Determinants of idea sharing in crowdsourcing: evidence from the automotive industry

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Drawing on external ideas through crowdsourcing has become common practice for firms that seek to improve and extend their product portfolios. As these initiatives often address the users of products, it is essential for firms to recognize those attributes that determine these individuals' willingness to share their ideas. This study takes the example of the automotive industry to examine how three attributes of car drivers determine their sharing behavior – that is, altruism, psychological ownership of ideas, and trust in car manufacturers. Our findings suggest that trust and altruism strengthen idea sharing, while psychological ownership weakens it. Furthermore, we find that car drivers' perception of sharing-related risk acts as an important boundary condition for these relationships.

1. Introduction

As part of the paradigm shift from closed to open innovation (Chesbrough, 2003), users have become a central source of ideas and an important factor for firms that seek to enhance their innovation processes (von Hippel, 2001; Balka et al., 2014). Firms from various industries including fashion (e.g., Howe, 2008; King and Lakhani, 2013) and consumer goods (e.g., Dodgson et al., 2006) have begun to draw on the ideas and knowledge of an external crowd of individuals to bring in external ideas for new designs, products, and services (e.g., Howe, 2008; Cappa et al., 2019; Pollok et al., 2019), thereby, enhancing the company's idea generation capacity (Terwiesch and Xu, 2008; Prelec et al., 2017; Ghezzi et al., 2018; Steininger and Gatzemeier, 2019; Segev, 2020). As a case in point, General Electric established the Ecomagination challenge to crowdsource ideas from

individuals and successfully generated innovations based on them (King and Lakhani, 2013; Piazza et al., 2019).

Inspired by such success stories, car manufacturers have become interested in similarly sourcing external knowledge (e.g., Ramaswamy and Ozcan, 2013). A success story in the automotive industry is Local Motors. This car developer and manufacturer exclusively operates on an online platform to collaboratively ideate, design, develop, and manufacture open source cars with a large community of professionals that consists of designers, engineers, and car enthusiasts (King and Lakhani, 2013). While these professionals are fairly capable of developing feasible product ideas and willing to share their knowledge (Poetz and Schreier, 2012; Magnusson et al., 2016), their interests often go beyond those of the broader market demand. In this regard, regular car drivers may have ideas that

better correspond to those of their peers, and are thus, of high value for companies (Magnusson et al., 2016).

Scholars have suggested that the effectiveness of crowdsourcing depends on the number, and thus, also the quality of proposals that individuals submit (Boudreau et al., 2011; Bayus, 2013), which in turn is determined by their willingness to participate and share their knowledge (Schäfer et al., 2017; Foege et al., 2019). Taking the example of the automotive industry, we, therefore, pose the following research question: *What attributes increase or decrease product users' willingness to share ideas in crowdsourcing?* We argue that sharing is related to three dimensions – the individual's personality, the idea itself, and the seeking firm – and we explore the role of three attributes that correspond to these dimensions: altruism, psychological ownership of ideas, and trust in the seeking firm.

To test our conceptual model, we conducted 297 structured interviews with car drivers to source ideas about how to improve their car and driving experience. This crowdsourcing initiative included a follow-up survey with questions about the personality of the individual, the idea, and their car manufacturer. In line with our conceptual model, the results of our analyses indicate that high levels of altruism and trust in the car manufacturer strengthen individuals' willingness to share, while high levels of psychological ownership toward the idea weaken it. Beyond that, we show that car drivers' perception of sharing-related risk strengthens the negative link between psychological ownership and idea sharing, and the positive link between trust and idea sharing.

Our findings contribute to the literature on crowdsourcing ideas from product users in several ways. First, we argue and find that users' perception that sharing ideas in crowdsourcing is risky constitutes a critical boundary condition that shapes their behavior. This is important, as most literature on crowdsourcing implicitly assumes that individuals share their ideas without hesitation or restriction (e.g., Piezunka and Dahlander, 2019). Second, we introduce and test the influence of three personal characteristics related to the individuals' personality (i.e., altruism), the idea (i.e., psychological ownership), and the seeking firm (i.e., trust) that determine whether they share their ideas. Finally, we extend studies on sourcing ideas from lead users, technology enthusiasts, and scientists (Mahr and Lievens, 2012) by conducting a large-scale interview study in the automotive industry that investigates how regular car drivers develop

real improvements for their vehicles and decide whether to share them.

2. Conceptual background and hypotheses

2.1. Crowdsourcing in the automotive industry

Starting in the late 1800s, when Carl Benz built the first car, innovation was considered the car builder's job. In the 20th century, the search for new ideas and inspiration for innovation in the automotive industry was mainly limited to the focal organization and its immediate environment (Salge, 2011). More recently a broad range of firms from various industries shifted their attention to the world outside their firm boundaries (West et al., 2014), starting to source knowledge from customers, suppliers, universities, and even competitors (Laursen and Salter, 2006). Through openness, firms can bring forth new processes and technologies that aid innovation (Rosenkopf and Nerkar, 2001), as inbound open innovation increases firms' idea generation capacity, broadens the pool of knowledge, and reduces internal R&D costs (Michelino et al., 2015; Bogers et al., 2017; Cammarano et al., 2017; Foege et al., 2017; Chesbrough et al., 2018).

Today, many car manufacturers open up their innovation process to benefit from crowdsourcing and increased collaboration with others. BMW, for example, continuously collaborates with HYVE, a Munich-based innovation company, to incorporate users into their innovation processes. In 2013, BMW announced its Trunk Contest to improve the luggage compartments of its vehicles. This crowdsourcing contest yielded 756 proposals submitted by 700 users. The proposals were complemented by more than 18,000 evaluations and nearly 10,000 comments by other users.[1]

2.2. Crowdsourcing for innovation

Following the democratization of innovation (King and Lakhani, 2013), crowdsourcing enhances firms' ability to generate innovations based on the access of external ideas, experiences, and abilities (Taylor and Greve, 2006; Boons and Stam, 2019). According to the concept of crowd wisdom, open idea sourcing is superior to closed idea generation, because a crowd is not limited by individual rationality or imperfect decisions (Surowiecki, 2004; Brabham, 2008, 2009; Prelec et al., 2017). Beyond

that, firms can save costs and avoid technological or market failures when drawing on, for instance, their users' knowledge in the innovation process, as it reduces discrepancies between need and solution information. Through this, manufacturers can prevent costly maldevelopment and improve the user-centricity of their product range (von Hippel, 2005).

The more ideas are collected in crowdsourcing initiatives, the higher the expected quality of submissions, which ultimately can be represented by individuals' willingness to participate in such initiatives (Pollok et al., 2019). In this study, we argue that individuals' willingness to share ideas in crowdsourcing depends on three dimensions – their personality, the idea itself, and the seeking firm. These dimensions relate to three personal attributes – altruism, psychological ownership of ideas, and trust in the seeking firm. Beyond that, we draw on the works of Salter et al. (2014, 2015) and Foege et al. (2019) to suggest that the perception that sharing knowledge in crowdsourcing is risky acts as an important boundary condition for these links.

2.2.1. Altruism

Sharing ideas is typically considered altruistic behavior (Afuah and Tucci, 2012; Sauermann and Franzoni, 2015). On crowdsourcing platforms such as Local Motors' LM Labs, altruistic individuals freely provide their knowledge to solve other people's problems (Constant et al., 1996; Dyer and Nobeoka, 2000). Hence, altruism is a personality trait that inspires individuals to share their ideas with others. In line with these suggestions, Eddleston and Kellermanns (2007) argue and show that altruism reduces relationship conflicts and enhances participative processes, loyalty, interdependencies, and commitment, which we expect to be conducive to idea sharing.

Therefore, we argue that altruism enables smooth interactions between sharing individuals and seeking firms in crowdsourcing, as it reduces potential reservations about knowledge exchange. Altruistic individuals are also more willing to use communications technologies to help others and contribute to the whole community (Wright and Li, 2011). However, Wu et al. (2009) highlight that altruism can also be connected to potential returns in the future. If the individual is not able to identify these future returns, the probability of sharing might also decrease.

Empirical evidence shows that altruism has a positive influence on the willingness to share knowledge (e.g., Acar, 2019). He and Wei (2009) find that knowledge workers participate in sharing processes because they enjoy helping others. Wasko and Faraj (2000) show that online community members are willing to share personal information to contribute to the overall welfare of the community. Moreover, Frey et al. (2011) suggest that altruistic individuals provide more useful and relevant information in crowdsourcing. Having an altruistic personality attenuates insecurities and provides a sense of satisfaction from participating in crowdsourcing, which, then, provides an easy-to-use platform for knowledge exchange and collaborative innovation.

H1: *Altruism increases individuals' willingness to share ideas in crowdsourcing.*

2.2.2. Psychological ownership

Scholars emphasize the importance of psychological ownership as a key determinant of human behavior (Vandewalle et al., 1995; Pierce et al., 2001; Pierce et al., 2003; van Dyne and Pierce, 2004). However, prior research provides inconclusive evidence on how psychological ownership affects the sharing of what is psychologically owned (Pierce et al., 2001, 2003). A psychologically owned object can be perceived as an extension of the self that goes along with feelings of safety, efficacy, and belonging (Pierce et al., 2001; Dawkins et al., 2017). A loss of control over psychologically owned objects can thus result in a loss of personality and self-efficacy (Isaacs, 1933; Davenport and Prusak, 1998; Pierce et al., 2003). Individuals with strong feelings of psychological ownership toward an object might, therefore, be unwilling to share it because this could endanger their self-concept (Pierce et al., 2003). Prior studies by Pierce et al. (2003) and Antons and Piller (2015) support this notion, showing that individuals with strong feelings of ownership toward their ideas tend to take measures more frequently to assert their ownership of them and deny collaboration.

In crowdsourcing initiatives, contributors traditionally lose property rights over their ideas when sharing them with the public. Therefore, we expect that there will be a negative relationship between psychological ownership of ideas and sharing it in our context of a one-shot, noncommunity crowdsourcing environment. Schäfer et al. (2017) suggest that participants' primary problem with sharing their ideas in crowdsourcing is a lack of feedback and reputation building and Foege et al. (2019) argue that individuals fear value expropriation by opportunistic seekers that appropriate knowledge without sufficiently rewarding the individual. We, therefore, argue that the stronger the psychological ownership feelings of individuals toward their idea, the lower will be their willingness to share it.

H2: *Psychological ownership decreases individuals' willingness to share ideas in crowdsourcing.*

2.2.3. Trust

In the context of knowledge transfer, Levin and Cross (2004) suggest that trust promotes knowledge exchange for two reasons. First, individuals with generally high levels of trust are more inclined to exchange useful information (e.g., Mayer et al., 1995; Levin and Cross, 2004). They feel reassured that their knowledge will be protected, fairly evaluated, and, perhaps, rewarded by the trustee, whom they feel to be trustworthy (Ye and Kankanhalli, 2017). Thus, trust enhances cooperation, problem-solving, and collaborative learning (Chen et al., 2014).

Second, trust reduces the transaction costs of knowledge exchange, as it diminishes the potential for conflict and makes the verification of information less necessary (Currall and Judge, 1995; Zaheer et al., 1998). Knowledge sharing requires open collaboration and effective exchange (Brown et al., 2014), which in turn depends on the levels of trust of the involved parties (Gefen et al., 2003). If individuals perceive a seeking firm as untrustworthy, they will not openly share their ideas. Therefore, sharing will appear more frequently in trusted relationships.

Individuals can perceive crowdsourcing as unfamiliar and anonymous, which can lower their level of trust (King and Lakhani, 2013). This dynamic is amplified by the sheer size and high fluctuation of participants in crowdsourcing (Hsu et al., 2007). Individuals might feel particularly vulnerable to the misuse of their ideas in these settings (Foege et al., 2019). Building trust is critical for seeking firms to overcome these negative effects (Jarvenpaa et al., 1998). We, therefore, expect that individuals with high trust in the seeking firm will be more likely to share their ideas than those who have low trust in the seeking firm.

H3: *Trust toward the seeking firm enhances individuals' willingness to share ideas in crowdsourcing.*

2.2.4. Risk perceptions

We expect that the general perception that sharing in crowdsourcing is risky constitutes an important contingency that moderates the effect of altruism, psychological ownership, and trust on idea sharing in crowdsourcing. While it can indeed enhance the innovation processes of seeking firms, it can come at the personal risk of losing control over valuable knowledge (Nelson and Cooprider, 1996; King and Lakhani, 2013; Foege et al., 2019).

Individuals operating out of altruism enjoy helping others and put aside their personal needs (Constant et al., 1996; Wasko and Faraj, 2000, 2005). For a truly altruistic individual, the perceived risk of sharing in crowdsourcing does not play an important role, as the personal risk is outweighed by the benefit of helping others. In contrast to this, we expect that the perception that sharing is risky will enhance the negative link between psychological ownership and idea sharing, as generally, strong risk perceptions will amplify the fear of losing control when sharing psychological ownership with seeking firms. Such a loss of control damages the self-concept (Davenport and Prusak, 1998; Pierce et al., 2003). As for the link between trust and idea sharing, we argue that the perception that sharing in crowdsourcing is risky amplifies the positive effect of trust toward the seeking firm on idea sharing.

H4: *The perception that sharing in crowdsourcing is risky moderates the effect of altruism, psychological ownership, and trust on sharing knowledge, such that*

a *it does not affect the relationship between altruism and individuals' willingness to share ideas.*
b *it enhances the negative relationship between psychological ownership and individuals' willingness to share ideas.*
c *it enhances the positive relationship between trust and individuals' willingness to share ideas in crowdsourcing.*

3. Methods

3.1. Data and sample

To collect our data, we conducted a crowdsourcing initiative in the form of an experiment that included a structured interview with car drivers from Germany to develop ideas on improving their vehicles and their personal driving experience. The interview was followed by a quantitative survey about the individuals' personality, the idea, and their car manufacturer. We invited a broad variety of individuals and collected a wide pool of ideas, ranging from nonfreezing windshields over self-repairing car paints to rotatable seats. Our data collection took place in 2014.

Overall, 315 car drivers participated in our crowdsourcing initiative and completed the survey. All individuals participated voluntarily and without any monetary incentives. Due to missing data points, our final sample consists of 297 individuals. Their average age is 36.7 years, with 45% being female, 46% of the surveyed drivers are younger than 25. 25% of drivers completed an

Table 1. Sample description

Job industry	N	%
Food and beverages	8	2.08
Textile and clothing	9	3.15
Wood and paper	10	3.50
Chemical and pharma	8	2.80
Rubber and plastic	5	1.75
Glass and stone goods	4	1.40
Metal production/goods	6	2.10
Machine engineering	9	3.15
Electrical	3	1.05
Automobile	28	9.79
Furniture and toys	2	0.70
Medical technology	11	3.85
Energy supply	13	4.55
Water supply	1	0.35
Wholesale	4	1.40
Retail	20	6.99
Mail services	6	2.10
Media services	4	1.40
Financial services	4	1.40
Telecommunication	2	0.70
R&D services	2	0.70
Consulting	5	1.75
Health care	17	5.94
Public Administration	68	23.78
Legal	16	5.59
Politics	6	2.80
Education	12	4.20
Food	1	0.35

Note: *N* = 286

Professional education	N	%
Apprenticeship[a]	86	28.96
Bachelor degree[a]	23	7.74
Master degree[a]	70	23.57
Doctoral degree[a]	15	5.05
No educational degree[a]	103	34.68

Note: *N* = 297, [a]or comparable degree.

Variable				N	Mean
			Std. Dev.	Min	Max
Age	297	36.7	17.3	17	84
Gender					
Male	164	36.2	17.3	18	84
Female	133	37.3	17.4	17	81

Position	N	%
Employee/Worker	85	28.72
Public Administration	130	43.92
Self-employed	18	6.08
Pensioner	49	16.55
Unemployed	14	4.73

Note: *N* = 295

Manufacturer	N	%
Audi	26	8.75
BMW	25	8.42
Chevrolet	1	0.34
Citroen	11	3.72
Dacia	1	0.34
Fiat	10	3.38
Ford	31	10.47
Honda	2	0.68
Hyundai	4	1.35
Jeep	3	1.01
KIA	2	0.68
Mazda	4	1.35
Mercedes-Benz	15	5.07
Mitsubishi	2	0.68
Nissan	5	1.69
Opel	22	7.43
Peugeot	9	3.04
Porsche	2	0.68
Renault	19	6.42

Vehicle type	N	%
Convertible	12	4.04
Coupé	10	3.37
Station Wagon	77	25.93
Sedan	26	8.75
Small Car	119	40.07
SUV	22	7.41
Transporter	4	1.35
Van/Minibus	25	8.42

Note: *N* = 295

Questions	Yes	No
Are you the only driver of the car?	99	198
	(33.33%)	(66.67%)
Are you the legal owner of the car?	138	159
	(46.46%)	(53.54%)

Note: *N* = 297

(Continues)

Table 1.   (Continued)

			Vehicle Information	Mean	Std. Dev.
Rover	1	0.34			
Saab	1	0.34			
Seat	6	2.03			
Skoda	10	3.38	**Vehicle Information**	**Mean**	**Std. Dev.**
Suzuki	2	0.68	Average km per year	16,471.13	32,059.67
Toyota	7	2.36	Average age of the car	3.74	4.46
Volkswagen	67	22.64	**Note:** $N = 297$		
Volvo	8	2.70			

Note: $N = 297$

apprenticeship and 37% hold a university degree. Table 1 provides a detailed report of our participants' demographics and information about their cars and manufacturers.

3.2. Measures

3.2.1. Dependent variable
To analyze users' willingness to share knowledge about their ideas, we adapted the *idea sharing* measure from Taylor and Todd (1995). We used a multi-item construct consisting of four binary items about individuals' sharing intentions. Participants answered, for instance, the question, '*Would you share your idea, in general?*' (1 – Yes, 0 – No).

3.2.2. Independent variables
Our first independent variable is *altruism* capturing the importance of having an altruistic personality for individuals' decisions to share knowledge. Following the work of Wasko and Faraj (2000), we used a three-item construct. Solvers responded to these statements: *(1) Helping other people is an important part of my life, (2) I enjoy doing good to others, and (3) I am convinced of the saying, 'It is more blessed to give than to receive'*. All items were measured on a 7-point Likert scale, which ranged between 1 (strongly disagree) and 7 (strongly agree). Our second independent variable, *psychological ownership*, describes the user's personal feelings of possession toward the idea. It was also measured with a three-item construct and a Likert scale from 1 (strongly disagree) to 7 (strongly agree). Following van Dyne and Pierce (2004), participants had to assess the following statements: *(1) That is my idea, (2) I have a feeling of ownership of my idea, and (3) My idea belongs to me*. The third independent variable, *trust*, captures the users' trust in the seeking firm, that is, their car manufacturer. We adapted the three-item measure from Cook and Wall (1980). Solvers responded to the following statements on a Likert scale from 1 (strongly disagree) to 7 (strongly agree): *(1) I believe that my car manufacturer is trustworthy, (2) I think that my car manufacturer keeps its promises, and (3) All in all, I am convinced that my car manufacturer is honest.*

3.2.3. Moderator variable
To analyze the moderating effect of the perception that sharing in crowdsourcing is risky, we adapted the general risk scale from Cox and Cox (2001). Solvers were asked to answer the following questions on a 7-point Likert scale (1-strongly disagree to 7-strongly agree): *In crowdsourcing, (1) sharing this idea is risky; (2) I would be concerned if I had to reveal this idea; (3) the disclosure of this idea scares me; (4) I would be concerned about the consequences of publishing my idea.*

3.3. Analysis

We performed covariance-based structural equation modeling (CB-SEM) to test our hypotheses. CB-SEM is a second-generation multivariate analysis and best suited for theory testing (Hair et al., 2016). It calculates the conceptual model by obtaining a measurement (outer) model and a structural (inner) model. Thus, measurement errors of the observed variables are analyzed as an integral part of the model, which provides better estimates than those produced by linear regression (Gefen et al., 2011). Hair et al. (2016) propose a two-staged procedure for CB-SEM analysis. The first stage evaluates the reliability and validity of the measurement model. The second stage assesses the structural model (Table 2).

3.3.1. Measurement model
We applied the following cutoff values following Hair et al. (2016): each outer loading needs to be higher than 0.7 to represent good indicator eligibility. Indicators with outer loadings between 0.7 and 0.4 are included if they increase the average variance extracted (AVE) of the construct. To verify construct reliability, Hair et al. (2016) suggest an internal item consistency above 0.70 for each construct. All constructs in our experiment rank above

Table 2. Survey items

Constructs and items	Mean	SD	Loadings
Idea sharing[1]			
1. Would you share your idea in general?	0.92	–	0.589***
2. Would you allow us to share your idea with other universities?	0.90	–	0.776***
3. Would you allow us to share your idea with your car manufacturer?	0.91	–	0.784***
4. Would you allow us to share your idea with other companies?	0.91	–	0.789***
Altruism[2]			
1. Helping other people is an important part of my life	4.92	1.50	0.881***
2. I enjoy doing good to others	5.38	1.33	0.805***
3. I am convinced of the saying, 'It is more blessed to give than to receive'.	4.74	1.55	0.650***
Psychological ownership[3]			
1. That is my idea	4.38	2.49	0.701***
2. I have a feeling of ownership of my idea	3.08	2.22	0.949***
3. My idea belongs to me	3.27	2.25	0.941***
Trust[4]			
1. I believe that my car manufacturer is trustworthy	4.92	1.51	0.831***
2. I think that my car manufacturer keeps its promises	4.44	1.46	0.681***
3. All in all, I am convinced that my car manufacturer is honest	4.53	1.41	0.942***
Perceived risk of sharing[5]			
1. Sharing this idea is risky	2.01	1.61	0.788***
2. I would be concerned if I had to reveal this idea	1.79	1.41	0.948***
3. The disclosure of this idea scares me	1.46	0.97	0.947***
4. I would be concerned about the consequences of publishing my idea	1.59	1.22	0.661***

Notes: $N = 297$; following [1]Taylor and Todd (1995), [2]Wasko and Faraj (2000), [3]Van Dyne and Pierce (2004), [4]Cook and Wall (1980), [5]Cox and Cox (2001).
***$P < 0.001$;**$P < 0.050$;*$P < 0.100$.

Table 3. Validity measures and HTMT

#	Construct	VIF	Q^2	1	2	3	4	5
1	Idea sharing	–	0.433	–				
2	Altruism	1.179	0.425	0.064	–			
3	Psychological ownership	1.028	0.584	0.160	0.111	–		
4	Trust	1.117	0.495	0.140	0.060	0.020	–	
5	Perceived risk of sharing	1.137	0.594	0.332	0.104	0.105	0.097	–

Note: $N = 297$.

this value. Table 3 summarizes the validity measures and heterotrait–monotrait (HTMT) ratios. All AVE's rank higher than 0.5, ensuring convergent reliability and internal consistency of our model. Our model accounts for discriminant validity by following Henseler et al. (2015), who proposed that HTMT ratios of correlations lower than 0.9 indicate discriminant validity (see Table 3). Moreover, the Fornell–Larcker criterion confirms the existence of discriminant validity (Fornell and Larcker, 1981).

3.3.2. Structural model

We tested the structural model's validity by employing different parameters. To test for multicollinearity, we estimated variance inflation factors (VIF). All VIFs in our model are below five, attesting to the absence of multicollinearity (see Table 3). Moreover, all path coefficients show significant results. T-values of 1.65, 1.96, and 2.58 for the path coefficients are considered to correspond to significance levels of 10%, 5%, and 1%, respectively. Our independent variables explain 22.4% of the variance in the dependent variable, which means our model has good explanatory power (Cohen, 1992). Furthermore, the standardized root mean square residual of 0.06 attests a good model fit. A Q-squared higher than 0 for all constructs underlines the predictive relevance and

external validity of our model (see Table 3) (Henseler et al., 2015).

4. Results

Table 4 shows the descriptive statistics and pairwise correlations. Figure 1 presents the results of our CB-SEM analysis. It shows the latent constructs with their corresponding items and their loadings and the path coefficients of the inner model. It shows a significantly positive path coefficient ($\beta = 0.156$, $P = 0.000$) of *altruism* on *idea sharing*. We also find a significantly negative path coefficient ($\beta = -0.155$, $P = 0.000$) of *psychological ownership* on *idea sharing*, while the path coefficient of *trust* on *idea sharing* is positive and significant ($\beta = 0.092$, $P = 0.000$). These findings provide evidence in support of Hypothesis 1, Hypothesis 2, and Hypothesis 3.

As expected in Hypothesis 4a, the moderating influence of the *perceived risk of sharing in crowdsourcing* on the relationship between *altruism* and *idea sharing* is statistically not significant ($\beta = 0.060$, $P = 0.468$). Beyond that, we find a significant and negative moderating effect of the *perceived risk of sharing in crowdsourcing* on the relationship between *psychological ownership* and *idea sharing* ($\beta = -0.197$, $P = 0.000$), and a significantly positive moderating effect of *perceived risk of sharing in crowdsourcing* on the relationship between *trust* and *idea sharing* ($\beta = 0.182$, $P = 0.000$), which supports Hypotheses 4b and 4c, respectively. Hence, the *perceived risk of sharing in crowdsourcing* intensifies the positive effect of *trust* and the negative effect of *psychological ownership* on *idea sharing*.

5. Discussion

In this study, we examined how three attributes of car driving users, that is, altruism, psychological ownership of developed ideas, and trust in the seeking firm, influence their willingness to share their ideas with their car manufacturers. Furthermore, we tested how the perception of risk when sharing in crowdsourcing moderates these relationships. Our findings support our conceptual model, as we found that individuals' altruism and trust in the car manufacturer enhance their willingness to share ideas, while psychological ownership of ideas decreases it. Furthermore, we find that the perception that sharing is risky in crowdsourcing strengthens both the negative effect of psychological ownership on idea sharing and the positive effect of trust on idea sharing.

5.1. Contribution to the literature

We contribute to the crowdsourcing literature by taking the example of the automotive industry to examine how three attributes of car driving individuals shape the way in which they share ideas with seeking car manufacturers. In particular, we introduce and examine individuals' altruism as a fixed personality trait that makes them open-minded to share their ideas in crowdsourcing, and thus, potentially benefit the welfare of others (Osterloh and Frey, 2000). Furthermore, we suggest and show that psychological ownership of ideas is critical for sharing, as sharing psychologically owned objects might cause fear of losing control of them, which in turn would result in feelings of unease (Pierce et al., 2001). Although trust toward a third party is a relatively well-examined driver of idea sharing in expert communities, we find that it is also important for the nonexperts (i.e., car drivers) in our one-shot non-digital crowdsourcing setting. While car manufacturers usually spend a significant amount of resources in establishing trust among their users especially regarding their trust in the reliability of the manufacturers' cars (Wiedmann et al., 2011), we still find that differences in trust matter in the automotive industry. This becomes even more important for individuals, who perceive sharing as generally risky since our findings suggest that

Table 4. PLS construct AVE and intercorrelations

#	Construct	No. of items	Internal consistency	AVE	1	2	3	4	5
1	Idea sharing	4	0.826	0.546	0.739				
2	Altruism	3	0.826	0.616	0.131	0.785			
3	Psychological ownership	3	0.903	0.759	−0.162	0.110	0.871		
4	Trust	3	0.862	0.680	0.135	0.279	0.009	0.825	
5	Perceived risk of sharing	4	0.907	0.713	−0.327	0.053	0.107	−0.100	0.844

Notes: $N = 297$. Composite reliability specifies the internal consistency of each construct. Diagonal elements depict the square root of the AVE. Correlations greater or equal to 0.11 are significant at the $P < 0.05$ level.
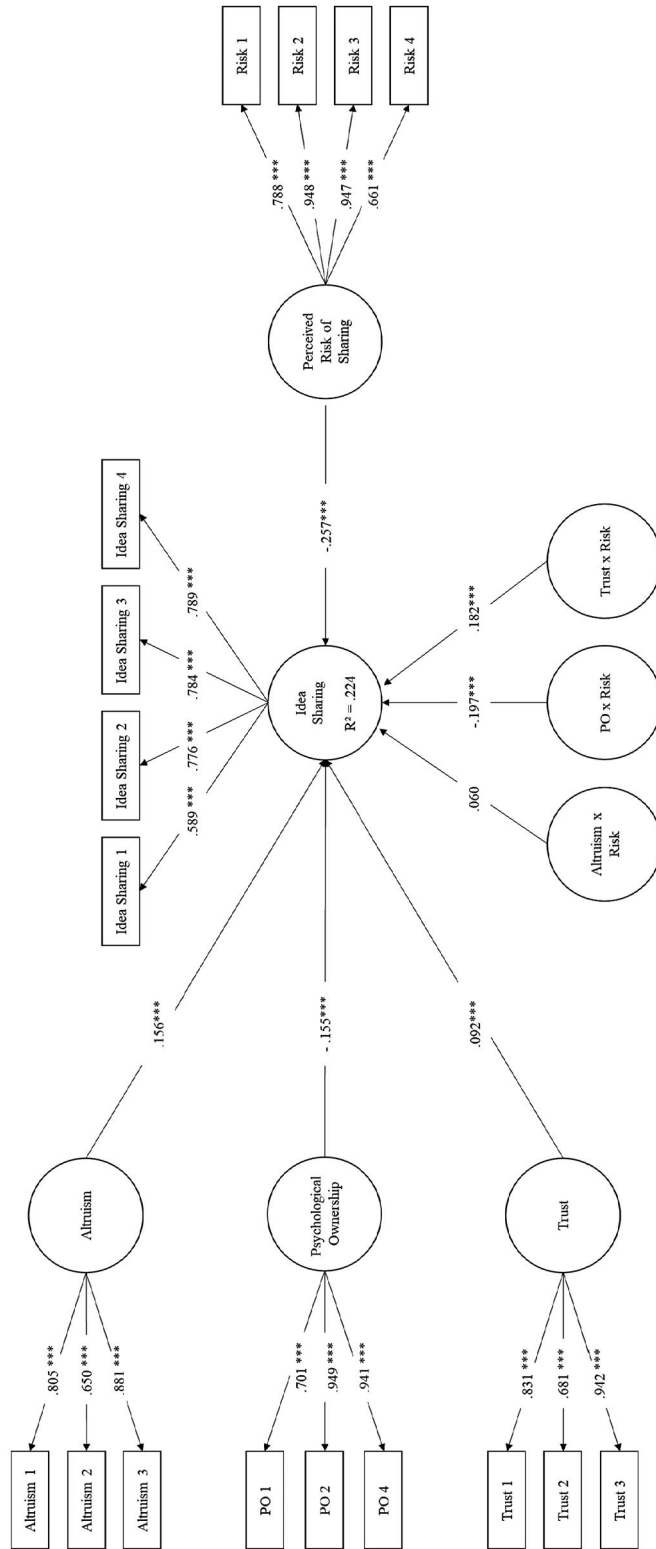
Figure 1. Structure equation model.

perceived risk of sharing amplifies the importance of trust in our crowdsourcing setting.

5.2. Implications for practice

Our findings can help car manufacturers and managers of firms from other industries to understand how their users' attributes influence the willingness to share ideas. As individuals with an altruistic personality are more inclined to participate in crowdsourcing, managers should try to appeal to altruistic individuals who seek to confront societal challenges. With regards to the automotive industry, this might be especially true for ideas that relate to sustainability, which is an important topic for car manufacturers that are currently in a transition phase from fossil fuel engines to new and potentially more sustainable propulsion technologies (Arcese et al., 2014, 2015).

Car manufacturers interested in sourcing ideas from their customers need also be aware of individuals' feelings of psychological ownership of their ideas. To overcome the negative feeling of losing ownership, they should increase their transparency about what they do with the ideas and provide contributors with control mechanisms for their knowledge. Contributor lists and open acknowledgment of contributions provides individuals with the opportunity to visibly present their competence and feel self-efficacious, which could reduce the negative effects of psychological ownership on idea sharing.

This brings us back to the topic of trust. For car manufacturers, individuals' trust is key, not only to selling cars, but also to sourcing knowledge. Without a sufficient level of trust in the manufacturer, users will not share their ideas. We, therefore, suggest that car manufacturers need to design their idea sourcing tools around their brand, which is often well established in the automotive industry through commercials and advertisements, and with clear rules to reduce any uncertainties.

6. Limitations and future research

Our study has some limitations that give rise to avenues for future research. First, the data are from a single-source survey. Thus, results should be interpreted against the possible backdrop of a common method bias that could distort our results. To test for potential common method bias, we conducted Harman's single factor test (Podsakoff et al., 2003). According to this test, substantial common method bias is unlikely in our study. However, future researchers might wish to integrate data from multiple data sources. Second, we examined only German car drivers, while users in other countries and industries may have different characteristics. Future studies could retest our hypotheses in other contexts than the automotive industry and other geographic locations. Finally, we examined a very specific case of crowdsourcing, in which car manufacturers source ideas from car drivers in a non-digital setting. Given the broad variety of crowdsourcing initiatives with a multitude of purposes ranging from sourcing simple ideas for t-shirts (Huang et al., 2014) to solving highly complex technical challenges (Pollok et al., 2019), we expect that individuals' perceptions and behavior will be manifold. This also depends on the nature of the crowdsourcing initiative including such features as the general theme, anonymity, community, problem complexity, accessibility, and intermediation (Ghezzi et al., 2018; Pollok et al., 2019). Therefore, we emphasize the importance of future research to introduce and examine our determinants in other distinct settings.

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