Open innovation using Web 2.0 technologies

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Abstract

Purpose – The internal resources of a firm should not be regarded as the only source of innovation; organizations need to look at the external sources which can contribute greatly. This can happen through the recent development in technologies and the emergence of social media; such advancements have empowered consumers to have social interaction with their peers in online communities. As a source of generation of innovative ideas, company-based communities have not received enough attention, although they are strong drivers for co-creation of value by customers. Easy online communication channels, facilitated through online communities, have developed open innovation as an attractive means of customer involvement in value creation. However, literature in this area is devoid of empirical research on the way consumers can participate in open innovation communities using Web 2.0 technologies. The paper aims to discuss these issues.

Design/methodology/approach – This paper, therefore, looks at the opportunities offered by social media to firms for open innovation in the context of new product development (NPD). The study is based on social support theory and the concept of social media generating open innovation; a model for the research has thus been proposed. The model has been tested using partial least square through an online questionnaire.

Findings – The results indicate that social media is a cost-efficient way for firms to look at external sources of innovation, specifically in NPD. Online communities, developed specifically for new products, can support the innovation process for the business sector. The paper discusses the results of this empirical research and has some practical implications for practitioners in this field.

Originality/value – The study indicate that social media empower individuals to come online, get involved in social interaction and share their experiences about a new product with other peers in the network. Social media and informational support, as social capital of online communities, both have influence on participation of individuals in the online communities of open innovation for NPD.

Keywords Open innovation, Online communities, Social media, New product development

Paper type Research paper

Introduction

Collaborative internet outlets have facilitated online content generation for individuals (Nov, 2007). Due to globalization and the new development in information and communication technologies, firms have been driven to extend their boundaries to include external contributors (Montoya *et al.*, 2009). These developments have attracted many people to social media through Web 2.0 technologies. Web 2.0 technologies now enable individuals to generate and share content (Oreilly, 2007). The internet and new advancements in technology have impacted on the process of co-creation of value with users (Sawhney *et al.*, 2005); based on this new strategy, firms can jointly create value with their customers. Online communities are one example of Web 2.0 technologies, encouraging users to join and participate in online activities. These communities can encourage the innovation process through sharing the experiences of their users, for instance, of a new product. Users, after joining online communities, now regularly share their experiences and knowledge about a product with their peers (Liang *et al.*, 2011). The resulting information generated from this network is an important source for members and impacts on their purchasing behaviour and opinions about a product (Trusov *et al.*, 2009). Online communities offer

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information sharing in a business context (Lu and Hsiao, 2010), producing both a type of informational support as well as social support for users of the network. The availability of social support attracts other users to join online communities (Ridings and Gefen, 2004). Online communication of consumers has been facilitated by online forums, communities, discussion groups and social networking sites, all adding to the innovation process of a company (Di gangi and Wasko, 2009). This is a direct outcome of users' interactions through social media. There are a number of innovations that have been developed by users (Jeppesen and Frederiksen, 2006). Companies must now take account of these external factors in developing their business strategy to include the innovation process.

Involvement of consumers in the innovation process of companies is a cost-efficient method of acquiring new knowledge (Antikainen *et al.*, 2010). These involvements shape open innovation. Open innovation is one of the most important topics in innovation management (Huizingh, 2011). Customer contribution towards open innovation has an important bearing on new product development (NPD) (Sandmeier *et al.*, 2010). Concepts behind open innovation are already in use in many different industries (Chesbrough and Crowther, 2006), which by the emergence of Web 2.0 technologies, have presented firms with more opportunities to use the social interaction of users on online communities. Open innovation is a valuable business strategy for importing ideas from external sources (Dodgson *et al.*, 2006). In recent years the interest in this concept has increased (Gianiodis *et al.*, 2010). Open innovation is now facilitated by the internet and Web 2.0 technologies through collaborative innovation, which involves users in co-creation of value for firms (Sawhney *et al.*, 2005). Most literature on open innovation focuses on face to face and physical strategies to develop the innovation process of a firm (Di gangi and Wasko, 2009). However, the popularity of social media and recent developments in this area now attracts individuals to come online and participate in online communities, providing an opportunity to develop open innovation through virtual contacts.

This paper examines the contribution of user-based communities and content generation by consumers through the facility of social media. It investigates the factors that encourage individuals to participate in online innovation communities (Nambisan and Baron, 2009). Online communities and open innovation have recently been looked at in various sectors. Examples of papers are Industry and Innovation (2008), Organization Studies (2007) and Management Science (2006). However, user-based innovation communities have not been investigated to a satisfactory degree (Jeppesen and Frederiksen, 2006; Nov, 2007; Janzik and Raasch, 2011). In addition, most of the literature on open innovation through communities focuses on industrial products in a company. This study looks at online communities and their contribution of value for open innovation of firms. More specifically, the paper looks at open innovation, generated from user innovation communities outside of a company, where the focus of interest is on customer products. In this case, the innovation process happens out with a company allowing consumers and businesses to co-create value for the market.

An empirical research has been conducted to investigate the questions put by the study. These questions are: does social media influence an individual's decision to participate in open innovation? does perceived informational support in online communities related to open innovation affect an individual's decision to participate in open innovation? does social media influence a user's informational support in online open innovation communities? is social media or perceived informational support more important in shaping an individual's decision to participate in open innovation?

The author has undertaken a literature review and explained the theoretical foundations of the study in the first part of the paper. The model of the study is then shown and the related hypotheses linked to the research questions posted. This is followed by an empirical test of the model, using partial least square-structural equation modelling (PLS-SEM) and analysis, the structural mode of the research. Finally, the author analyses the data and reveals the results, concluding that social media is a good opportunity for firms to conduct open innovation. The results show that intercreativity of individuals on the internet, through the facilities that Web 2.0 offer to users, provides informational support and encourages user participation and involvement in the open innovation process. The results also show that both social media and informational support influence a user's participation in the open innovation process of firms related to NPD.

Literature review and theoretical foundations of the research

The importance of external knowledge on improving the innovation process of an organization is a fact accepted by many scholars and practitioners (Pedrosa *et al.*, 2013; Chesbrough, 2003). Innovation through external bodies such as consumers offer different types of value to firms and they are a powerful locus of innovation (Lee and Cole, 2003; Dahlander *et al.*, 2008). Research shows that companies can adopt innovation produced by online communities for internal processes (Dahlander and Wallin, 2006; Jeppesen and Frederiksen, 2006). Online communities have many potential advantages for co-creation of value for firms in the innovation process (Füller *et al.*, 2011). It is also argued that user innovation increases social welfare (Henkel and Von Hippel, 2004).

Innovation communities of companies have different advantages for both consumers and the business sector (Jeppesen and Frederiksen, 2006). For instance, features of a new product can be made available online based on consumers' views and experiences, which can then be shared with other interested parties. This has been facilitated by Web 2.0 technologies and specific features that social media offers to consumers. As a consequence, a company can pick up on innovative views offered and adjust a new product according to consumer demands. This helps companies to expand the market for the new product and can be a strong tool for NPD (Jeppesen and Frederiksen, 2006; Henkel and Von Hippel, 2004). There are a number of examples of successful open innovation communities in an online context. InnoCentive, which has the vision of gathering innovators from around the world to establish virtual collaborations, is a good example. Dell's IdeaStorm is another online facility of user innovation communities; this mobilizes customers who post their ideas on the online innovation community (Di gangi and Wasko, 2009). This community actively encourages consumers to post their innovation ideas to assist Dell to improve its products. Wikipedia, another popular user-based community, is a successful collaborative user generating content from its community (Nov, 2007). Finally, Microsoft Longhorn Blogsphere, a blog for developments on products related to Microsoft, is another successful open innovation community (Kaiser and Müller-Seitz, 2008); open source software online communities are among the most popular creative communities to embrace innovation (Dahlander *et al.*, 2008). These examples indicate the successful business strategies used to develop online communities for open innovation development.

Given these examples, it can be argued that users have different motivations to contribute to these communities, not always financial rewards, but they appreciate intangible factors (Antikainen *et al.*, 2010). Motivation to participate is usually associated to the community type (Stahlbrost and Bergvall-Kareborn, 2011) but members usually seek or receive social support (Ridings and Gefen, 2004), learn new

ideas (Antikainen *et al.*, 2010), develop friendships and relationships (Nov, 2007), garner social capital (Wiertz and De ruyter, 2007) or exchange knowledge (McLure Wasko and Faraj, 2000). These motivations have practical implications for firms developing online communities and involve consumers in the innovation process, especially for new products.

Involving consumers in the innovation process of companies not only reduces costs (Antikainen *et al.*, 2010), but also decreases the problematic issues related to adopting a new product. Consumers use a new product and share their experiences through online communities. This will help other individuals to appreciate the real features of a new product and adopt it more easily. However, the use of consumers in value co-creation and the innovation process of a company cannot happen through a single consumer; a community involving all potential customers is a powerful tool. This highlights the role of collective thinking, which maximizes the efficiency of each single member of a group (Hargadon and Bechky, 2006). Online communities, generated by social media, are a valuable channel for companies to facilitate collective thinking of consumers in their online communities, thus establishing open innovation.

Open innovation and involvement of consumers in the business process not only is beneficial for new innovations but also increases the level of customer commitment (Ogawa and Piller, 2006) as it involves customers in value creation for firms. This research focuses on an informal innovation model, where the sources of innovation are non-traditional and also from unexpected sources (Di gangi and Wasko, 2009). Informal innovation has increased with the emergence of Web 2.0 and the opportunities that social media have offered to individuals to interconnect with others without limitations and geographical boundaries; this type of innovation is expanding as social media facilitate the social interaction of individuals to participate in innovation communities.

Online communities and social capital

Human capital is an essential part of the innovation process (Kaasa, 2009). Firms can develop online communities to attract consumers to use their products and contribute to the community by sharing their experiences and knowledge with the community (Jeppesen and Frederiksen, 2006). Specifically, for NPD, when there is less experience and knowledge about a product, consumers can give their opinion about this product or service. Hence, these communities are a powerful external source of innovation for the firms with the ability to establish a good network of relationship with members (Jeppesen and Frederiksen, 2006). Businesses can develop communities to provide a cost-efficient strategy in the innovation process. However, the nature of online communities has strong influence on the participation of consumers on the network (Muhdi and Boutellier, 2011).

Informational support is a dimension of social support, a theory established in social psychology. Social support is a type of social capital. Social capital is an intangible source of social groups (Adler and Kwon, 2002) and influences innovation in firms (Wu *et al.*, 2008). Social capital is based on the premise that there are benefits in social relationships (Coleman, 1988). Its basic principle is that the total value of a network is more than the sum of each individual member of a network (Wiertz and De ruyter, 2007). The social networks of individuals produce social capital, for example, social support or informational support. Cobb (1976) defines social support as "information leading the subject to believe that he is cared for and loved, esteemed and a member of a network of mutual obligations". In an online context, informational support has been examined with a focus on intangibility (Liang *et al.*, 2011; Ballantine and Stephenson, 2011). Informational support in online

communities is defined as advice, knowledge or recommendations (Trusov *et al.*, 2009). Social support is a major social value provided in online communities for their members (Obst and Stafurik, 2010). In addition, social support emanating from social networks is an important factor in the learning process (Eden and Heiman, 2011). Research shows that the closeness and social relationship of consumers in social networks affect their decision making and whether they retain with a provider; the social interaction of consumers has an explicit link to members' behaviour (Birke, 2012). Users rely on the informational support they provide and receive within the network to make best decisions. It is argued that open innovation, which has facilitated the interaction of firms and consumers, directly increases the social capital of a company (Rass *et al.*, 2013).

NPD through social media

The recent advancement of Web 2.0 technologies has developed the role of online forums and communities. These communities attract many individuals to come online and become involved in social interaction. Online communities are increasingly being developed by firms (Nambisan and Baron, 2009) to involve users in the co-creation of value and the innovation process. In online communities the decision to adopt new technology or not is largely dependent on the views of other peers in the network (Peng and Mu, 2011), indicating the influence of users on each other. Communities of users in an online context can support firms to clarify better understanding of consumer needs and desires in NPD (Kim *et al.*, 2008). Therefore, online communities can be a useful tool for NPD.

The model of research and hypothesis development

The literature review enabled the author to develop a research model and conduct a survey for analysis. The constructs of the model are shown in Figure 1.

Direct effect of social media on user's participation in open innovation

Research shows that reward influences consumer participation in online communities but other factors and tools, which facilitate the social interaction of individuals, may be more important and efficient in establishing collaboration (Antikainen *et al.*, 2010). Recent work in this area also shows that customer interaction in online communities increases knowledge about the brand, leading to idea generation in the community (Tickle *et al.*, 2011) as some users produce informational support for that community. Firms develop online communities by using social media to persuade consumers to

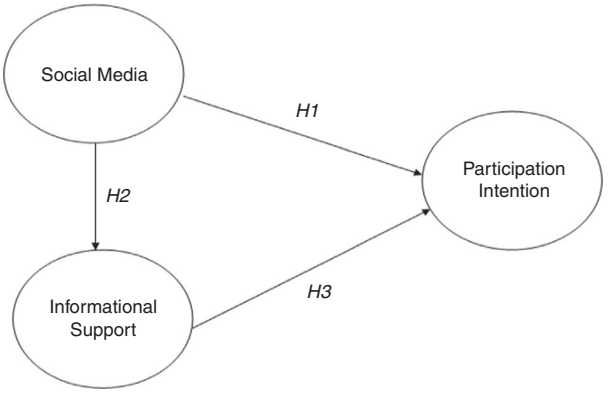

Figure 1.
The research model

interact, hopefully producing a positive brand image (Hartzel *et al.*, 2011). In addition, social media provide interconnectivity of users, a source for informational support for the communities (Obst and Stafurik, 2010). The above literature and discussion has enabled the author to postulate these hypotheses:

H1. Social media have direct effect on a user's intention to participate in open innovation.

H2. Social media influence perceived informational support on users of online communities.

Direct effect of informational support on user's participation in open innovation

The contribution of individuals to online communities can take the form of informational value or social capital they receive, which in turn attracts others to participate in these communities (Wiertz and De ruyter, 2007). In online communities, consumers share and exchange their knowledge and experience within the network (Mclure Wasko and Faraj, 2000). The benefits that consumers receive by interacting in online communities is a significant factor affecting their participation in the network (Nambisan and Baron, 2009), where social support can be vital for some users. The benefits of networking, informational support being only one of them, attracts consumers to participate in open innovation and develop their relationships with other peers (Jeppesen and Frederiksen, 2006). Users join online communities, using social media, to become involved in social interaction with other members of the communities, to address their social needs or to gain informational support they need, for instance for a new product. Hence, the author can hypothesize:

H3. Perceived informational support has a direct effect on a user's intention to participate in open innovation.

Research method

In this section the author discusses the subjects of the research, the methodology and justification in the use of this method. A survey has been conducted to test the relationships between constructs. The study was conducted on online communities, where members specifically gather for innovation purposes. The author collected the data through an online questionnaire in a number of online communities. A return of 300 questionnaires, which had 270 usable questionnaires, was received. From 270 responses, the study collected 45 per cent male and 65 per cent female participants, with an age range between 19 and 40 years old.

Measurement model analysis

The questionnaire items have been adopted from existing literature to increase the reliability and validity of the study. It has used a five-point Likert scale. To further increase the validity of research, content validity and face validity have been addressed by asking other researchers to read and answer the questionnaire to highlight any possible ambiguity in the questions. This was a useful step to support the author in detecting any mistakes or potential problem areas. This step was followed by a pilot study of eight students to check for any issues in completing the questionnaire. Constructs of the study have been measured as followed. The participation intention construct has been measured by user intention to participate in the online forums and

communities for innovation. Social media have been measured by the use of Web 2.0 technologies such as forums and communities, which facilitate the participation of users in open innovation. Finally, the informational support, as a dimensional of social support, has been measured by the informational support that peers provide in the online forums and communities by sharing their knowledge and experiences about a new product or service. Previous studies show that the informational support dimension is one of the most important dimensions of social support in an online context (Liang *et al.*, 2011).

Data analysis

For data analysis of the research model, the study applies SEM. This method is seen to have advantages over traditional regression models. This method originally tries to estimate a set of causal relationships (Esposito Vinzi *et al.*, 2010). Within the SEM approach, the author has chosen PLS as this method is appropriate for causal relationships (Naylor *et al.*, 2012). PLS is also appropriate in dealing with a small sample size (Ringle *et al.*, 2012; Chin, 1998). In this research, the object is to test a new model; again PLS is a good method to test a structural model (Gefen *et al.*, 2011). The SmartPLS software has been used to analyze the data as it is a suitable package for PLS-SEM (Ringle *et al.*, 2012).

Reliability and validity

One of the advantages of using PLS-SEM is that the method gives good opportunities to look at reliability and validity from different angles. To test the reliability, the author looked at the composite reliability of each construct. It is recommended that the results should be more than 0.70 (Mclure Wasko and Faraj, 2005). This has been shown with Cronbach's α for each construct in Table I, where all of the constructs exceed 0.70, ensuring the reliability of the research.

In the next step the author uses SmartPLS software to test the validity of the research. Construct validity is ensured by testing discriminant validity and convergent validity. First, the research looks at AVE to assess convergent validity. It has been recommended that AVE should be at least 0.50 (Wixom and Watson, 2001). The results of this test have been shown in Table II, indicating that the study has achieved this criteria.

The author also tested discriminant validity, which was carried out by comparing the square of the correlations among the latent variables with the AVE (Chin, 1998). This is shown in Table II, demonstrating that the research has this validity.

	Composite reliability	Cronbach's α
Informational support	0.834	0.701
Participation intention	0.85	0.7
Social media	0.85	0.738

Table I. Reliability

Informational support	0.626		
Participation intention	0.437098	0.711	
Social media	0.509995	0.675525	0.656
AVE	0.63	0.72	0.66

Table II. Square of correlation between constructs

Finally, the research looks at the validity by performing factor loading. It is recommended that the factor loading of each item should be greater than the construct of it than any other factor (Mclure Wasko and Faraj, 2005; Chin, 1998). This test gives a whole picture of validity as shown in Table III. The author does not find any cross-loading in the table.

Structural model analysis

The structural model analysis performed by SmartPLS software and the overall results show that all the paths in the model are positively significant at the 0.05 level. By looking at R^2 the model accounts for almost 47 per cent of the variance in participation intention, which indicates an acceptable level of explanation power. This section of the results indicates that participation intention was affected by social media construct and informational support. The R^2 for informational support means that 27 per cent of the variance in informational support was accounted for by social media. Overall the results of the structural model analysis show that the proposed model has a satisfactory level of explanation power. In the next step the author looks at the relationships among constructs. In this step, the path coefficients have been considered, as shown in Figure 2.

The pass coefficients show that informational support (0.13) and social media (0.51) have significant effects on participation intention, supporting *H1* and *H3*. The direct effect of social media on participation intention is stronger than that of informational

	Participation intention	Social media	Informational support
PI1	0.78492	0.454813	0.34777
PI2	0.897708	0.660056	0.389057
SCC1	0.564732	0.826838	0.45784
SM2	0.514792	0.800411	0.425468
SM4	0.561085	0.801882	0.351676
SI1	0.309121	0.424452	0.803984
SI2	0.382966	0.326104	0.748666
SI3	0.348311	0.453014	0.819102

Table III.
Cross-loadings

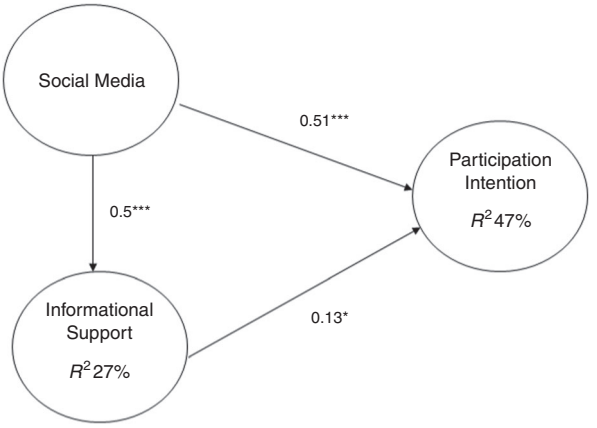

Figure 2.
Results of the PLS-SEM analysis

Notes: *$p < 0.05$; ***$p < 0.001$

support (0.51 vs 0.13). This indicates that social media is more important than any other construct on affecting participation intention of users in open innovation. Social media also have a significant effect on informational support (0.5), which supports *H2*.

Discussion

A research model has been developed to examine the role of social media and informational support in open innovation in online communities. A survey through an online questionnaire has empirically tested the structural model using PLS-SEM. The results of the empirical study show that interconnectivity of participants through social media in online open innovation directly affects their participation in user participation of open innovation. In this regard, social media is a strong tool to encourage individuals to participate in open innovation of NPD. Social media facilitates the social interaction of the participants to take an active position and share their experiences and knowledge about a new product with their peers in online communities. Individuals using social media are attracted to online communities to receive information and find out about the experiences of others related to a product. Therefore, it can be a valuable source of information for firms to use these communities for NPD. This answers the first question of the research by indicating that social media has a direct effect on intention to participate in open innovation in an online context. The results of the study also indicate that social media provide informational support or social support for the members of online communities. The informational support that participants receive through social media in online communities is a motivating factor and encourages them to participate in online communities of open innovation. This is a cost-efficient way of NPD for businesses by encouraging consumers to participate in online communities related to innovation. These results address the other questions of the study. The results of PLS-SEM analysis show that social media has both direct and indirect effects on intention to participate in online communities for open innovation. Social media and informational support, as social capital of online communities, both have influence on participation of individuals in the online communities of open innovation for NPD. However, social media has more effect than informational support. Therefore online communities, which have been specifically developed for innovation purposes, are strong tools for firms working on NPD.

Practical implications

Enabled by Web 2.0 technologies, individuals are increasingly using social media and joining online communities. Developing online communities, where individuals can join and participate by sharing their information, experiences and knowledge about a new product, can be a powerful and cost-efficient tool for firms. The findings of this study are consistent with previous research (Di gangi and Wasko, 2009), highlighting the fact that organizations are not the only source of innovation; consumers can support business in the innovation process. Organizations may change their innovation strategies to develop online communities to involve customers in their forward planning. Research shows that social media is a powerful tool for this purpose. However, the development of a community is not the only solution to achieve success in open innovation; the strategies of an engagement and contribution culture become a key fact as well (Tickle *et al.*, 2011).

Limitation

This research has some limitations as do other related studies. One of the main limitations of the study is that the author was unable to collect separate data from individual online

communities to compare the results between two or three communities. The future research direction for this type of work, therefore, can be aimed at testing the model in one or two specific online open innovation communities and comparing the results. As mentioned previously, the culture of each community is different and each may give different results.

Conclusion

It is fact that firms need to consider external sources for innovation to successfully develop their business. Some companies are now using consumers in the innovation process, sharing open innovation strategies, as a result of the development of social media and online communities. Consumers join these communities to participate in the social interaction of the network by sharing their knowledge and information. This research has built on social support theory and the concept of open innovation resulting from social media in NPD. A research model has been developed and tested. The results of the study indicate that social media empower individuals to come online, get involved in social interaction and share their experiences about a new product with other peers in the network. Some organizations are developing online communities to involve potential customers in the innovation process as they will look at the product from a different perspective; this can be a great source of innovation in NPD. The results show that individuals produce informational support in online communities, which influences others accessing the site. These communities can be innovation networks for new products and support firms in the process of NPD. Overall, the study shows that social media is a strong and cost-efficient tool for open innovation and NPD, as it provides easy interconnectivity for users with informational support for new products being made available. Convenient online channels through online communities have developed open innovation as an attractive way of involving customers in value creation.

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