt es landwirtschaftliche Aufgaben, die mit den derzeitigen landwirtschaftlichen Geräten/ der technischen Ausrüstung, nicht hinreichend erfüllt werden können.	.852	
8	Ich habe Bedürfnisse, die durch den Gebrauch der derzeitig verfügbaren landwirtschaftlichen Geräte/ der technischen Ausrüstung, nicht erfüllt werden.	.850	
9	Ich bin häufig irritiert über die Unausgereiftheit von landwirtschaftlichen Geräten/technischer Ausrüstung	.664	
Item	Technical Expertise Reference: Franke et al. (2006) CA = 0.894		
1	Ich kann meine eigenen landwirtschaftlichen Geräte / die für meine landwirtschaftliche Tätigkeit benötigte technische Ausrüstung eigenständig reparieren	.787	
2	Hinsichtlich Innovationen und Neuerungen in der landwirtschaftlichen Technik versuche ich mich ständig auf dem Laufenden zu halten.	.625	
3	Ich kann Bekannten/ Freunden helfen, wenn sie Probleme mit ihrer landwirtschaftlichen Technik haben.	.833	
4	Ich würde mich selber als praktisch veranlagt beschreiben und habe Freute am Basteln.	.852	
5	Ich kann eigenständig technische Änderungen an landwirtschaftlichem Gerät/ an technischer Ausrüstung vornehmen.	.879	
6	Ich bin ein großer Fan der technischen meiner Arbeit.	.839	
7	Ich habe einen technischen Hintergrund durch meine Ausbildung oder meinen beruflichen Werdegang.	.666	