Individual Innovativeness Levels of Lead Users and Non-Lead Users: The Case Study of Surgeons in Turkey

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Abstract

One of the important features of lead users is their desire to try and adopt new products or services being released to the market more quickly than other consumers are. Lead users are also expected to have high level of individual innovativeness. This study is to examine whether there is any difference in the individual innovativeness levels of lead users. This research was carried out on surgeons; 73 lead user and 70 non-lead user surgeons were compared and the results were presented. First of all, the individual innovativeness levels of the group were measured with the evaluation of all surgeons who participated in the survey and 60% of surgeons were determined to be in innovator and early adopter which are the highest two categories. Variance analysis showed that there was a significant difference between the individual innovativeness levels of lead users and non-lead users. Moreover, it was also found a significant difference in sub-dimensions of individual innovativeness (resistance to change, openness to experience and risk taking, opinion leading). The averages of lead users are lower than those of non-lead users in resistant to change, but the average of lead users are higher than those of non-lead users in other two sub-dimensions..

Keywords: Lead Users, Individual Innovativeness, Innovation, Medical Industry, Quantitative Research

1. Introduction

There are many factors that motivate organizations in order to make innovation. Innovation can reduce the production costs, improve the product quality, create the market for new products or can obtain market share and decrease its dependence on unreliable factors which can change at any time in the production. In general, innovation which provides the company a sustainable cost or demand advantage over its rivals is one of the most important competitive advantages in today's business world (Webster, 2004:733). The fact that innovation has a great importance makes the research conducted on this subject important. Nowadays open innovation, which changes the business world and becomes a new strategy for importing opinions, resources and technologies systematically, is an approach advocated by businesses when many companies appealed to their own R&D efforts in order to lead innovation and growth in the past (Kaplan and Winby, 2007).

Therefore, internal and external opinion-induced innovations are seen in the literature. In many innovation sources, users of products or services from external sources have become one of attractive research topics in recent years. Among the product users, lead users are users who have the idea for developing the product they use and carry out their ideas in a sort of way. These users who are also expressed as co-developers in some sources (Schweitzer et al., 2014:156) are thought to be able to contribute to a vital function such as new product development in organizations and provide stage-gate processes to occur more quickly and the developed new products to become more successful in the market.

Organizations should primarily identify such users so as to benefit from lead users in new product development. It is very likely that there is a link between the tendencies of lead users to develop new product and their acceptance speed of new product at individual level (Schreier et al., 2007; Schreier and Prügl, 2008). The starting point of this study is the link between the possibilities of lead user features of individuals who have high level of individual innovativeness and their new product development.

2. Conceptual Framework

Users have revealed data related to their unsatisfied needs in many areas to contribute more than the marketing researchers did. They even have their viewpoints which will contribute to solutions that can meet directly their needs. The data arising from these perspectives has a broad spectrum ranging from substantial opinions related to work to testing prototypes of the requested new product, process, and services. Lead users either tolerate their unsatisfied needs or develop innovative solutions that will meet their needs on their own (Terwiesch and Ulrich, 2009:59). Users leading new product, process and services have two main features (von Hippel, 1986:795; Urban and von Hippel, 1988:569; Morrison et al., 2000:1513);

- ✓ Lead users have the needs that will be generalized in the market in the future. However, they encounter these needs months and years before others in the market meet them.
- ✓ Lead users provide significantly benefit for developing solutions to these needs.

Empirical research has demonstrated that many users (from 10% to 40%) are interested in product development and modification (von Hippel and Oliveira, 2009:8). Some of the empirical researches have indicated that users developed some products and processes for the first time and used their prototypes and then commercialized these processes (Lettl et al., 2006; Lettl et al., 2008; Raash et al., 2008). The concept of user-centered innovation is mostly examined at the sectoral level. This is because some sectors are more suitable for user innovations in comparison with others. Innovative activities undertaken by lead users are seen more in such areas as medical equipment (Biemans, 1991; Lettl et al., 2006; Lettl et al., 2008), computer programs and infrastructures (Urban and von Hippel, 1988; Franke and von Hippel, 2003), construction support products (Herstatt and von Hippel, 1992), electronic banking services (von Hippel ve Riggs, 1996; von Hippel and Oliveira, 2009), library information systems (Morrison et al., 2000; Morrison et al., 2004), sports equipment (Lüthje, 2004; Lüthje et al,. 2005; Franke et al., 2006; Hienerth, 2006), smart houses (Schweitzer, 2014).

Individual innovativeness are also expressed as personal innovativeness (Tsou, 2012; Lopez-Bonilla and Lopez-Bonilla, 2012; Lu et al., 2005), innovative individual behaviors (Tabak et al., 2010) in the relevant literature. Although different expressions are used, individual innovativeness can be defined as “development, adoption and implementation of any innovation” (Yuan and Woodman, 2010; Çoklar, 2012). Innovativeness represents when an individual adapts to any innovation compared with the adaptation of the rest of the society. If individual adopts innovation in a very period when it occurs, one is considered to be innovator (Midgley, 2014). From one point of view; innovativeness is a concept that describes the extent to which individuals or units in a social system adopt innovations earlier than other members of the system do. Individuals are divided into five classes including innovators, early adaptors, early majority, late majority, and laggards in terms of innovativeness. This pattern was put forth by Rogers (2003). Rogers (2003:281) classified individuals according to their innovativeness levels and stated that they split up as 2,5% innovators, 13,5% early adaptors, 34% early majority, 34% late majority and 16% laggards. Innovators are the first ones to experience any innovation.

Their assertiveness is almost an obsession. They can cope with uncertainties about any innovation at high level. Early adaptors are more integrated parts of the local social structure than innovators. However, innovators are more cosmopolitan. Innovators and early adaptors are more willing to take a risk to try new opinions compared to other people in the system. Both two groups have greater tendency to benefit from innovative technologies (Yiv et al., 2006: 395). Early majority ask for advice and information from early adaptors on innovation. The majority of opinion leaders who will help them to achieve competitive power are placed in this category. Early majority are in close relations with other members of the society and they influence each other. They sometimes can take the positions of opinion leaders within the society. Late majority adopt the innovation after the adaptation of individuals in their own environment. They can’t comply with a new opinion without being sure that it is reliable. Laggards are the last ones to accept innovation. They behave in a way how the previous generation made a decision. When laggards attempt to adopt a new idea, it has already been out for innovators (Yılmaz Öztürk and Summak, 2014: 847).

It is thought that lead users must have an innovative disposition to contribute to innovation. When compared to the average level of users, lead users are interested in innovativeness at level that will contribute to their efforts for new product development to be more innovative (Schirr, 2013:238). Thus, these individuals can adopt innovations earlier than others can. Models and theories related to the adoption of innovations are generally classified under two titles as developer and adopter-based. Developer-based theories focus on the features and superiority of the new one whereas adopter-based ones concentrate on the characteristics of adopter individuals, their perspectives, and user-friendly products (Usluel and Mazman, 2010:61). When analyzed the research (Bilgram et al., 2008; von Hippel, 1986; Urban and von Hippel, 1988) which examine the characteristics of lead users, one of the important features of lead users seems to have high level of their adoption speed to new products and services. According to innovativeness levels, innovators are individuals who take more of a risk and have advanced technical knowledge (Yiv et al., 2006: 395) and these are also one of the features attributed to lead users in the literature. Individuals who have already made one or more innovations are expected to have higher level of innovativeness than ordinary users who haven't made any innovation before. When the innovativeness is discussed, lead users have also come into prominence in the developers' perspective.

Some research on innovativeness in the individual sense have focused on the adoption of innovations in the information technologies (Agarwal and Prasad, 1998; Lopez-Bonilla and Lopez-Bonilla, 2012; Jin, 2013) while some of them have focused on individual innovativeness levels in trainer, consultant and teacher candidates (Çoklar, 2012; Çuhadar et al., 2013). Jin (2013: 1912) put forward that innovators and early adopters evaluated the software more positively compared to other groups and were more satisfied in his study which he conducted by taking an internet content filtering software as an example. This study aims to determine the innovativeness levels of surgeons who have and haven't made innovation in the medical sector before and demonstrate the benefit of the partnership of potential lead users and companies in practice.

The hypothesis of the research is as below;

H_1: Lead users have higher level of individual innovativeness than non-lead users.

3. Research

3.1. Method and Scope of Research

The study was conducted by using a structured questionnaire. In the question form, the scale, which was developed by Hurt et al. (1977) and Turkish adaptation, validity and reliability studies were made by Kılıçer and Odabaşı (2010), was used as "individual innovativeness scale". Moreover, demographic features such as age, gender of the surgeons and professional features such as placement year, type of institution (private/public) and branch were asked in the second part of the survey. In the previous studies the researcher conducted earlier (Çetin Gürkan, 2013; Çetin Gürkan, 2014), questionnaire was directed to e-mail addresses of the surgeons obtained by scanning websites of private and public hospitals. Furthermore, as a result of qualitative research conducted especially in the previous study (Çetin Gürkan, 2012) questionnaire was also sent to e-mail addresses of the surgeons who made the device development studies in the medical sector. One hundred forty-four questionnaires were filled out, returned, and included in the analysis.

Demographic and professional characteristics of the surgeons involved in the research are as seen in Table 1.

Table 1: Demographic and Professional Characteristics of Surgeons

Gender	**Frequency**	**%**	**State of Being Lead User**	**Frequency**	**%**
Male	128	88,9	Lead User	73	50,7
Female	15	10,4	Non-lead user	70	48,6
Missing	1	,7	Missing	1	,7
Placement Year	**Frequency**	**%**	**Major**	**Frequency**	**%**
Up to 10 years	18	12,5	Neurosurgery	18	12,5
Between 11-20 years	42	29,2	Pediatric Surgery	4	2,8
Between 21-30 years	55	38,2	General Surgery	27	18,8
More than 31 years	26	18,1	Thoracic Surgery	6	4,2
Age	**Frequency**	**%**	Ophthalmology	9	6,3
Under the age of 40 years	30	20,8	Gynecology and Obstetrics	19	13,2
Between the ages of 41-50 years	56	38,9	Cardiovascular Surgery	7	4,9
51 –aged and above	57	39,6	Otorhinolaryngology	11	7,6
Missing	1	,7	Orthopedics and Traumatology	17	11,8
Type of Institution	**Frequency**	**%**	Plastic and Reconstructive Surgery	16	11,1
Public	85	59,0	Urology	7	4,9
Private	53	36,8			
Missing	6	4,2			

3.2. Findings

The Scale items of Individual innovativeness points of 144 surgeons participating in the research consist of 12 positive (1, 2, 3, 5, 8, 9, 11, 12, 14, 16, 18. and 19. items) and 8 negative (4, 6, 7, 10, 13, 15, 17. and 20. items) ones. With the help of the scale, innovativeness point is calculated by adding 42 points to the point obtained by subtracting total points taken from negative items from the received total points. The lowest 14 points and the highest 94 points can be achieved through the scale (Kılıçer and Odabaşı, 2010: 153). Total points of individual innovativeness were classified according to five categories proposed by Rogers (1995). In this classification, individuals are expressed as *"Innovator"* if the calculated point is above 80; as *"Early Adopter"* if it is between 69 and 80 points; as *"Early Majority"* if it is between 57 and 68 points; as *"Late Majority"* if it is between 46 and 56 points; as *"Laggard"* if it is below 46 points. Table 2 shows the classification of surgeons included in the study.

Table 2: Individual Innovativeness Levels of Surgeons

	Frequency	**%**
Innovator	27	18.8
Early Adopter	61	42.4
Early Majority	43	29.9
Late Majority	10	6.9
Laggard	3	2.1
Total	144	100

When the distribution of surgeons is examined in terms of individual innovativeness levels, 61.2% of surgeons are seen to gather in innovator and early adopter categories which adapt quickly to innovations. When considered that 73 of the surgeons in the study consist of individuals who have already an innovation idea and/or have made studies for manufacturing process of an innovation idea, this high rate is thought not to be unusual. Cronbach Alpha analysis was made for the reliability analysis of the individual innovativeness scale used in the study and confirmatory factor analysis was also made for the construct validity. According to the results of factor analysis, factor analysis was performed by using Principal Components Method and Varimax Rotation Method in order to verify the construct validity. Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and Bartlett Sphericity Test were implemented in order to test the suitability of data set for factor analysis. Data set was found to be suitable for factor analysis, because Bartlett Test became meaningful with 0,845 KMO value of the scale and 0,000 by removing two expressions (5th and 15th Expressions) gathered under one factor in two different stages.

As a result of factor analysis, the scale items were named as "resistance to change," "openness to experience and risk taking" and "opinion-leading" by collecting under three dimensions. Factor analysis results are given in Table 3.

Table 3: Factor Analysis Results Belonging to Individual Innovativeness Scale

Question Number	Resistance to Change	Openness to experience and Risk-taking	Opinion-Leading
AVERAGE	**2,5830**	**4,1591**	**3,9798**
S4	,716		
S6	,778		
S7	,759		
S10	,551		
S17	,689		
S20	,725		
S2		,678	
S3		,681	
S14		,706	
S16		,644	
S18		,695	
S19		,721	
S1			,676
S8			,774
S9			,788
S11			,661
S12			,736
Explained Variance	33,689	16,947	7,883
Total Explained Variance: 58,519			

The result of factor analysis has been seen that openness to experience and risk-taking dimensions collected under one single factor unlike other studies. It is difficult to abandon the existing methods in areas about human health and life, while experiencing new methods can bring about serious problems. That surgeon takes a risk comes into question in this case. This result is expected to arise from the thought that new experiences are seen to be equivalent with risk-taking in the working conditions of surgeons participated in the study

Table 4 shows Cronbach Alpha values of total individual innovativeness scale and sub-dimensions emerging as a result of factor analysis. The value of individual innovativeness scale demonstrates that the scale is very reliable when values of sub-dimensions show that they are highly reliable.

Table 4: Reliability Analysis Results of Individual Innovativeness Scale

	Cronbach Alpha Value (α)
Individual Innovativeness (Total)	,693
Resistance to change	,856
Openness to experience and risk-taking	,828
Opinion-leading	,833

Comparison tests were performed to test the hypothesis of the research. Firstly, individuals, who answered affirmatively for one of two questions such as "Have you ever developed any surgical instrument/device that can be used for your profession?" and "Have you ever contacted with any medical company to release any instrument/device/method to the market?" asked to identify the state of lead user, were considered as lead user and those who haven't had any experience for the product development were discussed in other group. Groups were compared both at the individual innovativeness level and at the sub-dimensions of the individual innovativeness level. Analysis results are given in Table 5 and Table 6.

Table 5: Comparison of Individual Innovativeness Levels of Lead Users and Non-Lead Users

State of Being Lead User	N	X	SS	Sd	T	P
Lead User	73	74,5097	8,84967	141	5,110	,000
Non-Lead User	70	66,1561	10,65084			

Table 6: Comparison of Sub dimensions of Individual Innovativeness Levels of Lead Users and Non-Lead Users

Dimension	State of Being Lead User	N	X	SS	Sd	t	p
Resistance to Change	Lead User	73	2,4189	,80087	141	-2,534	,012
	Non-Lead User	70	2,7541	,78069			
Openness to Experience and Risk-Taking	Lead User	73	4,4062	,51749	141	5,006	,000
	Non-Lead User	70	3,9014	,68052			
Opinion-Leading	Lead User	73	4,2402	,61016	141	4,587	,000
	Non-Lead User	70	3,7082	,77062			

The result of the discriminate analysis has indicated that there is a significant difference in individuals, who have the feature of lead user, in terms of all of the individual innovativeness and its sub-dimensions. It is seen that lead users have higher averages of individual innovations than non-lead users. The averages of resistance to change obtained from the avoidant questions in the scale have been realized to be higher in non-lead users. Moreover, it is seen in the previous studies that the averages of openness to experience, risk-taking tendency and opinion-leading which are the features of lead users and within the dimensions of individual innovativeness become different in lead users and non-lead users and these are higher in lead users than others are.

4. Discussion

The purpose of the study is to demonstrate whether there is a difference between lead-user surgeons and non-lead user surgeons in the context of individual innovativeness levels. Surgeons who had an idea to develop a new device/method and/or shared this idea with the producing company and those who had never experienced such a situation were included in the study. Individual innovativeness behaviors of one hundred forty-four surgeons were evaluated and analyzed. 50.7% of surgeons participated in the research were identified as lead user. Target sampling was carried out to lead users by sending questionnaire to surgeons who were identified in the studies conducted by Çetin Gürkan (2012; 2014) because there aren't many lead users and the long-term preliminary study is necessary to determine them. Hence, lead users and non-lead users were tried to balance numerically.

Individuals are classified into five categories as innovator, early adopter, early majority, late majority, and laggard in terms of their individual innovativeness levels (Rogers, 1995). According to the results of the survey, it is seen that 18.8% of surgeons are innovator, 42.2% of them are early adopters, 29.9% is early majority, 6.9% is late majority and 2,1% is laggard. When examined other research which were conducted on the subject in Turkey, it was seen that there was a similar result in the studies, which Çoklar (2012: 104) had applied with training managers, and the total of innovators and early adopters is 62.7%. Another study conducted on teacher candidates by Çuhadar et al. (2013) demonstrated that the candidates took place in early majority category on the basis of average points. Similarly, Adıgüzel (2012) carried out another study on teacher candidates and the study showed that 55% of candidates were early majority and only 26% of them were included in innovator and early adopter categories. Lead user surgeons in this study constitute the half of the total participants and 60% of surgeons who are included in innovator and early adopter categories.

The scale was gathered under three dimensions in the factor analysis applied to the individual innovativeness scale. Openness to experience and risk-taking dimensions which are two of four dimensions were combined as one dimension in the validity – reliability studies performed by Kılınçer and Odabaşı (2010). As a consequence, individual innovativeness scale consists of the sub-dimensions such as "resistance to change", "openness to experience and risk-taking" and "opinion-leading" and it is used in the analysis. When the averages are examined, it is seen that the dimension of resistance to change has the lowest average. Although there isn't any huge difference between other two dimensions, openness to experience and risk-taking dimensions have the highest averages. It is an expected result that the participant group, who has high innovativeness levels, has low level of the average of resistance to change and others are above the medium level.

The analysis, which examined differences in the individual innovativeness levels in terms of lead users and non-lead users, have demonstrated that both two groups showed statistically significantly difference in the context of both individual innovativeness and its sub-dimensions. When the averages of individual innovativeness are compared, it is shown that lead user surgeons have higher level of individual innovativeness than non-lead user surgeons do. It is revealed that surgeons who tend to develop a new product idea and make various studies to carry out this idea adopt new device and methods in their own field more quickly. Considering the difference in the sub-dimension of resistance to change, that lead users have lower averages of resistance to change supports this situation.

In the context of the area of this study, it can be useful that companies which develop products and release these products to the market in the medical sector benefit from lead-user and improve the product development processes. One of the most important results of this study is that the individual innovativeness levels of surgeons are significant criteria for determining lead users among surgeons. Companies follow surgeons who are eager to try different device and methods, open to new experiences, tend to take a risk and become prominent among their colleagues due to their opinions in their own field, receive support from them as lead users and include them in the processes of the new product development, which will provide competitive advantage and can give the way to reach the better position on the market.

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