

Antecedents and consequences of consumers lead usersness: The case of mobile applications

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Abstract: *Lead usersness (LU) captures to what extent a user, in a given product domain, is ahead of an important market trend and expects high benefits from innovating. A comprehensive understanding of antecedents and consequences of LU are important both to theory and practice. To lead-user theory, it can contribute by better being able to explain why some users display LU whereas others do not. Also, an improved understanding of consequences may help explain why users displaying LU provide advice to other consumers and often come up with attractive innovations. To practice, knowledge on the antecedents and consequences of LU may provide insights of how to identify these users at lower cost as well as how to get use of them in developing or promoting new products.*

Previous studies have investigated different antecedents and consequences in different product domains. Therefore, there is a need to further investigate the previously studied antecedents and consequences. This way a more comprehensive understanding of the relative importance of different antecedents and consequences within and across product domains can be gained. In the current study we therefore set out to investigate three previously studied antecedents of LU: consumer knowledge, intrinsic motivation and extrinsic motivation. In addition we study a fourth antecedent, technology cognizance, which may be of particular importance in the information technology intense domain we study. Further, two previously studied consequences of LU, opinion leadership and opinion seeking, are researched in the present study of mobile applications.

Based on a survey study of 156 undergraduate students we report in a series of regression analyses: (1) consumer knowledge to be the only antecedent of LU; (2) opinion leadership and opinion seeking to be consequences of LU, the former being a relatively more important one, and; (3) Our findings to overall correspond highly to findings in researches of other domains ranging from extreme sports such as kite-surfing and sailplaning to the mass market of home kitchen appliances. Implications for research and practice are provided.

Keywords: lead user theory, lead usersness, opinion seeking, opinion leadership, knowledge, intrinsic motivation, extrinsic motivation, technology cognizance, mobile applications

INTRODUCTION

Lead userness (LU) captures to what extent a user, in a given product domain, is ahead of an important market trend and expects high benefits from innovating (Von Hippel, 1986; Faullant et al, 2012). As has been pointed out repeatedly in the literature users displaying high LU may contribute by developing innovations attractive to the many users that subsequently will recognize the important market trend (Schreier and Prügl, 2008). The importance of LU for business is further evidenced by findings showing that all major innovations in fields such as windsurfing, skateboarding and snowboarding were first developed by users (Shah, 2000). User innovation has also been found to be frequently occurring in many different industries ranging from clinical surgery (Lüthje, 2003) to software (Franke and Von Hippel, 2003) thereby further pointing to the importance of LU.

A comprehensive understanding of the antecedents and consequences of LU may contribute both to lead user theory and practice. This follows from that individuals who display high LU play important roles in the market as Sällberg and Bengtsson (2013) proposes based on an extensive review of lead user research: they may come up with attractive innovations, they may prevent inferior innovations from being developed and they may contribute to speeding up diffusion rates. For instance, to lead user theory, more knowledge on an antecedent such as intrinsic motivation may contribute to an improved understanding of the underlying mechanisms that explain why users displaying high LU innovate. In turn, such knowledge may potentially be used by professional organizations to further spur these users intrinsic motivation in order to increase their propensity of creating commercial innovations. To practice, an improved understanding of the different antecedents of LU may also contribute to lower the cost of identifying users displaying high LU (Schreier and Prügl, 2008). Thus, such users typically constitute a small proportion of the user population in a given market domain (Belz and Baumbach, 2010). An improved understanding of consequences of LU such as opinion leadership may be used to find out more about how such users influence other users in the domain, such as by demonstrating their innovations in different ways to different user groups (Hiernerth and Lettl, 2011). To practitioners such knowledge may provide insights of how to get use of users with strong LU for improving diffusion rates of new products.

A few studies have particularly focused on antecedents and consequences of LU (Simbeck, 2013; Faullant et al, 2012; Schreier and Prügl, 2008; Schreier, Oberhauser and Prügl, 2008). These studies have addressed different antecedents such as creativity (Faullant et al) and consumer knowledge (Schreier and Prügl, 2008) as well as different consequences such as adoption behavior (Schreier and Prügl, 2008) and opinion leadership (Schreier, Oberhauser and Prügl, 2007). Further empirical work may contribute to an improved understanding of these antecedents relative importance for LU within and across domains. In the current study we therefore empirically investigate three antecedents of LU addressed in previous research: intrinsic motivation, extrinsic motivation and consumer knowledge. Also, we investigate a fourth antecedent, technology cognizance, which may be an important antecedent of LU in information technology intense product domains. Further, we study opinion leadership and opinion seeking as consequences of LU thereby enabling us to compare our results of these consequences with those previously reported for other domains.

The antecedents and consequences of LU have been explored in domains such as home kitchen appliances (Faullant et al 2012) and extreme sports including kitesurfing and sailplaning (Schreier and Prügl, 2008, Schreier, Oberhauser and Prügl, 2007). In the present research we instead investigate mobile applications. This domain was selected for three reasons. First of all, mobile applications can be considered a mass user domain in difference to the extreme sports domains previously studied. This difference may impact on the relative importance of different antecedents

and consequences of LU. For instance, users displaying high LU may exert relatively stronger opinion leadership in niche markets than in mass markets due to that overall there are fewer users promoting a market trend to come. Secondly, as Faullant et al (2012) point out previous studies of LU have typically been conducted in a leisure context such as tech diving or sailplaning. In difference, mobile applications may be used both for work and leisure purposes. An antecedent such as intrinsic motivation may be a relatively stronger driver of LU in the hobby context than in the professional context due to that extrinsic motivation may crowd out intrinsic motivation in the professional context as has repeatedly been reported in the economics literature (Lepper and Green, 1978; Benabou and Tirole, 2003). Thirdly, previous research of antecedents and consequences of LU have not been conducted on information technology intense product domains. Such a domain may differ from extreme sports and kitchen appliances in that domain specific antecedents such as technology cognizance are important for LU. In the current paper we consequently study the following two research questions:

RQ1: What is the relative importance of different antecedents and consequences of lead userness (LU) in the mobile application domain?

RQ2: Do the antecedents and consequences of lead userness (LU) found in other domains generalize to the mobile application domain?

Based on a survey study of 156 undergraduate students, we report: (1) consumer knowledge to be the only antecedent of LU; (2) opinion leadership and opinion seeking to be consequences of LU, the former being a relatively more important one, and; (3) Our findings to overall correspond highly to findings in researches of other domains ranging from extreme sports such as kite-surfing and sailplaning to the mass market of home kitchen appliances. The paper is organized as follows. First, we review related work and specify the research hypotheses. We then describe the research method and the results of the study. Finally, the findings of the study are discussed and implications for research and practice are provided.

RELATED WORK AND HYPOTHESES

Different antecedents of LU have been studied in different contexts in previous research. Schreier and Prüggl (2008) based on a sample of 129 sailplaners, an extreme sport user group, found consumer knowledge, use experience, locus of control and innovativeness to all significantly and positively influence LU. In a second study of 139 kite surfers, another extreme sport user group, they in line with the previous finding reported use experience and locus of control to positively and significantly influence LU. Consumer knowledge in their studies refers to know-how stemming from various sources beyond product usage such as magazines, hence the distinction between it and use experience. Whereas consumer knowledge and use experience are field related variables locus of control and innovativeness are field-independent variables. In the two studies, locus of control captures to what extent users believe that outcomes primarily depend on their own actions (Rotter, 1966) and innovativeness refers to a generalized unobservable predisposition toward innovation (Im, Bayus and Mason, 2003).

Faullant et al (2012) in their study of 146 users (consumers) of kitchen appliances found product-related knowledge, use experience and cognitive style (divergent thinking) to all positively and significantly influence LU. The findings for consumer knowledge and use experience as antecedents of lead userness thereby correspond to what Schreier and Prüggl (2008) found. Contrary to their expectations the Faullant et al did not find intrinsic motivation (liking the task per se) nor extrinsic motivation (earning money) to significantly influence LU. The positive directions of these relationships were thus found to be small. The unexpected finding may be a consequence of that

single-item scales were used to measure these two constructs. Commonly, multi-item scales are used to measure intrinsic and extrinsic motivation (Deci and Ryan, 1985; Davis, Bagozzi and Warshaw, 1992; Venkatesh and Davis, 2000)

Simbeck (2013) surveyed a sample of 121 small company veterinarians and reported network position to positively and significantly influence LU when it comes marketing activities but not when it comes to management accounting activities. This may suggest, as we pointed out earlier, that some antecedents of LU are more domain-specific than other ones. Network position (betweenness centrality) in their study refers to the number of paths between other actors that go through a particular actor (Freeman, 1978). Hence, network position has to do with how important a person is as a contact in a certain community or group of users.

A few studies have also particularly focused on investigating consequences of LU. In their study of kite surfers Schreier and Prügl (2008) found LU to positively influence adoption behavior, measured as number of new products owned. Further, in a study of 193 tech divers, yet another extreme sport user group, the authors also found the number of new products owned to be positively and significantly influenced by LU. Further, in the tech diving case, time of adoption was found to be significantly influenced by LU. Hence, adoptive behavior was thereby also operationalized as *“time of adoption of one particular product that had been on the market long enough to generate a reasonably high percentage of diffusion”* (ibid, p. 341).

Schreier, Oberhauser and Prügl (2007) found consumers leading-edge status to positively and significantly influence opinion leadership (influencing other consumers) in the domain of tech diving (N=193). Also, they found tech divers leading edge status to negatively and significantly influence opinion seeking (seeking advice from other consumers). The construct leading edge-status was put forth by Morrison, Roberts and Midgley (2004) as a continuous analog to the lead user construct. In line with Schreier, Oberhauser and Prügl’s finding that LU positively influences opinion leadership, Simbeck (2013) report a correlation of 0.66 between these two constructs in their study of veterinarians.

As the above review shows there is a growing stream of research on different antecedents and consequences of LU. Still, more studies are needed to understand these antecedents relative importance within and across domains. The remainder of this paper we devote to this issue by further studying some of the antecedents and consequences of LU previously studied and reviewed in this section.

Hypotheses development

Motivation as a determinant of behavior has been repeatedly reported to explain managerial (Fagan, Neill and Wooldridge, 2008) as well as consumer behavior (Van Der Heijden, 2004; Agrifoglio et al, 2012). Most of these studies draw on Deci and Ryan’s self-determination theory which distinguishes between intrinsic motivation and extrinsic motivation (Ryan and Deci, 2000). The former refers to doing something because it is inherently interesting or enjoyable and the latter refers to doing something because it leads to a separable outcome (Deci and Ryan, 1985). A user may choose to engage in innovating for extrinsic motives such as making money or satisfying unsolved private usage needs. The latter can for instance be illustrated by being able to jump higher with one’s skateboard. In line with such extrinsic motives for innovating a characteristic of lead user theory is that those high on LU expects high benefits from innovating (von Hippel, 1986). It therefore follows that extrinsic motivation ought to be positively linked to LU as pointed out by Faullant et al (2012).

Users high on LU have further been found to display higher likelihood of creating attractive innovations (Franke, Von Hippel and Schreier, 2006; Franke and Von Hippel, 2003). People who produce highly creative work, such as an attractive user innovation, have been found to be deeply immersed and invest significant energy in that work (Simonton, 1999). In line with these findings in the creativity literature Ryan and Deci (2000) point out that intrinsic motivation implies seeking novelty and challenges as well as learning and exploring. Hence, users may display high LU due to that they find the innovation activity per se to be enjoyable. Also, experiencing enjoyment in using particular products per se may explain why some users move ahead of a market trend, one of the characteristics of LU (Von Hippel, 2005). It therefore also follows that intrinsic motivation ought to be positively related to LU.

In general, it is put forth in the creativity literature that intrinsic motivation is a more effective determinant for creative work, such as user innovation, than extrinsic motivation (Nickerson, 1999). Further, high levels of extrinsic motivation have been found to sometimes crowd out intrinsic motivation, especially in the employee context where an agent is offered monetary incentives for performance (Lepper and Green, 1978; Benabou and Tirole, 2003) but also such crowding out effects can be detrimental for creativity (Collins and Amabile, 1999). The empirical evidence that users high on LU to a high extent come up with attractive innovations rather suggest though that such detrimental effects only occur to a low extent. Similar to Faullant et al (2012) we therefore hypothesize:

H₁: Intrinsic motivation is more positively related to lead usersness than extrinsic motivation.

With regards to lead user theory, it is argued that high levels of consumer knowledge is a prerequisite for a user to display high LU (Schreier and Prüggl, 2008). Consumer knowledge refers to the inferences a consumer can draw on when facing consumption problems like selecting the appropriate product for a specific usage situation (Mitchell and Dacin, 1996). Before users can move ahead of an important market trend and come up with attractive user innovations they thus need to have a clear understanding of how to perform ordinary product-related tasks successfully (Schreier and Prüggl, 2008; Alba and Hutchinson, 1987). As users gain more knowledge they will also more thoroughly understand the complex relationships of product-related challenges (Meeds, 2004). In line with these arguments in the literature, Schreier and Prüggl (2008) in the domain of kite-surfing and Faullant et al (2012) in the domain of kitchen appliances found consumer knowledge to be positively and significantly related to LU. Faullant et al (2012) further provides anecdotal indications of the importance of consumer knowledge for user innovation by pointing out that Alexander Fleming who discovered penicillin was a bacteriologist in a hospital and that the composer Mozart was an excellent pianist. In line with the arguments in the creativity and consumer research literatures and also in line with the empirical findings reported by Schreier and Prüggl (2008) and Faullant et al (2012) we thus hypothesize:

H₂: The greater the consumer knowledge in a given domain becomes the stronger the lead usersness will be in that domain.

In information technology intense product domains technology cognizance is likely also a prerequisite for a user to display high LU. While consumer knowledge more generally captures a user's interest, expertise and insights about a product's characteristics in a given domain (Schreier and Prüggl, 2008), technology cognizance particularly captures awareness of such a product's

technical capabilities and features (Salovaara, Helfenstein and Oulasvirta, 2011). Hence, although the two constructs are expected to somewhat share variance on the theoretical level, a consumer may be aware of a product's technical aspects without having deeper insights about it and so it follows that they are distinct constructs. For information technology intense products high levels of technology cognizance ought to be necessary for a user to be able to display LU. It ought otherwise be hard to be able to move ahead of a current market trend or successfully engaging in modifying such products. In line with such arguments, Morrison, Roberts and Von Hippel (2000), in the context of library users of information search systems, and Franke and Von Hippel (2003) for security software reported that the users modifying the product (those who created add-ons or reprogrammed it) displayed much higher technical capabilities than those who did not modify it. We therefore hypothesize:

H₃: The greater the user's technology cognizance in a given domain the stronger the lead usersness will be in that domain.

Users displaying high LU are characterized as being ahead of the mass who seeks to follow their lead (Schreier, Oberhauser and Prügl, 2007). Users high on LU are thus found to be more knowledgeable (Schreier and Prügl, 2008, Faullant et al, 2012) and have more use experience (ibid) and expertise (Franke and Von Hippel, 2003) than users low on LU. As a consequence hereof, users low on LU are likely to turn to users high on LU for advice on selection of products and services in a given domain. Thereby users high on LU can be expected to act as opinion leaders, implying that they influence other consumers' attitudes and behavior in a given product domain (Flynn et al, 1997). In line with such reasoning LU has been found to be positively linked to opinion leadership (Morrison, Roberts and Von Hippel, 2000; Schreier, Oberhauser and Prügl, 2007; Simbeck, 2013). Thus, our hypothesis is:

H₄: Lead usersness is positively related to opinion leadership.

Whereas opinion leaders are those that provide information for others, opinion seekers are those that actively seek advice from the former species. Those high on LU are generally not expected to seek advice from others, thereby not displaying opinion seeking. This follows from them being ahead of a current market trend which the large mass of users do not yet follow. Nevertheless, users high on LU may seek advice from certain others who are also ahead of the important market trend and expect high benefits from innovating. In fact, Flynn et (1996) acknowledge that there are opinion leaders who may also seek advice from certain others but still argue for the two constructs independence since there are opinion leaders who are not opinion seekers and vice versa. In line with such an argument, Schreier, Oberhauser and Prügl (2007) report a negative correlation of -0.13 between opinion leadership and opinion seeking in their study of lead users. Further, they also found leading-edge status to be significantly and negatively related to opinion leadership. Our hypothesis is:

H₅: Lead usersness is negatively related to opinion seeking.

THE CASE OF MOBILE APPLICATIONS

In order to test the five hypotheses developed in the previous section we conducted an empirical survey study with undergraduate students on their overall use of mobile applications. Hence, students may use mobile applications both for leisure and study-related purposes. Also, it is interesting to investigate LU in a mass market domain such as that for smartphone and its related applications. In this section we describe the method used, the results found and finally discuss the findings of the empirical study.

Method

Sample. A convenience sample of 176 undergraduate students in business administration at Blekinge Institute of Technology, Sweden were surveyed. The students were recruited from colleagues' courses which we had access to. Participation in the survey was voluntary and students were offered a free seminar on research methods in exchange for their participation. Two respondents dropped out prior to taking the survey due to that they had no smartphone and eight respondents were removed due to incompletely filled out questionnaires. In addition ten respondents displayed response style bias (Rorer, 1965; Castaldi, Reynolds and Wallace, 2008) and were in line with recommendations in the literature removed (Schmitt and Stults, 1985) yielding a usable sample of 156 respondents. The response style bias was in six out of ten cases found for opinion leadership which scale was balanced and the other 4 cases were found for opinion seeking which scale was also balanced. For the opinion leadership scale, on a likert-type-scale 1 (strongly disagree) to 5 (strongly agree) the four respondents displaying response-style bias rated "5" on the item reading "*My opinion on mobile units and applications does not seem to count with other people*" and also rated "5" on the item reading "*I often influence people's opinions about mobile units and applications*". Hence, their responses were completely inconsistent and so the rationale for removing these respondents from the sample.

The survey was conducted in a classroom setting. In connection with classes in courses students spent 10 minutes to fill out the questionnaire using paper and pen. The usable sample consisted of respondents aged 18 to 46 with a mean of 22.5 (SD= 4.63). Out of the 156 respondents 108 (69.2%) were males and 48 (30.2%) were females.

Measures. In addition to age and sex respondents self-reported their intrinsic motivation, extrinsic motivation, knowledge, technology cognizance and LU of mobile applications. Constructs were operationalized using existing scales from the literature. For each construct higher scores indicate higher levels of the construct being measured (after appropriate transformation of reversed-scored items for opinion leadership and opinion-seeking). The score of each construct was formed by the sum of all item scores divided by its number of items. A likert-scale response format was used to measure each construct. Items were changed to reflect the mobile applications domain. For instance, one sample item of intrinsic motivation reads: "*I find using a smartphone to be enjoyable*". A complete list of all items used in the study are shown in appendix 1.

Measurement scales were thus adapted to reflect the mobile application context studied, as illustrated by the two opinion leadership items in the preceding paragraph. Intrinsic motivation was measured using the three-item scale developed by Davis, Bagozzi and Warshaw (1992) and we used three items from Venkatesh and Davis (2000) to measure extrinsic motivation. The three-item measurement scale for knowledge was adapted from Mitchell and Dacin (1996) and following Salovaara, Helfenstein and Oulasvirta (2011) technology cognizance also consisted of a three-item scale. The six-item opinion leadership and opinion seeking scales were adapted from Flynn et al (1996). Finally, we used the six-item measurement scale for LU developed by Kratzer and Lettl

(2008). In line with the original scales extrinsic motivation was measured on a likert-type-scale 1 to 7 whereas all other constructs were measured on a likert-type-scale 1-5. Good psychometric properties have been previously reported for all scales used in the present research.

In line with Faullant et al (2012) we used age and sex (male=1 and female=0) as control variables, thus enabling us to compare our control variable findings to related work. Data was analyzed using SPSS version 22.

Data analysis

Data was analyzed in two phases. First, we assessed construct reliability using Cronbach's alpha (α) and also provide some further descriptives pointing to the independence of constructs included in the study. Secondly, the results of the OLS-regression analyses conducted to test the research hypotheses are presented.

Instrument validation. According to Nunnally (1978) levels above 0.7 are recommended for α . Except for LU all constructs were found internally consistent. After removal of one item for LU reading "*I think that mobile units and applications should be nicer and more advanced*" which had a low corrected item-to-total correlation (0.22) α was improved from 0.67 to 0.69. Corrected item-to-total correlations for the five remaining items were all sufficiently high (>0.4) indicating no serious concerns with the measurement scale. Alpha levels for remaining constructs ranged from 0.79 for extrinsic motivation to 0.89 for technology cognizance, hence, measurement scales were internally consistent. Descriptives for measurement scales are provided in table 1 including means and standard deviations of items as well as cronbach alpha values for constructs.

INSERT TABLE 1 ABOUT HERE

In table 2 the correlations between constructs are reported. Also, it includes age and sex which serve as control variables in our regression analyses to verify that our conclusions of LU will not be confounded by demographics. Age is negatively correlated to gender ($r = -0.23$) implying that males are older than females in our sample. Sex is further positively correlated to LU such that males display higher LU than females, an issue we will return to. The insignificant correlation of 0.003 between opinion leadership and opinion seeking is a further indication of the two constructs being independent and in line with what Schreier and Prügl (2008) reported in their lead user study. Further, the positive and significant correlation of 0.43 between intrinsic and extrinsic motivation is in line with arguments and findings in the motivation literature that these two types of motivation are interrelated but nevertheless distinct types of motivation (Venkatesh, Speier and Morris, 2002, Fagan, Neill and Wooldridge, 2008; Agrifoglio et al, 2012). As we expected, technology cognizance was positively correlated to consumer knowledge ($r = 0.54$). Despite the strong correlation between these two variables, as we shall see we find the two to impact differently on LU indicating the importance of treating them as separate constructs.

INSERT TABLE 2 ABOUT HERE

Hypothesis testing. As described earlier we test 5 hypotheses in the domain of mobile applications. The first three hypotheses captured antecedents of LU and the results of these are reported in table 3. Contrary to what we expected we did not find intrinsic motivation to significantly influence LU ($\beta=0.014$; $p>0.05$). Also contrary to expectations, extrinsic motivation was found not to be significantly related to LU ($\beta=0.014$; $p>0.05$). Consequently, we could not confirm H_1 which stated that intrinsic motivation has a stronger positive influence on LU than extrinsic motivation. We though find confirmation for a positive relationship between consumer knowledge in the domain and LU in that domain (H_2 : $\beta=0.353$; $p<0.01$). We could not confirm H_3 since the positive relationship between technology cognizance and LU was found to be statistically insignificant (H_3 : $\beta=0.075$; $p>0.05$). Following the strong positive correlation found between consumer knowledge and technology cognizance ($r=0.54$) the divergent results for H_2 and H_3 are unexpected but at the same time highlights the importance of treating these two constructs as separate ones. In the regression model which tested the antecedent hypotheses, the two demographic variables age and sex were also included as is shown in table 3. Neither age ($\beta=0.016$; $p>0.05$) nor sex ($\beta=0.157$; $p>0.05$) were though found to have an impact on LU. In sum, consumer knowledge were found to be the only antecedent of LU in the mobile applications domain.

INSERT TABLE 3 ABOUT HERE

We also tested two consequences of LU. In table 4 below we present the regression results capturing these consequences and in tables 5 we summarize the findings for all hypothesized relationships. First of all, in line with expectations we find LU to positively influence opinion leadership (H_4 : $\beta=0.542$; $p<0.01$). We also confirm the hypothesis that LU negatively influences opinion seeking (H_5 : $\beta=-0.277$; $p<0.01$). As we mentioned earlier we found no correlation ($r=0.003$) between opinion seeking and opinion leadership thereby providing further indications of the two constructs independence. The two demographic control variables age and sex were included in the two regression models as well. Whereas age was found to have no significant impact on opinion leadership ($\beta=-0.021$; $p>0.05$) or opinion seeking ($\beta=-0.016$; $p>0.05$) sex was found to positively and significantly influence opinion leadership ($\beta=0.460$; $p<0.01$) but not opinion seeking ($\beta=-0.04$; $p>0.05$). The result suggests that men to a higher extent are opinion leaders than females. Recall though that despite that we find opinion leadership to be a consequence of LU we still do not find sex to have a significant influence on LU as is shown in table 3.

INSERT TABLES 4 AND 5 ABOUT HERE

Discussion. Quite surprisingly we found that neither intrinsic motivation nor extrinsic motivation acts as an antecedent of LU in the mobile application domain. One would expect that motivation would play an important role in this regard due to the LU characteristic: expecting high benefits from innovating (Von Hippel, 1986; Faullant et al, 2012). The benefit thus ought to be of either extrinsic kind such as for instance the user making money or accelerating faster with his car or of intrinsic kind by the user finding innovating enjoyable per se. Still, neither the current study of mobile applications nor Faullant et al (2012) in their study of kitchen appliances find any support for motivation to positively influence LU. A potential explanation to why motivation does not seem to be an antecedent of LU is that users displaying high LU are preoccupied with being frustrated over current supply in the market not satisfying their needs. In other words, it would be

to say that frustration rather than finding it enjoyable to innovate per se or being able to jump higher or drive faster is what makes users display high LU.

We report consumer knowledge to be a strong antecedent of LU for mobile applications. More specifically, as we argued up front drawing on previous studies, in order to move ahead of an important market trend in a given domain a user needs to have a clear understanding of how to perform ordinary product-related tasks successfully (Schreier and Prügl, 2008; Alba and Hutchinson, 1987). Our finding of consumer knowledge as antecedent of LU in the mobile applications domain further corresponds to findings by Schreier and Prügl (2008) in the domain of kite-surfing and Faullant et al (2012) in the domain of kitchen appliances. Consumer knowledge therefore seems to be an important determinant of LU across product domains.

We did though not find technology cognizance to be an antecedent of LU in the mobile application domain. On the one hand this may seem surprising since technology cognizance was found to be strongly and positively related to consumer knowledge which in turn was found to be a strong antecedent of LU. On the other hand, there may be a significant amount of users who display high awareness of technical capabilities in a domain who still do not have the deeper insights required for moving ahead of a trend as characterized for LU. As a consequence hereof, consumer knowledge and technology cognizance may impact differently on LU.

Turning to consequences we found opinion leadership to be strongly influenced by LU. Following that those high on LU are knowledgeable it is hardly surprising that others turn to these expert users asking them for advice on selections of products and services or trends to come in the given domain. Our findings of mobile applications correspond to findings in the domains of tech diving (Schreier, Oberhauser and Prügl, 2007) and veterinaries (Simbeck, 2013). Following such findings users high on LU are likely to play an important role for diffusion of products as they influence other consumers and by definition are ahead of an important market trend.

Finally, as expected we found a significant negative relationship between opinion seeking and LU. The negative influence of opinion seeking on LU was though found to be relatively weaker than the positively influence of opinion leadership on LU. This relative difference in magnitude between the two consequences on LU is possibly explained by that some users high on LU seek advice from certain others who are also ahead of the important market trend and expect high benefits from innovating. It could also be that those high on LU to a higher extent want to: demonstrate their innovations to other users, promote the important market trend or are approached by opinion seekers due to their high level of knowledge in the domain. Our findings for the relative importance of opinion seeking and opinion leadership as consequences of LU are in accordance to what Schreier, Oberhauser and Prügl (2007) found in their study of tech-divers.

CONCLUSIONS

In the present research we investigated four antecedents (intrinsic motivation, extrinsic motivation, consumer knowledge and technology cognizance) and two consequences (opinion leadership and opinion seeking) of lead userness (LU). Based on a survey study of mobile applications, using a sample of 156 undergraduate students in business administration, we report: (1) consumer knowledge to be the only antecedent positively and significantly influencing LU; (2) opinion leadership and opinion seeking to be consequences of LU. More specifically, opinion leadership was found to be positively and significantly influenced by LU whereas opinion seeking was found to be negatively and significantly influenced by LU. Hence, with regards to RQ1 we find that consumer knowledge is the most important antecedent of LU whereas opinion leadership is found to be the relatively more important consequence of LU.

RQ2 captured to what extent our findings for antecedents and consequences found in other domains generalize to the mobile application domain. In this regard, our findings corresponds highly to studies of LU in other domains. Our finding for knowledge as an antecedent of LU is in line with findings of previous studies in the domains of kite surfing and kitchen appliances. Our finding that neither intrinsic nor extrinsic motivation acted as an antecedent of LU for mobile applications corresponds to what has been previously found for kitchen appliances. Also, our finding for opinion leadership and opinion seeking as consequences of LU in the mobile application domain corresponds to findings reported for tech-diving and veterinarians.

The most unexpected result reported in the current study is that motivation does not seem to be an antecedent of LU. This is surprising since users displaying high LU expect high benefits from innovating whether that benefit is of monetary or other extrinsic kind such as being able to drive faster or safer in one's vehicle. Future research should further investigate different motivational styles (Deci and Ryan, 2000) to further explore the role of motivation for LU. Also, studies are called for on other driving forces of LU than reaching a goal or liking to perform a task per se. One such potential avenue for future research is what role frustration plays as an antecedent of LU. That is, users who are disappointed about current supply may be driven by their feelings of frustration rather than their enjoyment or separable outcomes reached from innovating.

We also suggest future research of antecedents and consequences of being ahead of a market trend as well as antecedents and consequences from expecting high benefits from innovating. Hence, studying each of these two characteristics of LU separately may shed important light on what drives a user to be ahead of a market trend and what drives him to innovate. This way some antecedents and consequences related to only one of the two LU-characteristics can likely be more easily discovered. In turn such insights may contribute to extend lead-user theory by providing insights on how to stimulate each characteristic of LU in a user.

Finally, our findings also have implications to practice. Companies should search for users displaying high LU among those consumers that are knowledgeable and provide advice to other consumers in the market. This way the cost of identifying the users high on LU may be lowered, especially since this user group typically constitutes a small proportion of all the users in a market. Also, companies should think of how these identified users can help promote their innovations. Especially that is since many consumers prefer to rely on advice from such users high on LU rather than relying on commercial marketing information in making purchase decisions. Finally, companies may benefit from being informed by users high on LU about important market trends to come as well as get use of their expertise in coming up with new innovations and preventing inferior innovations from being developed and marketed.

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TABLE 1: Measurement and items (N=156)

Construct	Item	Mean	SD	Cronbach's Alpha (α)
Intrinsic Motivation*				0.89
	IM1	4.37	0.80	
	IM2	4.00	0.93	
	IM3	4.23	0.89	
Extrinsic Motivation**				0.79
	EM1	5.42	1.27	
	EM2	5.43	1.37	
	Em3	6.35	0.97	
Technology Cognizance*				0.89
	TC1	4.03	0.99	
	TC2	4.28	0.89	
	TC3	4.00	1.00	
Knowledge*				0.87
	CI1	3.09	1.04	
	CI2	3.13	1.04	
	CI3	3.50	0.99	
Opinion Leadership*				0.84
	OL1	3.14	1.05	
	OL2	3.10	1.30	
	OL3	3.14	1.25	
	OL4	2.75	1.08	
	OL5	2.75	1.30	
	OL6	2.72	1.15	
Opinion Seeking*				0.80
	OS1	2.79	1.15	
	OS2	3.85	1.07	
	OS3	3.27	1.27	
	OS4	3.33	1.21	
	OS5	3.37	1.19	
	OS6	3.32	1.16	
Lead Userness *				0.69
	LU2	1.20	0.54	
	LU3	1.64	1.07	
	LU4	1.33	0.86	
	LU5	1.92	1.05	
	LU6	2.17	1.32	

Note 1: All measurement scales used a likert-type scale such that higher scores indicate higher levels of the construct being measured. * scale 1-5, ** = scale 1-7

TABLE 2: Correlation matrix for variables (N=156)

Constructs	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
(1) LU								
(2) IM	0.15							
(3) EM	0.18*	0.43**						
(4) TC	0.35**	0.36**	0.08					
(5) KNOW	0.54**	0.22**	0.18*	0.54**				
(6) OL	0.47**	0.17**	0.20*	0.38**	0.59**			
(7) OS	-0.23**	0.10	0.00	-0.10	-0.03	0.00		
(8) AGE	0.04	-0.25**	0.04	-0,27**	-0.10	-0.15	-0,09	
(9) SEX	0.28**	-0.07	-0.03	0.23**	0.40**	0.37**	-0.06	-0,23**

Note 1: LU= Lead Userness, IM= Intrinsic motivation, EM= Extrinsic motivation, TC= Technology cognizance, KNOW= Knowledge, OL= Opinion Leadership, OS= Opinion Seeking.

Note 2:* denotes p-value: <0.05; ** denotes p-value <0.01.

TABLE 3: Results of OLS regression for lead userness (LU) of mobile applications

Antecedents of LU		
Independent variables	β - estimate	p-value
<u>Research variables:</u>		
H ₁ : Intrinsic motivation	.014	.847
H ₁ : Extrinsic motivation	.050	.225
H ₂ : Knowledge	.353	.000**
H ₃ : Technology cognizance	.075	.256
<u>Control variables:</u>		
Age	.016	.189
Sex	.157	.164

Note 1: OLS regression (N=156); dependent variable: Lead userness (LU); R²= .xxx (F= 12.128; p<0.00); p-values are one-sided: * p<0.05, ** p<0.01.

TABLE 4: Results of OLS regression for opinion leadership and opinion seeking of mobile applications

Consequences of LU				
Independent variables	<u>Opinion leadership</u>		<u>Opinion seeking</u>	
	β - estimate	<i>p</i> -value	β - estimate	<i>p</i> -value
<u>Research variables:</u>				
H ₄ , H ₅ : Lead usersness (LU)	.542	.000**	- .277	.008
<u>Control variables:</u>				
Age	-.021	.130	-.016	.278
Sex	.460	.001**	-.040	.794

Note 1: OLS regression (N=156); dependent variable: Opinion leadership; R²= .xxx (F= 21.258; p<0.00); *p*-values are one-sided; * p<0.05, ** p<0.01.

Note 2: OLS regression (N=156); dependent variable: Opinion Seeking (LU); R²= .xxx (F= 3.259; p<0.02); *p*-values are one-sided; * p<0.05, ** p<0.01.

TABLE 5: Summary of hypothesized relationships

Relationship		Expected	Found
<u>Antecedents of lead usersness (LU):</u>			
H ₁	IM → LU	+	n.s.
	EM → LU	+	n.s.
	(IM → LU) – (EM → LU) ^a	+	n.s.
H ₂	KNOW → LU	+	+
H ₃	TC → LU	+	n.s.
<u>Consequences of LU:</u>			
H ₄	LU → OL	+	+
H ₅	LU → OS	-	-

Note 1: LU= Lead Usersness, IM= Intrinsic motivation, EM= Extrinsic motivation, TC= Technology cognizance, KNOW= Knowledge, OL= Opinion Leadership, OS= Opinion Seeking.

Note 2: ^a Relationship between IM and LU is stronger than relationship between EM and LU

Note 3: + positive significant; - negative significant; n.s. not significant.

APPENDIX 1: Scale items

Intrinsic Motivation (1= *strongly disagree*; 5= *strongly agree*)

- IM1: I find using a smartphone to be enjoyable
- IM2: The actual process of using a smartphone is pleasant
- IM3 I have fun using a smartphone

Extrinsic Motivation (1= *strongly disagree*; 7= *strongly agree*)

- EM1: Using a smartphone increases my performance
- EM2: Using a smartphopne enhances my effectiveness
- EM3: Overall I find the smartphone to be useful

Technology Cognizance (1= *strongly disagree*; 5= *strongly agree*)

- TC1: I have acquainted myself with, more or less, every feature of my smartphone
- TC2: I know how to adjust the settings of a computer smartphone such that it works well for me
- TC3: I know the most important technical strengths and weaknesses of my smartphone

Consumer Knowledge (1= *strongly disagree*; 5= *strongly agree*)

- KNOW1: How high would you rate your expertise in mobile units and applications?
- KNOW2: How interested are you in mobile units and applications?
- KNOW2: How clear an idea do you have of which characteristics are important in providing you maximum satisfaction when using mobile units and applications?

Opinion Leadership (1= *strongly disagree*; 5= *strongly agree*)

- OL1: My opinion on mobile units and applications does not seem to count with other people
- OL2: When they choose mobile units and applications, other people do not turn to me for advice
- OL3: Other people rarely come to me for advice about choosing mobile units and applications
- OL4: People I know pick mobile units and applications based on what I have told them
- OL5: I often persuade others to buy the mobile units and applications that I like
- OL6: I often influence people's opinions about mobile units and applications

Opinion Seeking (1= *strongly disagree*; 5= *strongly agree*)

- OL1: When I consider buying/downloading mobile units and applications, I ask other people for advice
- OL2: I don't like to talk to others before I buy/download mobile units and applications
- OL3: I rarely ask other people which mobile units and applications to buy/download
- OL4: I like to get others' opinions before I buy/download mobile units and applications
- OL5: I feel more comfortable buying/downloading mobile units and applications when I have gotten people's opinions on it
- OL6: When choosing mobile units and applications, other people's opinions are not important to me

Lead Userness (1= *strongly disagree*; 5= *strongly agree*)

- OL2: I invent mobile units and applications myself
- OL3: I think I can better invent and advance mobile units and applications than others can
- OL4: I invent new mobile units and applications thinking that I will be somehow rewarded for it
- OL5: I am normally the first to adapt new mobile units and applications
- OL6: I would prefer to be the only one having new mobile units or applications