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Araştırma Makalesi

RELATIONSHIP BETWEEN WEB BASED USER INNOVATION TOOLS AND FIRMS' INNOVATIVENESS

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Abstract

The main objective of this study is to investigate the relationship between the usage of web based user innovation tools and firms' innovativeness. Besides, it is also aimed to explore the tools that are used in conjunction and trigger innovativeness. 61 firms operating in consumer goods/services sector within the list of Fortune Top 500 Turkey List, published in 2014, responded to the questionnaire. Findings reveal that not all of the web based user innovation tools have a significant relationship with firms' innovativeness. Hypotheses of the study are tested by correlation analysis and research questions are investigated via mining association rules with FP-Growth algorithm. The association rules mined pinpoint that 71% of the companies that use "virtual communities formed by users, and marketing intelligence services" together and 65% of the firms using market intelligence services in their new product development process are found to trigger innovativeness. Up to date, to the best of our knowledge, there has been no research focusing on the relationship between the usage of web based user innovation tools and firms' innovativeness. Therefore, the most important contribution of this study is being a pioneer attempt to provide an empirical evidence for the aforementioned relationship by shedding light on each tools' effect on firm's innovativeness for consumer goods/services. Web based user innovation tools are the prominent enablers of customer integration into innovation processes of firms leading to customer generated value. Thus, it may be important for firms to decide on the bundle of the web based user innovation tools to be used; since the usage of these tools together or separately might have different effects on firms' innovativeness.

Keywords: *Innovativeness, Web Based User Innovation Tools, Association Rules, Innovation.*

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WEB TABANLI KULLANICI İNOVASYON ARAÇLARI VE FİRMA YENİLİKÇİLİĞİ İLİŞKİSİ

Öz

Bu çalışmanın temel amacı, web tabanlı kullanıcı inovasyon araçları kullanımı ile firma yenilikçiliği arasındaki ilişkiyi araştırmaktır. Bunun yanı sıra çalışmada, birlikte kullanılan inovasyon araçlarının ve yenilikçiliği tetikleyen araçların ortaya çıkartılması hedeflenmektedir. 2014 yılı Fortune ilk 500 Türkiye listesinde yer alan ve son tüketiciye yönelik ürün ve hizmet üreten 61firma çalışmamızın örneklemini oluşturmaktadır. Hipotezler korelasyon analizi ile test edilmiş olup, araştırma soruları ise FP-Büyüme algoritmasıyla analiz edilmiş ve birliktelik kuralları elde edilmiştir. Bulgular, araştırmaya konu olan web tabanlı kullanıcı inovasyon araçlarından sadece bazılarının firma yenilikçiliği ile ilişkili olduğunu ortaya koymaktadır. Birliktelik kurallarından elde edilen bulgular ise, yeni ürün geliştirme süreçlerinde, "kullanıcılar tarafından oluşturulan sanal toplulukları" ve "pazar istihbarat hizmetlerini" birlikte kullanan firmaların %71'inde; yalnızca "pazar istihbarat hizmetlerini" kullanan firmaların %65'inde yenilikçiliğin tetiklendiğini işaret etmektedir. Bilgimiz çerçevesinde bugüne kadar, web tabanlı kullanıcı inovasyon araçları ve firma yenilikçiliği arasındaki ilişkinin incelendiği bir çalışma yazında bulunmamaktadır. Ülkemizde ve dünyada artan inovasyon çalışmaları göz önüne alındığında, bu çalışmanın akademik alandaki en önemli katkısı, tüketim ürünleri için firma yenilikçiliğini pozitif yönde etkileyen her bir aracın ortaya çıkarılarak, söz konusu ilişkiye ampirik kanıt sağlayan öncü bir girişim olmasıdır. Web tabanlı kullanıcı inovasyon araçları, firmalara, inovasyon süreçlerine kullanıcıları entegre ederek, kullanıcılar tarafından oluşturulan değerin yaratılmasında önemli katkılarda bulunmaktadır. Bu sebeple, kullanılacak araçların doğru olarak seçilmesi firmaların yenilikçilik kapasitelerini arttırarak değer yaratmaları için de büyük önem taşımaktadır. Bu anlamda bu çalışmanın firmalar açısından da faydalı olması beklenmektedir.

Anahtar Kelimeler: *Yenilikçilik, Web Tabanlı Kullanıcı İnovasyon Araçları, Birliktelik Kuralları, İnovasyon.*

INTRODUCTION

Role of collaborations with customers in creation of value through product and service innovation process has been stressed widely by marketing scholars (Sawhney et al., 2005). Baldwin and von Hippel (2011) assert that both innovation by individual users and open collaborative innovation increasingly compete with, and may displace producer innovation in many parts of the economy. Desouza et al. (2008) claim that by identifying, analyzing and communicating with customers; incorporating them into their existing innovation process and encouraging customers to engage in improving existing products and services, firms can achieve to integrate customers in their innovation process. Consumers are invited to actively participate in the creation of new products by generating and evaluating new product ideas; elaborating, evaluating, or challenging product concepts; discussing and improving optional solution details; selecting or individualizing the preferred virtual prototype; testing and experiencing the new product features by running simulations; and demanding information about or just consuming the new

product (Füller et al., 2009: 72). Technology is providing opportunities to gain access to input from larger groups of users and the use of Internet can be less costly than other types of user feedback (Bosch-Sijtsema and Bosch, 2015: 794). Information technologies enhance the producer–consumer collaboration in new product development processes which enables the usage of different web based tools used to engage customers in collaborative product innovation besides the traditional forms providing a way to capture customer insight in order to be market oriented. Market orientation which is an antecedent of firms' innovativeness foster user/customer ideas to be used as a source of new product/service ideas (Lawton and Parasuraman, 1980).

In this regard, the main objective of this study is to explore the relationship between the usage of web based user innovation tools and firm's innovativeness. Besides, the duration of the usage of these tools are considered to have an effect on the relationship between tool usage and innovativeness, thus the effect of the duration is also investigated. Furthermore, the relationship between "offering a new product to the market through the usage of customer ideas" and firms' innovativeness is also analyzed. Association rules of web based user innovation tools are mined to explore which tools are used in conjunction and trigger innovativeness. This study provides new insights on the integration of users into innovation processes of firms via web based user innovation tools by shedding light on its effect on firm's innovativeness by being a pioneer study to provide empirical validation in Turkey for consumer goods/services.

THEORETICAL FRAMEWORK

Role of Users in Innovation Process

The concepts of innovation and market orientation are gaining ground steadily in the context of an increasingly competitive and highly volatile environment, subject to the pressures of rapid-changing customer needs and desires (Aldas-Manzano, et. al., 2005). Openness to external knowledge is a critical factor in facilitating individual creativity within organizations (Salter et al., 2015). Moreover, collaborating with stakeholders has gained a strategic importance for firms (Gulati, et. al, 2000; Iansiti and Levien, 2004) and has led to the emergence of the practices of open innovation, distributed innovation (Bengtsson and Ryzhkova, 2013) or distributed co-creation (Bughin, et. al., 2008) which are similar terms emphasizing innovation through an open network of interested users, suppliers and other stakeholders. Users as important actors in open innovation practices, can significantly contribute to the innovation process (Schuhmacher and Kuester, 2012). Studies reveal that 6.2 % of the UK population have recently developed or modified consumer products to better serve their personal needs (Flowers et al. 2010) and 10% to over 30% of user respondents report developing a new product for personal or in-house use studied to date (von Hippel, 2002). Moreover, recent studies in consumer goods sector claim that users are successful

co-creators of new products (Bogers et. al, 2010; von Hippel and Jin, 2008; Hienerth, et. al, 2014; Poetz and Schreier, 2012) which have a positive impact on companies' innovation performance (Carbonell et al., 2009; Wadell et al., 2013; Ryzhkova, 2015).

Thus to increase the innovativeness of a company, understanding the customer and integrating them via different techniques and tools into the innovation process is vital for marketers. Nevertheless, conventional market research techniques could only provide shallow information regarding consumer needs, while other techniques, such as ethnographic studies, are both difficult and time-consuming (von Hippel, 2001). However, emergence of internet has made it much easier to reach customers and collaborate with them. Today, conventional marketing research tools like questionnaires, focus groups and observation can be applied through internet. Further, new technologies enable customers to design and develop their own products. Throughout this paper, both online conventional and contemporary technologies that involve users within new product development process are conceptualized as web based user innovation tools.

Web Based User Innovation Tools

There are various web based innovation tools that stimulate user based innovation. Reichwald et al., (2004) have identified them as: survey, test market, lead-user-method, communities, group discussions, idea competition, brainstorming, workshops, concept tests, open source applications and focus groups. Dodgson et al. (2006) have focused on a range of new technologies, including simulation, modeling, virtual reality, data mining and rapid prototyping technologies and named these technologies as innovation technologies.

Most prominent web based user innovation tools are as follows (summarized in Table 1):

Online questionnaires (Prandelli et al., 2006) are most useful for understanding articulated or explicit customer needs and in situations where the firm can accurately identify target audiences for its offerings (Sawhney et al., 2005). **Online suggestion boxes** are the second alternative tools where users might express their own innovative ideas. (Prandelli et al., 2006). **Online virtual community** is another idea generation tool embraced by many companies. They bring together users sharing the same interests and willing to exchange opinions and experiences (Prandelli et al., 2006). Getting use of customer **advisory panels** is another way of reaching lead users in the idea generation phase (Sawhney et al., 2005; Nambisan, 2002). **Idea and design contests** also provide opportunities for generating new individual ideas and support the potential for collaborative innovation (Füller et al., 2014; Piller and Walcher, 2006). Through **online market intelligence services** firms monitor blogs, web sites, and bulletin boards to uncover trends that may be useful for product development (Sawhney et al., 2005). **Listening-in** is recording and analyzing ongoing dialogues created when customers

use the Internet to search for information and advice about products. Customers are seeking advice and have an incentive to reveal their needs. The virtual advisers generating the data are updated often to include new products and new customer benefits (needs), providing evolving data with which to identify new combinations of needs as soon as customers express them (Urban and Hauser, 2004:73). **Virtual concept testing** and **online focus groups** are used for concept testing. Virtual reality allows companies to develop product concepts in detail so that consumers can compare product features and select the most convincing concept (Sawhney et al., 2005). With virtual prototypes new ideas and preliminary designs are tested earlier in the process, well before physical prototypes are built (Füller et al., 2009). Online focus groups on the other hand enable firms to meet with people in a more convenient way whereby in virtual teams consumers could discuss different product concepts (Prandelli et al., 2006). **Open source projects** are other means of reaching innovations and innovative ideas. Many of today's most successful computer applications, including Apache, Linux, and Firefox are **open source** projects that are managed by self-organizing communities of volunteer programmers (O'Hern and Rindfleisch, 2008). In open source software projects, users develop particular bits of the software that they individually need–and then "contribute" those innovative bits to the project by openly revealing the details of what they have done (von Hippel and Jin, 2008: 20).

Table 1: Web Based User Innovation Tools

TOOL	AIM
Online questionnaires	Understanding articulated or explicit customer needs
Online suggestion boxes	Users might express their own innovative ideas and suggestions
Online virtual community	Brings together users sharing the same interests and willing to exchange opinions and experiences
Advisory panels	Way of reaching lead users in the idea generation phase
Idea and design contests	Way of reaching new idea and design concepts
Online market intelligence services	Understanding the trends that may be useful for product development
Listening-in	Recording and analyzing ongoing dialogues created when customers use the Internet to search for information and advice about products
Virtual concept testing	Allows companies to develop product concepts in detail so that consumers can compare product features and select the most convincing concept
Online focus groups	Enable firms to meet with people in a more convenient way whereby in virtual teams consumers could discuss different product concepts
Open source projects	In open source software projects, users develop the particular bits of the software that they individually need–and then "contribute" those innovative bits to the project by openly revealing the details of what they have done
Online toolkits	Enable customers to design and develop their own products
Computer simulation	Allows customers to quickly try out ideas and design alternatives without having to manufacture the actual products (A type of an online toolkit)

Online toolkits are mainly used in the design stage of the new product development. Experiments show that configuration toolkits should be interpreted as learning instruments that allow consumers to understand their preferences more clearly (Franke and Hader, 2014). von Hippel (2001) defines toolkits for user innovation as a technology that (1) allows users to design a novel product by trial-and-error experimentation and (2) delivers immediate (simulated) feedback on the

potential outcome of their design ideas. Customer toolkits can be used by communities of customers to build upon designs that have been created by other customers, as in the case of designing new games for mobile phones (Piller et al. 2004). **Computer simulation** is a toolkit that allows customers to quickly try out ideas and design alternatives without having to manufacture the actual products (Thomke and von Hippel, 2002). Digital environments can significantly contribute to simplifying and making the new product testing stage more efficiently before launching a product on the market, e.g., Google does by beta testing new ideas in the Google Labs section of its Web site (Sawhney et al., 2005).

Within this context, since this is a preliminary study, research questions regarding the usage patterns of web based user innovation tools are developed in an exploratory manner.

Research Question$_1$: Which web based innovation tools are used in conjunction by f*irms that have launched a new product to the market by using customer ideas?*

Research Question$_2$: Usage of which web based user innovation tools trigger the usage of other tools and innovativeness?

Firms' Innovativeness

Innovation is a broad concept implying the generation, acceptance and implementation of new ideas, processes, products or services (Calantone et al., 2002). Zaltman et al., (1973: 2) define innovation as "an idea, practice or material artifact perceived as new by the relevant unit of adoption."(Hurley and Hult, 1998).

There are various researches on innovation but "innovativeness" still emerges as a topic not being studied widely in depth. There are different approaches leading to ambiguity and confusion in practice (Tajeddini et al., 2006) as "innovation" and "innovativeness" terms are often used interchangeably (Damanpour, 1991). Knowles (2007) suggests that the inconsistency in defining these constructs has also resulted in studies with inconsistent and sometimes conflicting results. For example, Cho and Pucik (2005) state that innovativeness is universally perceived as exploring something new that has not existed before. On the other hand, Kunz et al., (2011) claim that there is a key difference between the two concepts. Whereas "innovation" focuses on the outcome of firm activity (i.e., goods and services), "innovativeness" refers to the capability of a firm to be open to new ideas and work on new solutions (Crawford and Di Benedetto, 2003). Hurley and Hult, (1998: 44) define organizational innovativeness as "the notion of openness to new ideas as an aspect of a firm's culture" and regard innovativeness of the culture as a measure of the organization's orientation toward innovation. Dobni (2008) includes the capacity to innovate to the definition and claims that innovativeness in an organization can be broadly defined – ranging from the intention to be innovative, to the capacity to introduce some new product, service or idea through to the introduction of processes and systems which can lead to

enhanced business performance. In line with this approach, Wang and Ahmed (2004: 304) describe organizational innovativeness as "an organization's overall innovative capability of introducing new products to the market, or opening up new markets, through combining strategic orientation with innovative behavior and process". Calantone et al.(2002) claim that firm innovativeness is conceptualized from two perspectives which are behavioral, the rate of adoption of innovations by the firm, and organization's willingness to change.

To summarize, in this study, innovativeness refers to 'a firm's capacity to engage in innovation: that is, introduction of new processes, products, or ideas in the organization in line with Hult et al., (2004: 429).

Market Orientation as an Antecedent to Firms' Innovativeness

Market needs evolving in time and being responsive to these changing needs require the introduction of new products and services that fits the needs of customers. Accomplishing this necessitates being market oriented and having innovation capacity (Erdil et al., 2003). Narver and Slater (1990) assert that market orientation consists of three behavioral components; customer orientation, competitor orientation, and inter-functional coordination which comprehend the activities of market information acquisition and dissemination and the coordinated creation of customer value. According to Kohli and Jaworski (1990) there are three pillars of market orientation which are market intelligence generation, intelligence dissemination and responsiveness. Market orientation essentially involves doing something new or different in response to market conditions; it may be viewed as a form of innovative behavior (Jaworski and Kohli, 1993: 56). Besides, market orientation has been found as an antecedent to innovativeness in various researches (Hult et.al., 2004; Erdil et.al., 2003; Rhee et.al., 2010; Radas and Bozic, 2009)

Narver et al. (2004) address two forms of market orientation. Responsive market orientation is a business's attempt to understand and to satisfy customers' expressed needs whereas, proactive market orientation suggests that businesses attempt to discover, to understand, and to satisfy the latent needs of customers" (Narver et al., 2004: 335). A business should practice both forms of market orientation if it is to attract and retain customers (Kristensson et al., 2008). User involvement in innovation is suggested as one type of practice whereby the co-creation of innovations takes place via the generation of knowledge of latent needs (Kristensson et al., 2004). Adoption of the market orientation concept implies greater reliance on marketing research in various stages of new product planning, thus it involves using user/customer ideas as a source of new product/service ideas (Lawton and Parasuraman, 1980). Therefore, firms invite their customers/users to actively participate in the creation of new products by generating and evaluating new product ideas (Füller et al., 2009).

Therefore, offering a new product to the market through the usage of customer ideas is an indicator of market orientation. Moreover, as the usage of

web-based user innovation tools enables marketers to discover both expressed and latent needs, those tools are also conceptualized as a source of market orientation. Based on the findings with significant relationship between market orientation and innovativeness and the behavioral definition of market orientation of Kohli and Jaworski (1990), the following hypotheses are structured:

H_1: As firms offer new products to the market through the usage of customer ideas, the extent of the firms' innovativeness gets higher.

Based on the knowledge-based view, Durmuşoğlu and Barczak (2011) investigate the impact of eleven IT tools (e-mail, web meetings, product design software, decision support systems (DSS) for project evaluation, idea generation software, shared drives/project rooms, file transfer protocols, secondary data, virtual prototyping, concept testing software, and online needs surveys) on new product development effectiveness. Findings of the study assert that not every IT tool influences all effectiveness measures considered.

Kawakami et al. (2015) reported that organizational innovativeness had no influence on IT tool use frequency, but did have a positive impact on IT tool replacement frequency. This finding may differ dependent on types of products, sectors, and countries and it should be noted that most of the IT tools in abovementioned studies and web based user innovation tools analyzed in this research are different in that they do not aim to integrate users into their innovation process. Furthermore, another distinction is that the usage of web based user innovation tools is considered as a source of market orientation which is an antecedent of innovativeness. Therefore, an inverse relationship is suggested. Hence, H_2 is structured in this manner:

H_2: The higher the level of usage of web based user innovation tools in new product development process, the higher the firms' innovativeness.

Because of the fact that engagement with the aforementioned tools is not very common or some of the tools are newly adopted by the firms in Turkey, the usage of those tools may not immediately show its effect on innovativeness of firms, for that reason it is thought that duration of usage may have a significant effect on innovativeness. Limited number of studies on web based user innovation tools in new product development process aggravates to form a theoretical basis to test the effect of duration of usage. However, duration of usage has been found as a factor affecting the adoption of new products and services in different researches (Joshua, and Koshy, 2011; Lee et al., 2007). Also, since organizational learning is a key antecedent of innovation (Hurley and Hult, 1998), one might also claim that organizational learning regarding web based user innovation tools might take some time. Thus, as time passes and knowledge accumulates, their effect on firms' innovativeness might increase. Thus, considering this effect, the following hypotheses are constructed:

H_3: Longer the time firms use the web based user innovation tools, the higher the firms' innovativeness.

H_4: Duration of the web based user innovation tools usage will positively affect the relationship between firms' innovativeness and the usage of web based user innovation tools.

Other than the direct effect of duration of usage on innovativeness, duration may also increase the strength of the relationship of web based user innovativeness tool usage and innovativeness. H_4 is developed within this context.

METHODOLOGY

Market orientation, being an antecedent to firms' innovativeness, provides the theoretical basis for the main objective of this study, which is to determine the relationship between the usage of web based user innovation tools and firms' innovativeness. Besides, the duration of the usage of these tools are considered to have an effect on the relationship between tool usage and innovativeness, thus the effect of the duration is also investigated. Furthermore, the relationship between "offering a new product to the market through the usage of customer ideas" and firms' innovativeness is also investigated. Hypotheses of the study are tested by correlation analyses.

In addition, association rules of web based user innovation tools are mined by using FP-Growth algorithm to explore which tools are used in conjunction and trigger innovativeness. Moreover, identifying the usage of tools that result in launching a new product to the market by using customer ideas and innovativeness within the sample of Turkish firms are the other two research questions of the study.

Data Collection

145 firms operating in consumer goods/services sector are selected within the list of Fortune Top 500 Turkey List published in 2014. All firms are contacted via phone to get the e-mail addresses of the research & development, and product development executives of the firms and a self-administered questionnaire is e-mailed. The first mailing is completed in 18 March 2015, reminders to complete the survey were sent twice in 25 March 2015 and 03 April 2015. Only 61 usable questionnaires consisting of 17 R&D managers, 18 Product Development/Marketing managers, 9 CEO, 17 other managers are collected with a respond rate of 41%. The distribution of sectors of 61 respondent firms is presented in Table 2. Most of the firms belong to food & beverage; automotive, and textile & apparel sectors, respectively.

Table 2: Frequency Distribution of Sectors

Sector	*n*	Sector	*n*
Food & Beverage	19	IT	5
Automotive	9	Banking	2
Textile and Apparel	9	White goods	2
Chemical and Plastic	7	Metal products	1
Telecommunication	6	Construction	1

Measurement

Web Based User Innovation Tools: To identify the web based user innovation tools used in the questionnaire, an extensive literature review is undertaken. Interviews with two research and development and two product development executives guided the selection of gathered tools. Moreover, since the executives have stated that some of the tools are new to Turkish firms and Turkish literature, to decide on the Turkish translations of those new tools, opinions of five academicians are taken.

Consequently, a total of 13 web based user innovation tools (*online questionnaire, online suggestion box, virtual communities(formed by firms and users), online customer advisory panel, idea and design contests, online complaint box, online market intelligence services, listening-in, online concept testing, online focus groups, online simulations, online toolkits and online product testing*) are included in the questionnaire. The responses regarding the usage and the duration of usage of the abovementioned tools are measured separately based on five-point Likert scale (ranging from 1: completely disagree to 5: completely agree), and three-point scale (anchored with 1: not being used, 2: started using recently 3: being used for a long time).

Offering a new product to the market through the usage of customer ideas: this variable is measured by directly asking the respondents if they have offered a new product to the market through the usage of customer ideas via five-point Likert scale (1: completely disagree to 5: completely agree).

Innovativeness: In order to measure innovativeness, the scale used by Calantone et al., (2002) which was drawn from Hurt et al.(1977), Hollenstein (1996), and Hurt and Teigen (1977) is adapted. Before testing hypotheses, original innovativeness scale items are tested for reliability by using Cronbach-alpha statistics. The results show that the item *"Innovation in our company is perceived as too risky and is resisted"* decreases the reliability of the scale therefore, it is excluded from the variable set and the reliability of the scale has increased to 0.835. Three additional items are added from the second community innovation survey of Eurostat (Guellec and Muzart, 2002). After adding three items to the original scale, the new version of the innovativeness scale is found to be more reliable than the original one with an alpha score of 0.884.The questionnaire was pre-tested by ten practitioners in order to ensure that the survey content and

measurement scales were clear, valid and appropriate. Based on their response, some items were modified and others eliminated. The final version of the scale is as follows:

- Our company frequently tries out new ideas (inno1)
- Our company seeks out new ways to do things (inno2)
- Our company is creative in its methods of operation (inno3)
- Our company is often the first to market with new products and services (inno4)
- Our new product introduction has increased over the last 5 years (inno5)
- Our company applied for at least one patent in last 5 years (inno6)
- Our company has at least one patent (inno7)
- Our company has introduced new products/services to the market in last 5 years (inno8)

In order to identify the dimensions of the scale, factor analysis is performed. Preliminary tests are performed to see if the variable set is compatible for factor analysis. In this regard, KMO statistic is obtained above 0.50 as desired for the sample adequacy and Bartlett's Test is significant approving that there is homogeneity among the variables in terms of their variances. Factor analysis is then executed using Principal Component Analysis and eight items are grouped under one factor explaining 58% of the variance (see Appendix 1).

Further, variables associated with innovativeness are aggregated into a single variable in terms of their factor score. This new variable and the variables related to web based user innovation tools are also converted into binominal variable to mine association rules. For this, factor scores that are greater than or equal to mean factor score are defined as "high innovativeness/usage (1)" whereas values below this number are defined as "low innovativeness/usage (0)". All statistical analysis is performed using SPSS 22, and association rule mining is performed through the model developed in RapidMiner Studio 6.3.

RESULTS

Hypothesis Testing

H_1: As firms offer new products to the market through the usage of customer ideas, the extent of the firm's innovativeness gets higher.

Bivariate correlation conducted to analyze the relationship depicts that there is a significant (p=0,038) but weak and a positive relationship (r= 0.267) between "offering a new product to the market through the usage of customer ideas" and "firm's innovativeness" (Appendix 2). Therefore, "Offering a new

product to the market through the usage of customer ideas*"* has a positive relationship with innovativeness, but the determination level is very low indicating that there are many additional variables affecting innovativeness.

H_2: The higher the level of usage of web based user innovation tools in new product development process, the higher the firm's innovativeness.

Relationship between the usage of web based user innovation tools and firm's innovativeness is examined on the basis of each individual tool. The rationale behind is that each tool may have a different effect on innovativeness and as this is a pioneer research which focuses on this issue, it is vital to observe each individual tool's effect on firms' innovativeness. Findings (Appendix 2) reveal that many of the tools are significantly correlated with "firms' innovativeness" and also correlated with the other tools. Usage of online suggestion boxes (p<0.05), online virtual communities formed both by firms (p<0.05) and users (p<0.01), customer advisory panels (p<0.05), online concept testing (p<0.01), market intelligence services (p<0.01) and online toolkits (p<0.05) are found to have a significant positive (weak/moderate) relationship with firms' innovativeness. Hence, it can be concluded that not all web based user innovation tools have an effect on innovativeness. Although there are significant relationships between the innovativeness and some of the online innovation tools, they cannot be combined in a single regression model because of the significant correlations between the innovation tools.

H_3: Longer the time firms use the web based user innovation tools, the higher the firm's innovativeness.

Correlation analysis is conducted between "firm's innovativeness" and "duration of the web based user innovation tools usage" (Appendix 3). Findings show that duration of usage of online suggestion box (p<0.05), advisory panels (p<0.01), complaint box (p<0.05), online market intelligent services (p<0.05) have a positive relationship (weak/moderate) with firms' innovativeness.

H_4: Duration of the web based user innovation tools usage will positively affect the relationship between firms' innovativeness and the usage of web based user innovation tools.

Partial correlation analysis results show that relationships between innovativeness and the usage of web based user innovation tools decrease when duration variables are controlled; indicating that duration of the usage has a positive impact on innovativeness.

Table 3: Impact of the Duration of Usage on the Relationship between Firms' Innovativeness and the Usage of Web Based User Innovation Tools

Web Based Tools	Innovativeness			
	Bivariate Cor	*p*-value	Parital Cor (Control Var: duration of tool usage)	*p*-value
Suggestion box	0.303	0.018	0.177	0.18
Online virtual Communities (firm)	0.262	0.04	0.215	0.10
Online virtual Communities (user)	0.439	0.00	0.423	0.001
Customer advisory panels	0.311	0.015	0.213	0.10
Online concept testing	0.276	0.03	0.243	0.06
Market intelligence services	0.401	0.001	0.294	0.02
Online toolkits	0.269	0.04	0.165	0.21

As depicted in Table 3 when the duration of the online suggestion box usage is controlled, partial correlation between innovativeness and online suggestion box usage decreases from 0.303 (p=0.018) to 0.177 (p=0.18) eliminating the significance of the relationship, thus duration of suggestion box usage seems to have higher impact on the relationship. Same situation can also be observed for the usage of online virtual communities formed by firms & users, online customer advisory panels, online market intelligence services, online toolkits and online concept testing. These findings show that when the effect of duration is considered, the relationship between tool usage and innovativeness disappear.

Association Rules

The association rule mining is commonly used in data mining applications for finding interesting patterns in datasets. Association rules are conditional statements that give predictions on the occurrence of an item based on the occurrences of other items in a particular transaction set. These rules are often utilized for basket analysis in marketing applications (Tan et al., 2005). Association rule mining is used as a method for the first and the second research questions using frequent item sets on binary data and then a particular algorithm is executed to extract rules.

Association rule mining, also known as frequent item set mining, can be implemented through particular algorithms, e.g., Apriori (Motoda and Ohara, 2009) and FP-Growth (Han et al., 2000). In order to obtain association rules, these algorithms first generate frequent sets of items based on occurrences of variables, and then calculate support values to filter the item set for creating association rules which are determined with respect to the confidence parameter (Borgelt, 2005).

In this study, FP-Growth algorithm is applied via RapidMiner Studio to extract association rules among web based user innovation tools. The algorithm is executed based on 90% confidence and support parameter is kept at relatively low level, due to the small sample size.

Using preprocessing operators, e.g., *select attributes*, *replace, nominal to binominal* of RapidMiner Studio, all scale variables are primarily converted into binominal variables, i.e., values above three is converted to one, and others are converted to zero. Secondarily, *FP-Growth* operator is executed for the selected variables with respect to support parameter to generate frequent items, then *Create Association Rules* operator is finally executed to determine over the conditional probabilities which are above the confidence parameter. The corresponding model is given in Appendix 4. After the execution of the model, many rules including different set of tools are found out.

Research Question$_1$: Which web based innovation tools are used by f*irms that have launched a new product to the market by using customer ideas?*

As seen in Table 4, association rules suggest that all firms using "suggestion box and listening-in" together; "customer advisory panel and listening-in" together; "complaint box, suggestion box and listening-in" together , have launched a new product to the market through the usage of customer ideas. 93% of respondent firms that are using "suggestion box and product testing" and 92% of the firms using "Complaint box, suggestion box and product testing" together have launched a new product to the market through the usage of customer ideas.

Table 4: Association Rules for Launching a New Product to the Market by Using Customer Ideas and Tool Usage

Premise	Conclusion	Support	Confidence
Suggestion box, listening-in	launching a new product to the market by using customer ideas	0.2	1.0
Customer advisory panel, listening-in		0.2	1.0
Complaint box, suggestion box, listening-in		0.2	1.0
Suggestion box, product testing		0.22	0.93
Complaint box, suggestion box, product testing		0.2	0.92

Research Question$_2$: Usage of which web based user innovation tools trigger the usage of other tools and innovativeness?

Within 90% confidence no web based user innovation tools trigger innovation. Hence, the model has also been run for different confidence levels to discover the association rules related with the firm's innovativeness. Only, 71% of the companies that use "virtual communities formed by users and marketing intelligence services" together and 65% of the firms using market intelligence services in their new product development process are found to have higher innovativeness (see Table 5).

Table 5: Association Rules for Innovativeness and Tool Usage

Premise	Conclusion	Support	Confidence
Market intelligence services	Innovativeness	0.22	0.65
Online virtual communities (user), market intelligence services		0.2	0.71

The usages of tools that trigger each other are presented in Table 6. As can be seen in the table, at 90% confidence, specific interactions are found for complaint, suggestion boxes and virtual communities developed by customers. They do not need a further explanation, but an interesting finding is that 90% of the firms which have high scores in innovativeness use virtual communities developed by customers. Besides, 93% of the firms having "high scores in innovativeness and using idea and design contest"; 92% of the firms having "high scores in innovativeness and using market intelligence services" also use virtual communities developed by customers.

Table 6: Association Rules between Tools

Premise	Conclusion	Support	Confidence
Suggestion boxes, customer advisory panels	Complaint Box	0.32	1.0
Suggestion boxes, virtual communities developed by firm		0.27	1.0
Suggestion boxes, online questionnaires, customer advisory panels		0.25	1.0
Online questionnaires, virtual communities developed by firm		0.23	1.0
Customer advisory panels, virtual communities developed by firm		0.23	1.0
Suggestion boxes, Online questionnaires, virtual communities developed by firm		0.22	1.0
Idea and design contests, customer advisory panels		0.2	1.0
Suggestion boxes, listening-in		0.2	1.0
Suggestion boxes, customer advisory panels, virtual communities developed by firm		0.2	1.0
Customer advisory panels		0.37	0.96
Online questionnaires, customer advisory panels		0.27	0.94
Listening-in		0.23	0.94
Suggestion boxes, product testing		0.22	0.93
Customer advisory panels, product testing		0.2	0.92
Suggestion boxes		0.58	0.92
Idea and design contests, suggestion boxes		0.38	0.92
Suggestion boxes, online questionnaires		0.35	0.91
Complaint box, online questionnaires, customer advisory panels	Suggestion Box	0.25	0.95
Online questionnaires, virtual communities developed by firm		0.22	0.93
Complaint box, online questionnaires, virtual communities developed by firm		0.22	0.93
Idea and design contests, Innovativeness	Virtual Communities Developed by Customer	0.22	0.93
Innovativeness, market intelligence services		0.2	0.92
Innovativeness		0.31	0.90

DISCUSSION AND CONCLUSION

Exploring how to transfer innovation tasks to the customer in a way to gather customer generated value is an emerging research topic that needs further investigation in innovation literature. For companies to benefit from user input and feedback in various stages in the innovation process, it becomes important to find mechanisms to test and explore more ideas and concepts with users at a much

lower cost (Bosch-Sijtsema and Bosch, 2015: 794). Web-based user innovation tools are one of the ways to accomplish this goal in a less costly way. Those tools can also be considered as a source of market orientation which is an antecedent of firms' innovativeness.

To the best of our knowledge, this study is the first attempt to investigate the relationship between the usage of web based user innovation tools and firms' innovativeness. Thus, the first contribution of this study is to provide an empirical evidence for the abovementioned relationship.

Findings of this study reveal that launching new products to market by using customer ideas are found to have a relationship with firm's capacity to engage in innovation. This result complies with the findings of Carbonell et al., (2009) and Wadell et al., (2013) where cooperation with customers is found to have a positive impact on companies' innovation performance. Thus, it can be concluded that customers should be among the major actors to take place in the innovation processes and web based user innovation tools which reduce the cost of transmission of user knowledge enhances this integration.

Even though, the web based user innovation tools enable the transmission of knowledge from user to firm; findings show that not all of the tools have a significant relationship with firms' innovativeness. Only online suggestion boxes, virtual communities formed both by firms and users, online customer advisory panels, online concept testing, market intelligence services, and online toolkits are found to have a positive relationship with firm innovativeness. This is parallel with the finding of Ryzhkova (2015) which states that interacting with customers using online methods positively effects companies' innovation output. However, the study of Ryzhkova (2015) could not offer a direct comparison with our findings since it addresses online information and communication technologies as online methods without identifying the tools within. Extant research fails to investigate the influence of specific web based tools effect on firms' innovativeness.

The second contribution of the study is the utilization of a data mining technique to discover the association rules between the variables. The association rules mined pinpoints that 71 % of the companies that use "virtual communities formed by users and marketing intelligence services" together and 65% of the firms using market intelligence services in their new product development process are found to have higher innovativeness. On the other hand, 93% of the firms having "high scores in innovativeness and using idea and design contest"; 92% of the firms having "high scores in innovativeness and using market intelligence services" also use virtual communities developed by customers. Therefore, it can be concluded that both innovativeness and web based user innovation tool usage trigger each other.

Considering that the duration of the usage of these tools might have an effect on the relationship between tool usage and innovativeness; online suggestion

box, advisory panels complaint box, online market intelligent services are found to have a positive relationship with firms' innovativeness. Despite their significant relationship with innovativeness, it is interesting to observe that the usage duration of the virtual communities; online concept testing and online toolkits have no significant relationship with innovativeness. On the other hand, duration of online complaint box usage significantly correlated with innovativeness although the usage of this tool has no relationship with innovativeness. When the duration of the tool usage is controlled; partial correlation between innovativeness and tool usage decreases, implying that duration has an effect on this relationship.

Lastly, it is important to remark the limitations of the study. Some of the web based user innovation tools are new to Turkish firms therefore; different results can be reached when this study is replicated in other countries where these tools are widely used. Moreover, sample size of the study disenabled the application of more advanced statistical analyses. Also, due to the limited sample size, this study fails to obtain sector specific information. Therefore, this study can be replicated with a larger sample size in order to identify sector specific information.

As web based user innovation tools alter the ways firms collaborate with their customers, it is vital for them to uncover the most appropriate tools that they can make use of. Our findings revealed only some of the tools' effect on firms' innovativeness in Turkey. Further research can be conducted on the effect of these tools via an in-depth case based investigation. Besides, association rule mining results pinpoints that innovativeness and web based user innovation tool usage trigger each other yielding another subject of further investigation with experimental design to discover the causal relationship.

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APPENDIX 1: Output Tables of Factor Analysis on the Innovativeness

Table 7: KMO and Bartlett's Test for Factor Analysis on Innovativeness

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.788
Bartlett's Test of Sphericity	Approx. Chi-Square	335.588
	df	28
	Sig.	.000

Table 8: Total Variance Explained by Factor Analysis on Innovativeness

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.655	58.189	58.189	4.655	58.189	58.189
2	1.124	14.052	72.242			
3	.43	9.287	81.529			
4	.552	6.905	88.433			
5	.381	4.766	93.199			
6	.335	4.186	97.385			
7	.141	1.765	99.150			
8	.068	.850	100,000			

Extraction Method: Principal Component Analysis.

Table 9: Component Matrix[a] of actor Analysis on Innovativeness

	Component
Items	1
inno1	.740
inno2	.803
İnno3	.760
İnno4	.802
İnno5	.618
İnno6	.823
İnno7	.813
İnno8	.722

Extraction Method: Principal Component Analysis.
a. 1 components extracted.

APPENDIX 2

Table 10: Correlation Anaylsis for Web Based User Innovation Tool Usage and Firms' Innovativeness

		Online Questionnaires	Online Suggestion Boxes	Online Virtual Communities (Firm)	Online Virtual Communities (Users)	Advisory Panels	Idea and Design Contests	Online Complaint Box	Online Market Intelligence Services	Online Concept Testing	Online Focus Groups	Online Toolkits	Online Product Testing	Listening-in	Computer Simulation	Offering a new product to the market through the usage of customer ideas	Firm's Innovativeness
Online Questionnaires	P.Corr	1	.376**	.478**	.497**	.401**	.258*	.170	.462**	.274*	.304*	.241	.224	.465**	.276*	.046	.105
	Sig. (2-tailed)		.003	.000	.000	.001	.044	.190	.000	.033	.017	.062	.083	.000	.031	.724	.419
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Suggestion Boxes	P.Corr	.376**	1	.453**	.433**	.384**	.311*	.560**	.311*	.071	.094	.175	.094	.255*	.227	.340**	.303*
	Sig. (2-tailed)	.003		.000	.000	.002	.015	.000	.015	.585	.473	.177	.471	.047	.079	.007	.018
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Virtual Communities (Firm)	P.Corr	.478**	.453**	1	.637**	.560**	.458**	.438**	.546**	.283*	.419**	.302*	.267*	.517**	.322*	.291*	.262*
	Sig. (2-tailed)	.000	.000		.000	.000	.000	.000	.000	.027	.001	.018	.037	.000	.011	.023	.041
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Virtual Communities (Users)	P.Corr	.497**	.433**	.637**	1	.615**	.441**	.338**	.536**	.374**	.294*	.359**	.264*	.538**	.365**	.384**	.439**
	Sig. (2-tailed)	.000	.000	.000		.000	.000	.008	.000	.003	.022	.004	.040	.000	.004	.002	.000
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Advisory Panels	P.Corr	.401**	.384**	.560**	.615**	1	.485**	.426**	.565**	.449**	.341**	.447**	.442**	.573**	.478**	.382**	.311*
	Sig. (2-tailed)	.001	.002	.000	.000		.000	.001	.000	.000	.007	.000	.000	.000	.000	.002	.015
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Idea and Design Contests	P.Corr	.258*	.311*	.458**	.441**	.485**	1	.177	.326*	.387**	.417**	.313*	.223	.381**	.376**	.275*	.022
	Sig. (2-tailed)	.044	.015	.000	.000	.000		.173	.010	.002	.001	.014	.084	.002	.003	.032	.865
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Complaint Box	P.Corr	.170	.560**	.438**	.338**	.426**	.177	1	.462**	.119	.082	.141	.179	.310*	.273*	.270*	.159
	Sig. (2-tailed)	.190	.000	.000	.008	.001	.173		.000	.359	.529	.277	.167	.015	.033	.036	.222
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Market Intelligence Services	P.Corr	.462**	.311*	.546**	.536**	.565**	.326*	.462**	1	.486**	.294*	.362**	.246	.513**	.203	.194	.401**
	Sig. (2-tailed)	.000	.015	.000	.000	.000	.010	.000		.000	.021	.004	.056	.000	.116	.134	.001
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Concept Testing	P.Corr	.274*	.071	.283*	.374**	.449**	.387**	.119	.486**	1	.445**	.455**	.602**	.530**	.457**	.265*	.276*
	Sig. (2-tailed)	.033	.585	.027	.003	.000	.002	.359	.000		.000	.000	.000	.000	.000	.039	.031
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Focus Groups	P.Corr	.304*	.094	.419**	.294*	.341**	.417**	.082	.294*	.445**	1	.299*	.431**	.456**	.504**	.266*	.104
	Sig. (2-tailed)	.017	.473	.001	.022	.007	.001	.529	.021	.000		.019	.001	.000	.000	.039	.426
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Toolkits	P.Corr	.241	.175	.302*	.359**	.447**	.313*	.141	.362**	.455**	.299*	1	.500**	.551**	.683**	.175	.269*
	Sig. (2-tailed)	.062	.177	.018	.004	.000	.014	.277	.004	.000	.019		.000	.000	.000	.176	.036
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Product Testing	P.Corr	.224	.094	.267*	.264*	.442**	.223	.179	.246	.602**	.431**	.500**	1	.662**	.767**	.405**	.233
	Sig. (2-tailed)	.083	.471	.037	.040	.000	.084	.167	.056	.000	.001	.000		.000	.000	.001	.071
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61

Listening-in	P.Corr	.465**	.255*	.517**	.538**	.573**	.381**	.310*	.513**	.530**	.456**	.551**	.662**	1	.636**	.401**	.251*
	Sig. (2-tailed)	.000	.047	.000	.000	.000	.002	.015	.000	.000	.000	.000	.000		.000	.001	.051
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Computer Simulation	P.Corr	.276*	.227	.322*	.365**	.478**	.376**	.273*	.203	.457**	.504**	.683**	.767**	.636**	1	.317*	.103
	Sig. (2-tailed)	.031	.079	.011	.004	.000	.003	.033	.116	.000	.000	.000	.000	.000		.013	.427
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Offering a new product to the market through the usage of customer ideas	P.Corr	.046	.340**	.291*	.384**	.382**	.275*	.270*	.194	.265*	.266*	.175	.405**	.401**	.317*	1	.267*
	Sig. (2-tailed)	.724	.007	.023	.002	.002	.032	.036	.134	.039	.039	.176	.001	.001	.013		.038
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61
Firm's Innovativeness	P.Corr	.105	.303*	.262*	.439**	.311*	.022	.159	.401**	.276*	.104	.269*	.233	.251	.103	.267*	1
	Sig. (2-tailed)	.419	.018	.041	.000	.015	.865	.222	.001	.031	.426	.036	.071	.051	.427	.038	
	N	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61	61

APPENDIX 3

Table 11: Correlation Analysis for the Duration of Web Bases User Innovation Tools and Firms' Innovativeness

		Online Questionnaires	Online Suggestion Boxes	Online Virtual Communities	Advisory Panels	Idea and Design Contests	Online Complaint Box	Online Market Intelligent Services	Online Concept Testing	Online Focus Groups	Online Toolkits	Online Product Testing	Offering a new productto the market throughthe usage of customer ideas	Firm's Innovativeness
Online Questionnaires	P. Corr.	1	.521**	.409**	.156	.254*	.363**	.258*	.242	.438**	.050	.260*	.365**	.176
	Sig. (2-tailed)		.000	.001	.231	.049	.004	.044	.060	.000	.703	.043	.004	.176
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Suggestion Boxes	P. Corr	.521**	1	.423**	.344**	.264*	.646**	.354**	.112	.166	-.047	.100	.366**	.283*
	Sig. (2-tailed)	.000		.001	.007	.040	.000	.005	.389	.200	.717	.442	.004	.027
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Virtual Communities	P. Corr	.409**	.423**	1	.452**	.391**	.335**	.174	.352**	.207	.053	.270*	.228	.154
	Sig. (2-tailed)	.001	.001		.000	.002	.008	.180	.005	.110	.687	.035	.077	.236
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Advisory Panels	P. Corr	.156	.344**	.452**	1	.340**	.234	.212	.270*	.181	.118	.247	.274*	.335**
	Sig. (2-tailed)	.231	.007	.000		.007	.070	.101	.035	.162	.366	.055	.033	.008
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Idea and Design Contests	P. Corr	.254*	.264*	.391**	.340**	1	.219	.124	.234	.173	.331**	.213	.214	.087
	Sig. (2-tailed)	.049	.040	.002	.007		.090	.342	.070	.183	.009	.099	.097	.505
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Complaint Box	P. Corr	.363**	.646**	.335**	.234	.219	1	.440**	.191	.151	.178	.224	.240	.297*
	Sig. (2-tailed)	.004	.000	.008	.070	.090		.000	.141	.245	.171	.083	.063	.020
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Market Intelligent Services	P. Corr	.258*	.354**	.174	.212	.124	.440**	1	.212	.360**	.097	.149	.139	.295*
	Sig. (2-tailed)	.044	.005	.180	.101	.342	.000		.101	.004	.457	.251	.287	.021
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Concept Testing	P. Corr	.242	.112	.352**	.270*	.234	.191	.212	1	.336**	.482**	.529**	.135	.134
	Sig. (2-tailed)	.060	.389	.005	.035	.070	.141	.101		.008	.000	.000	.299	.302
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Focus Groups	P. Corr	.438**	.166	.207	.181	.173	.151	.360**	.336**	1	.265*	.410**	.209	.167
	Sig. (2-tailed)	.000	.200	.110	.162	.183	.245	.004	.008		.039	.001	.107	.198
	N	61	61	61	61	61	61	61	61	61	61	61	61	61

Online Toolkits	P. Corr	.050	-.047	.053	.118	.331**	.178	.097	.482**	.265*	1	.430**	.149	.241
	Sig. (2-tailed)	.703	.717	.687	.366	.009	.171	.457	.000	.039		.001	.252	.061
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Online Product Testing	P. Corr	.260*	.100	.270*	.247	.213	.224	.149	.529**	.410**	.430**	1	.208	.170
	Sig. (2-tailed)	.043	.442	.035	.055	.099	.083	.251	.000	.001	.001		.108	.190
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Offering a new productto the market throughthe usage of customer ideas	P. Corr	.365**	.366**	.228	.274*	.214	.240	.139	.135	.209	.149	.208	1	.267*
	Sig. (2-tailed)	.004	.004	.077	.033	.097	.063	.287	.299	.107	.252	.108		.038
	N	61	61	61	61	61	61	61	61	61	61	61	61	61
Firm's Innovativeness	P. Corr	.176	.283*	.154	.335**	.087	.297*	.295*	.134	.167	.241	.170	.267*	1
	Sig. (2-tailed)	.176	.027	.236	.008	.505	.020	.021	.302	.198	.061	.190	.038	
	N	61	61	61	61	61	61	61	61	61	61	61	61	61

**. Correlation is significant at the 0.01 level (2-tailed).

*. Correlation is significant at the 0.05 level (2-tailed).

APPENDIX 4: Association Rule Mining- Model

Figure 1: Data Mining Model to Explore Association Rules for the Usage of Web based User Innovation Tools and Firm's Innovativeness