Pyramiding 2.0:

Exaptation of the Pyramiding Approach to Recruit New Idea Contributors for a Virtual Ideas Competition

Completed Research Paper

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Abstract

When searching for user innovations, the identification of so called 'technology lead users' is one of the most important tasks. However, scientific literature indicates that the present me assures to search and to recruit new members imply high spreading losses. As a con-sequence we develop the "Pyramiding 2.0" approach. Building on existing literature we develop a theory-motivated approach for systematically recruiting participants for a crowdsourcing environment with the help of a virtual social network. This paper describes our reasons for using the pyramiding approach and elaborates on the supposed benefits that an adaption of the pyramiding search within an online setting implies. Our findings confirm the assumption that the pyramiding 2.0 approach can be successfully applied to recruit new idea contributors for a virtual ideas competition. Moreover, our results show that pyramiding can be applied within a virtual social network, thereby expanding existing literature within the field of pyramiding.

Keywords: Virtual community, Idea generation, Social networks, Open innovation

Introduction

Due to an increased mobility of skilled labor and a greater dissemination of knowledge as well as to an increased competition in relevant markets, many companies face increasing pressure to shift their innovation efforts (Chesbrough 2003b). As a consequence, they turn their attention towards external knowledge sources, which have turned out to be a valuable source for continuous and radical innovations (Chesbrough and Vanhaverbeke 2011; Gales and Mansour-Cole 1995; Lettl et al. 2006; Poetz and Schreier 2012; von Hippel 2005).

However, when searching for radical user innovations, the identification of so called 'technology lead users' is one of the most crucial tasks (Lettl 2007). Consequently, many different approaches to identify innovative customers have been proposed, which are capable of generating new product ideas (Bilgram et al. 2008; Henkel and Sander 2007; Herstatt 2003; Spann et al. 2009; Tietz et al. 2006). These different approaches are either based on screening a large sample of customers or on the principle of social recommendation (von Hippel et al. 2009). Among these approaches for identifying innovative customers, the pyramiding approach has gained much interest in research and practice (Lilien et al. 2002; Olson and Bakke 2001; Von Hippel et al. 1999), as it requires only about one third of the effort of screening approaches (von Hippel et al. 2009).

While the pyramiding approach has turned out to be a successful approach for identifying individuals with special characteristics, it still demands a high amount of skilled labour. As a consequence, the cost of identifying one individual is about $1,500. (von Hippel et al. 2009). The paper at hand will therefore propose a new approach for identifying innovative customers. By adapting the pyramiding approach (von Hippel et al. 2009) for use in a virtual social networks (VSN) we propose an appropriate solution to the problem of identifying individuals with rare characteristics and still minimizing the spreading losses when searching for suitable individuals. We will test our approach by using it for identifying customers that would contribute to company-hosted ideas competitions. These competitions in which distributed customers focus on voluntarily generating innovation ideas are used by firms to integrate customers into ideation for new product development, rooted in Chesbrough's Open Innovation paradigm (Chesbrough 2003a; Gassmann et al. 2010).

The outline of the rest of the paper is as follows. In the next section we review existing literature concerning the identification of individuals with rare characteristics in order to identify a suitable approach for such individuals within a virtual social network. The third section describes the method of adapting pyramiding for use in an online setting. Next, we describe the testing of the adopted process of our actual ideas competition on SAPiens as well as the results of the conducted pyramiding search. The fifth section discusses these results and outlines the implications for theory and practice. Concluding the paper, the last sections provide the limitations and recommendations for future research.

Theoretical Background: Identification of Individuals with Rare Characteristics

According to von Hippel et al. (2009), identifying individuals with special characteristics within a large population can be classified into two different streams. The first is called screening, which requires the researcher to collect information from every subject within a population in order to identify those with the desired characteristics (Sudman 1985). This screening approach is used within a variety of applications, such as marketing, biology, as well as innovation management (Chen et al. 2009; Herstatt and Von Hippel 1992; Shrivastava et al. 2011). The second approach of identifying individuals with rare characteristics is based on the principle of social recommendation (Spreen 1992). These approaches make use of the social networks of a predefined sample to provide new recommendations to researchers.

This is implied in von Hippel et al.'s (2009) pyramiding approach - a variant of snowball sampling that has been commonly used in the past (Atkinson and Flint 2001; Frank and Snijders 1994; Griffiths et al. 1993; Sudman 1985). In snowball sampling, an individual with special characteristics is asked to identify another individual with the same number of these characteristics (Vogt and Johnson 2011). In contrast, pyramiding requires that a given individual knows another individual with a *higher* number of the

searched characteristic. In recent years, pyramiding has gained much interest in research and practice (Lilien et al. 2002; Olson and Bakke 2001; Von Hippel et al. 1999).

Pyramiding is useful if someone wants to identify an individual with a high number of a given attribute in an efficient manner, as it requires only about one third of the effort of screening approaches (von Hippel et al. 2009). The pyramiding approach is based on the assumption that people with a high interest in a given field are likely to know other people that know more than they do about the same topic. In our case, we would assume that a person very interested in the field of social media will be likely to know other persons that are even more sophisticated within the field of social media. A pyramiding search typically starts with a list of individuals possessing a high number or level of a specific attribute for which the person or company executing the search process (hereafter called researchers) is searching. In the next step, every individual is asked for another person that has an even higher number of the searched attribute. The researcher then follows this recommendation and interviews the recommended person to find out whether the person actually possesses a higher level of the searched attribute. If the recommended person turns out to have a sufficient level of the desired attribute, the company asks the person for another expert within the given field. This procedure is repeated until the desired person with a predefined level of the searched attribute is found (von Hippel et al. 2009). Figure 1 illustrates the approach.

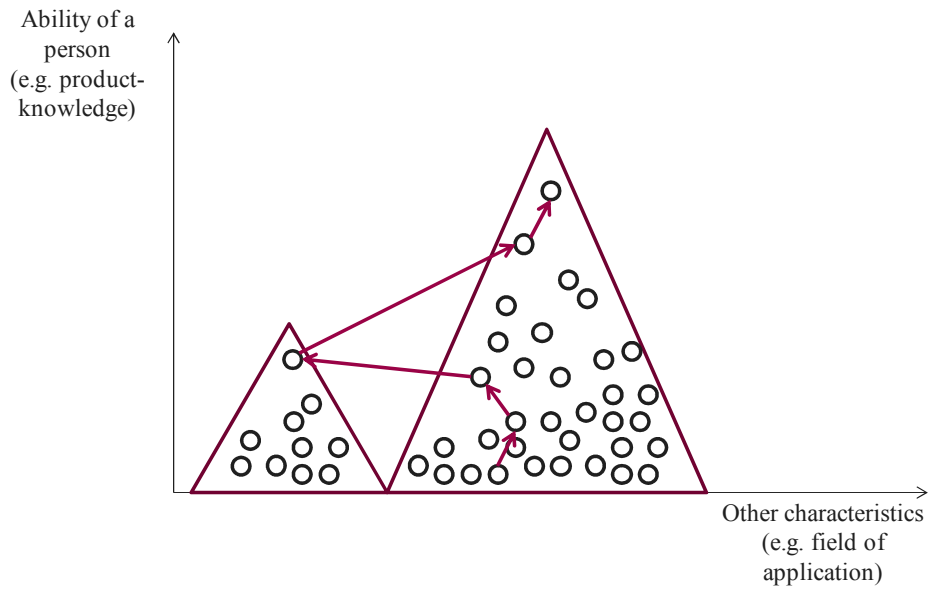

Figure 1: Illustration of the Pyramiding Approach (von Hippel et al. 2009)

While the pyramiding approach has turned out to be a successful approach for identifying individuals with special characteristics, it is still too expensive to use for identifying idea contributors for a virtual ideas competition. This is because conducting a pyramiding search typically requires the researcher to conduct telephone interviews, thus implying a high level of skilled labor. As a consequence, the cost of identifying one individual is about $1,500. (von Hippel et al. 2009). Although this is only one third of the cost of the screening approach, this procedure is too expensive to use when identifying idea contributors for an ideas competition. We therefore adapt the pyramiding approach for use in an online setting. In doing so, we can access a large network of connected people (Kietzmann et al. 2011) without being forced to carry out telephone interviews, thereby assuming that the cost of identifying an expert within the field of social media should decline significantly.

Exaptation of Pyramiding Principles

After screening the scientific literature for different approaches to identifying individuals with special characteristics, we recognized that existing approaches were inefficient to identify new idea contributors for a VIC. We consequently exapted the pyramiding principles for use in an online setting (Gregor and Hevner 2013). This design was theory-ingrained, meaning that our artifact is informed by theory (Sein et al. 2011). In this context, we built on pyramiding theory, which can be categorized as explanation and prediction theories, according to Gregor (2006). Thus, pyramiding theory helped us to structure our underlying problem and to identify solution possibilities for it.

Looking at the existing procedure of conducting a pyramiding search, we identified two principles. First, pyramiding requires the researcher to move up the pyramid and identify people with a higher level of the searched attribute. This principle distinguishes pyramiding from the most similar approach, snowball sampling, within which an individual is asked for a person with the same level of the given attribute. We thus leave this principle unchanged when adapting the pyramiding approach for use in an online setting.

The second principle is the application of a sequential process to identify people with the desired characteristics. Pyramiding incorporates serial experiments (Thomke et al. 1998) which enable the researcher to learn step-by-step (von Hippel et al. 2009). In addition, these serial experiments give the researcher the possibility to determine whether he is moving up the pyramid. As the researcher interviews all recommended persons to find out whether they really possess a higher level of the searched attribute, he is able to confirm that he is really moving up the pyramid. Previously, this has been done via telephone interviews, where the researcher can carefully examine the characteristics of the identified individual. As these interviews require a considerable amount of skilled labor, we substitute them with standardized messages.

For this purpose, we prepared a letter (Appendix 1) in which we asked participants to name one individual who had a higher level of the desired characteristics. To find out whether the recommended person really possessed a higher level of the searched attribute, we used a questionnaire that probes for the desired characteristics (Appendix 2). The results of the questionnaire were then compared to the results of the previous individual. If the individual reached the desired level of the searched characteristic, the particular person would be invited to participate in the ideas competition. In order to be able to contribute ideas to the topic of the actual ideas competition, the individuals to be identified were expected to possess a high level of two personality traits: high product-knowledge and –experience related to different social media applications.

To test the resulting recommendations, we developed a questionnaire to investigate the personality traits of idea contributors in virtual ideas competitions. For two reasons, we decided to use a questionnaire within which we requested self-assessment. First, as we intended to contact a large number of persons, using a questionnaire would be more effective than using the interview method. Second, using a questionnaire would enable us to collect standardized data that could be assessed more for reliability and validity (Bortz and Döring 1995).

To assess the personality traits of the identified individuals, we used a questionnaire developed by Bretschneider (2012) In which product-knowledge was defined as knowledge about different social media applications, and product-experience defined as the experience of the identified people in using different social media applications. Each item was evaluated with the help of a five-point rating scale. Appendix 4 provides an overview of the two personality traits as well as their operationalization.

If the recommendation was accepted, we asked the identified person to recommend another individual with a higher level of the two personality traits mentioned above. A search chain was judged to be successful if the identified individual had a higher number of the searched personality traits than the average idea contributor had. We therefore provided the questionnaire to all existing idea contributors and calculated the average for both characteristics. The average results were then compared to the answers of the identified individuals. If the identified individuals turned out to possess a higher amount of product-knowledge and –experience than the average idea contributor, the search chain was judged to be successful. Whenever we reached such a local maximum the corresponding search chain was stopped. An English version of the questionnaire can be found in Appendix 2.

As we relied completely on standardized messages, there was no possibility of checking whether the chain had been cancelled by participants. In a telephone interview the researcher would have the possibility of asking the participant if he really wanted to break up the search chain. Unless the participant informed us explicitly, we did not have this possibility, since it would be much easier to ignore an electronic message compared to a telephone call by the researcher. For this reason, we incorporated a rule to judge whether a search chain had been cancelled. We contacted every identified person three times within a period of three weeks. If the person did not respond within this span of time, the search chain was judged to be cancelled.

Piloting the ”Pyramiding 2.0” Approach: The SAPiens Ideas Competitions

SAPiens is an internet-based innovation contest, hosted by the German software supplier SAP. Based on the open innovation paradigm, SAP transcend their boundaries in order to make use of external resources in developing ideas for innovation (Chesbrough 2003a). In this context, customers are seen as a key resource, as they often have high product expertise as well as experience and creativity potential gained by regular product usage (Amabile 1979; Fuchs and Schreier 2011; Henle 1962).

Within such an ideas competition on SAPiens, customers or other stakeholders of SAP are asked to contribute their ideas according to the environment or the value creation of the company within a given period of time (Ebner et al. 2009; Haller et al. 2011; Piller and Walcher 2006). After the submission phase, within which the different stakeholders submit their ideas, all contributions are reviewed by a jury of experts, and the best contributions are awarded.

As in many other successful examples, such as IBM’s Innovation Jam (Bjelland and Wood 2008) or OSRAM’s LED Design Contest (Hutter et al. 2011), it was possible to collect many innovative ideas with the help of SAPiens, within which several topic-related ideas competitions were conducted (Ebner 2008; Ebner et al. 2008). Despite this positive contribution, the number of ideas within the current competition that deals with the topic of “SAP and Social Media” has declined significantly. **Figure 2** provides an overview of the number of submitted ideas within the several topic-related ideas competitions. This drop in the number of submitted ideas can be explained by the effect of motivational crowding, describing the phenomenon of intrinsic motivation of participants being undermined by external rewards such as monetary prices or external recognition (Frey and Jegen 2001). This finding calls for the need to recruit new idea contributors in order to revive competitions and to give existing community members the possibility to discuss and share their experiences with new individuals (Adamczyk, Haller, Bullinger, & Moeslein, 2011; Bullinger, Neyer, Rass, & Moeslein, 2010).

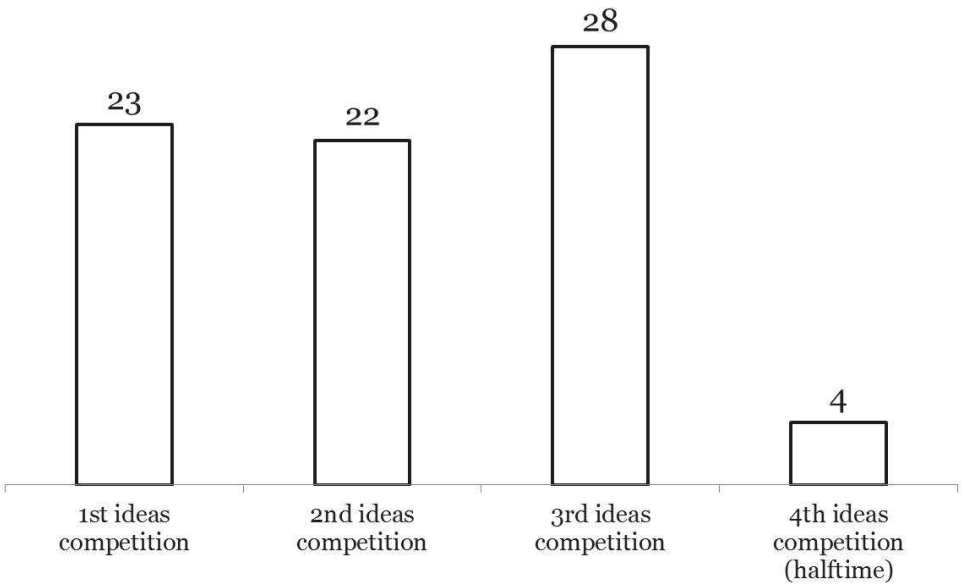

Figure 2: Number of Submitted Ideas within the Several Topic-related Ideas Competitions on SAPiens (Source: Own Research)

As a consequence, the moderators of SAPiens turned their attention towards recruiting new idea contributors in order to revive the actual competition and to give participants the possibility to discuss and share their experiences with new individuals (Adamczyk et al. 2011; Bullinger et al. 2010). To attract new idea contributors for topic-related ideas competitions, the moderators used a set of different marketing measures. This marketing mix comprised offline measures such as mailing of promotional material and the representation of SAPiens on events. Further, it included several online marketing measures, e.g., emailing, fan pages within social networks, as well as newsletters. While these approaches could be valuable instruments for other settings, it was not possible to recruit new idea contributors for the actual ideas competition.

Scientific literature indicates that this is mainly due to the high spreading losses of several marketing measures (Hass and Willbrandt 2011). Idea contributors on virtual ideas competitions differ from other individuals according to their product-knowledge and product-experience (Bretschneider 2012). Taken together, these two characteristics (product-knowledge and product-experience) implicate that idea contributors for our actual ideas competition had to possess extensive product-knowledge and –experience on the topic of "SAP and Social Media." As a consequence these idea contributors form a specific target group that cannot be fully reached by the existing marketing measures. Accordingly, the aim of the research described in this paper is to develop a different approach to identify and recruit idea contributors that are experts in the field of "SAP and Social Media."

Finding idea contributors for the narrow topic "SAP and Social Media" required the organizers to identify people with a high product-knowledge and –experience according to the fields of social media and SAP. Given these characteristics, the idea contributors that had to be recruited formed a very specific target group and could not be fully reached by the existing marketing measures.

In order to test the developed approach, we relied on a virtual social network where the network messages could be easily sent to different individuals without any media disruptions. Furthermore, people within a social network had access to a big network of other individuals. Taking into account the fact that successful search chains in previous works were disproportionally based on business contacts (Dodds et al. 2003), we conducted our search in the social network, Xing, which is a social network for business professionals. Similar to LinkedIn, it allows users to find and connect to new business contacts. We chose Xing, as it is the biggest as well as most active social networking site within German speaking countries (Table 1).

Table 1: Comparison of Xing and LinkedIn (tobesocial 2011)		
	XING	***LinkedIn***
Registered users within German speaking countries	5 m	2 m
Average time per page visit	9.6 min	6.3 min
Monthly search queries in Google	1,500,000	165,000
Monthly page views	160 m	23 m

In the previous sections we identified the pyramiding approach as a promising approach for identifying idea contributors for a virtual ideas competition. While the pyramiding approach had been successfully employed in an offline setting, we proposed that employing a virtual social network would give us the opportunity to access a big network of people without the need for time intensive telephone interviews. As a pyramiding search had never been carried out in a virtual social network, we needed to evaluate whether these networks were a proper medium for conducting a pyramiding search.

Results

Before presenting the results of our pyramiding search, we will first describe the validation of the questionnaire that was used for identifying idea contributors for virtual ideas competitions. The results of this analysis are based on the answers of 138 individuals (N=138).

Validation of Empirical Data

We tested the construct validity of our two personality traits and the related seven items with the help of an exploratory factor analysis. We analyzed the items with the help of the statistical software program SPSS 20.0. To assess whether the data were appropriate for factor analysis, we pre-analyzed the Measures of Sampling Adequacy (MSA) for the individual items and for the whole data structure. The results showed that all items achieved an MSA that exceeded the value 0.5, which is in line with Cureton et al. (Cureton and D'Agostino 1983). We also pre-checked the global MSA value. With a MSA of 0.755, the stringent 0.5-criteria of Cureton et al. (Cureton and D'Agostino 1983) was also met.

The factor analysis resulted in two factors with values higher than 1 (varimax rotation). The two factors explained a total of 68.296% of the variance. The first factor explained 52.442% of the variance, which was mostly determined by all items representing the personality trait "product experience" (PE) The item PK3 also loaded on this factor. Due to the close relationship between product-experience and -knowledge (Lüthje 2000; Sauer 2003), we accepted this item in the factor "product knowledge." The second factor determined by the items that were related to "product knowledge" explained 18.470% of the variance. As the item PE2 did not reach a value of 0.55 (Hair et al. 1998), it was excluded from further analysis. The reliability of the resulting factors was checked using Cronbach's alpha. A Cronbach's alpha of 0.7 or higher (Nunnally 1978) was used as an acceptable value for internal consistency. A first iteration revealed that Cronbach's alphas ranged from 0.830 for factor 2 to 0.833 for factor 1.

As emphasized by Bogazzi et al. (1991), with the sole examination of validity and reliability by directly applying explanatory factor analysis Cronbach's alpha does not meet modern requirements. We therefore tested our resulting model, based on the two remaining factors and the corresponding six items, by applying confirmatory factor analysis (Straub et al. 2004). In order to do so, we used AMOS 19.0 to check the global fit of the new model. The Goodness of Fit Index (GFI) was 0.989 and the Adjusted Goodness of Fit Index (AGFI) was 0.971. In addition, we found that the squared multiple correlations for the item PW2 was below 0.4, and was thus deleted from further analysis. As a result of this deletion, we conducted another factor analysis, within which only the resulting factors PE1, PE3, PE4 as well as PK1 and PK3 were included. As within the first round, all items achieved an MSA that exceeded the value of 0.5 and the global MSA value of 0.762.

The factor analysis resulted in two factors with values higher than 1 (varimax rotation). The two factors explained a total of 77.937% of the variance. The first factor explained 64.031% of the variance, which was mostly determined by all items representing the personality trait "product experience" (component 1 in Appendix 5). The second factor was determined by the items that were related to "product knowledge," which explained 13.906% variance. We thus called this factor "product knowledge" (component 2 in Appendix 5). After this explanatory factor analysis, the results support the assumption that the resulting model has adequate construct validity.

Considering the reliability of the resulting factors, the second iteration revealed that Cronbach's alphas ranged from 0.737 for factor 2 to 0.818 for factor 1 (see Appendix 5). The Goodness of Fit Index (GFI) was 0.995 and the Adjusted Goodness of Fit Index (AGFI) was 0.982, indicating an adequate fit (Browne and Cudeck 1993). In order to check the reliability of the model, we measured all individual Item reliabilities. As depicted in Appendix 6, all items exceeded the minimum threshold for good reliability of 0.4 (Homburg and Giering 1996).

Further, all factors of our new model showed good values for Composite Reliabilities as well as for Average Variance Explained (AVE), and thus convergent validity can be assumed (see Appendix 6). Values of 0.6 regarding the Composite Reliability and 0.5 for the AVE can be seen as minimum values for indicating a good measurement quality (Bagozzi and Yi 1988). The discriminant validity of the factors was checked by using the Fornell-Larcker criteria, which claims that one factor's AVE should be higher than its squared correlation with every other factor (Fornell and Larcker 1981).

Results of the Search Process

After validating our questionnaire, we now present the results of the search process. In a first step towards the identification of idea contributors for our ideas competition, we identified 77 moderators. We chose these moderators, as their groups were related to the field of social media. When searching for a suitable recommendation, we concentrated our efforts on groups that had at least 200 members in order to enhance the probability that the identified moderators had a big network to access. All moderators were previously unknown to us. The identified moderators were asked to give one recommendation to another person within their network on Xing. 49 moderators answered our request, serving as a basis to start our pyramiding search. From these 49 moderators, we received 33 recommendations, thus building the first link of the pyramiding chains. Out of these 33 persons, six turned out to have a sufficient amount of product-knowledge and –experience, which justified stopping the corresponding search chains. Out of the remaining persons, 21 provided us with another recommendation and 6 did not respond to our request. Out of the 21 persons that were recommended as the second link of the several search chains, twelve were identified as being an expert within the field of social media. Out of the remaining persons, five recommended another person within their network and four people did not respond to our request. Within the third and fourth chain links, four persons were identified as being experts in the field of social media, and one did not respond. Altogether 154 persons were contacted during the course of our pyramiding search. A successful search chain had an average length of two chain links. **Table 2** summarizes these results.

Table 2: Results of the Online Pyramiding Search

Chain link	***0***	***1***	***2***	***3***	***4***
Σ (individuals contacted)	*77*	***33***	***21***	***5***	**2**
Number of experts	*0*	*6*	*12*	*2*	2
Number of further recommendations	*33*	*21*	*5*	*2*	0
Number of individuals not able to provide further recommendations	*16*	*0*	*0*	*0*	0
Number of persons not responding	*28*	*6*	*4*	*1*	*0*

Discussion

Recall from the first section that the goal of this research endeavor was to identify experts within the field of social media for our virtual ideas competition on SAPiens. Given the narrow topic of the competition, we decided to employ a new approach that would enable us to avoid the spreading losses implied in the marketing measures that were previously used. Based on this goal, we first investigated the efficiency of our online pyramiding search. Given the fact that we identified 22 experts by contacting 95 persons, the spreading loss of our pyramiding search was 76.8%. Compared to our other marketing measures, this is an adequate value. Altogether, when compared to our traditional marketing measures, we were able to reduce the implied spreading losses by 21.74%. **Table 3** provides an overview of the different marketing measures as well as the spreading losses when trying to recruit idea contributors for our actual ideas competition.

Table 3: Spreading Losses of the Existing Marketing Measures on SAPiens Compared to the Adapted Pyramiding Approach

Marketing measure	***Representation on events***	***E-Mail***	***Fan pages***	***Newsletter***	***posts on external weblogs***	***Pyramiding Search***
Contacted persons/ institutions	430 students	583 institutions	29,749 members	930 recipients	24,315 members	**95**
Number of people reached (cumulated)	430	11,600	*29,749*	*930*	24,315	**95**
Number of new members(across all measures)			20			**22**
spreading loss	95.3%	99.8%	99.9%	97.8%	99.9%	**76.8%**

Another strength of our new approach becomes obvious when the costs per identified individual are taken into account. By using the pyramiding approach in an online setting, we intended to make use of highly standardized messages, thus lowering the costs of the search. As a result, we spent 33 hours of unskilled labor on conducting the search (the efforts in designing the approach were not included). As we identified 22 individuals, we spent 1.5 hours or 14.25 € on identifying one individual. Although we are aware of the fact that online and offline pyramiding cannot be compared per se (we will discuss this fact within the limitations section), we do consider the low labor costs as a success.

Apart from these efficiency measures, our pyramiding search revealed some other interesting insights into the structure of social networks. In sum, we contacted 154 individuals within the virtual social network, Xing. Out of these 154 persons, 55 did not respond to our request, resulting in a response rate of 64.1%. Compared to the results of Sheehan (2001), who reported a mean response rate of 36% within 31 email based studies, the participation rate can be considered to be high. Further, the responses of the moderators that refrained from participating in our study are encouraging. Only two moderators refused to answer requests from unknown persons.

With regard to other reasons that moderators did not participate in our study, two facts are noteworthy. First, the majority of the respondents (46%) responded with being unwilling to participate in a SAP related competition. Although this fact negates our purpose of recruiting idea contributors for a SAP related competition, the possibility remains that the persons would have participated in a study with a

different purpose. Further, only 36% of the respondents felt unable to name an individual with a higher level of the searched characteristics.

Another interesting point becomes obvious when the number of false recommendations is taken into account. As the pyramiding approach requires the researcher to move up the pyramid and identify people with a higher level of the searched attribute, we had to check all recommendations for their level of product-experience and –knowledge. Only if the recommended person turned out to have a higher number of both characteristics, did we judge the recommendation to be successful and then asked the identified person for a further recommendation. After completing our search, we found that only 10 recommendations had an insufficient number of the searched characteristics, requiring us to step back and ask the previous person for another recommendation. Given the total number of controllable recommendations (the persons that did not respond could not be controlled), the ratio of successful recommendations was about 87%.

Implications

Implications for Practice

Considering practical implications, we developed an approach that enables the host of a topic-related ideas competition to efficiently find and identify idea contributors. With the help of an online pyramiding search, the host of a topic-related ideas competition can efficiently identify idea contributors, as the implied spreading losses are significantly smaller than those in other approaches for identifying idea contributors. In this regard, online pyramiding constitutes an effective measure, which can be used for recruiting new participants for a topic-related ideas community. Additionally, it might be possible to search for individuals that possess other personality traits. By modifying the questionnaire in terms of the searched criteria, the hosts of an ideas competition could enrich their competitions with new members meeting the desired criteria. In doing so, hosts of a topic-related ideas competition are able to search directly for participants, who are lead users in a predefined topic and therefore capable of providing new insights and ideas related to this topic. This would not only contribute to the number of participants within the ideas competition, but also provide new input for the other participants within the ideas competition.

Apart from the different application possibilities within a virtual ideas competition, our approach might be used in different settings as well. Although we tested our approach in the setting of a virtual ideas competition, this approach might also be used in other open innovation settings, such as virtual ideas communities, which are comparable to ideas competitions. These communities, in which distributed groups of individual customers focus on voluntarily sharing and elaborating innovation ideas, are also used by firms to integrate customers into ideation for new product development (Bretschneider et al. 2014). The identification of lead users can also be named as an example of such an application. As the pyramiding approach was originally designed for identifying lead users, our approach might be an efficient way to search for customers that can be employed in such co-creation workshops.

Implications for Theory

According to Dibbern et al. (2008), different kinds of theoretical contributions to research can be distinguished, depending on the goal and type of the underlying theory. Among others, the authors distinguish confirmation and extension of existing theories.

Considering theory confirmation, our results provide empirical evidence that the pyramiding approach can be successfully applied in order to identify idea contributors for a virtual ideas competition. Thus, our results have delivered additional insights into the usefulness of the pyramiding approach for identifying persons with rare characteristics. While the pyramiding approach has previously been used for identifying lead user (von Hippel, et al., 2009), our study was the first one using the pyramiding approach for identifying other kinds of rare individuals. Thereby we expand the scope of the pyramiding approach beyond its use within lead user research. In doing so we contribute a new method to the existing prescriptive knowledge (Gregor and Hevner 2013) within the field of user innovation. As a consequence, our results might not only enable host of a VIC to ensure a constant supply of new idea contributors

(Bayus, 2010), but might also encourage other researchers to apply the Pyramiding 2.0 approach in other crowdsourcing initiatives.

In accordance with theory extension, our results prove that the pyramiding approach can be successfully adapted for use in an online setting. In this regard we were capable to enhance existing literature considering the use of pyramiding for identifying people with rare characteristics. While it is widely acknowledged that pyramiding is very helpful to identify certain individuals (von Hippel et al. 2006; von Hippel et al. 2009), participants in a traditional pyramiding search, are familiar to each other and do have strong relationships. Within a social network this is not necessarily the case, as people connect to each other without knowing themselves personally. Thus previous studies focused on the use of lines of acquaintanceship when conducting a pyramiding search. The use of a VSN has previously not being considered when searching for individuals with rare characteristics. By employing the "Pyramiding 2.0" approach for recruiting new idea contributors for an existing crowdsourcing platform we were able to show that a pyramiding search can be conducted successfully within a VSN. By using a standardized questionnaire, when looking for suitable participants for our ideas competition, we also provided other researchers with a possibility to avoid interviewer biases when conducting a pyramiding search. Thereby, one of the most challenging limitations in previous research projects, may be resolved (Poetz and Prügl 2010).

In addition to enhancing pyramiding literature with a new channel to conduct a search process, our results also deliver new insights into the existing body of knowledge related to small world principles (Milgram 1967) in social networks. As we were able to show, similar to an analogous setting, individuals within a VSN are capable of providing the researcher with a directed recommendation. This is in contrast to the existing body of knowledge as previous studies focused on studying small world problems in a setting within which the messages were distributed on nonsocial networks or on crude proxies of social networks and mostly employed a physical distribution channel (Dodds et al. 2003). In contrast to that, our study offers an example of using VSN for identifying individuals with rare characteristics. Thereby we were able to enhance the body of knowledge concerning small world problems with another application field, within which principles of a small world can be identified.

Thirdly, the results of our search process show that successful search chains within a small world setting are not reliant to personal acquaintances. As previous studies focused on a personal network when searching for distinct individuals (Dodds et al. 2003; Milgram 1967), we were able to extent existing literature by relying on a network of professionals when conducting our small world procedure. Thereby we expanded the scope of small world research by providing a new area of application, namely social networks among business professionals.

Limitations and Future Research

Regarding the limitations of our research endeavor, we suggest that the limitation of the sole use of the virtual social network, Xing, needs to be addressed. Although we had good reasons to conduct our first pyramiding search within Xing (the most active virtual social network for business purposes in German speaking countries), its sole use does inhibit the generalizability of our results. While we have been able to show that pyramiding can be successfully applied in an online setting, we are not able to predict whether our proposed course of action can be applied to other VSN. We will therefore conduct similar searches in other VSN in order to enhance the generalizability of our results. This might enable us to shed light on the characteristics of these networks.

Second, when looking at the design of our questionnaires, one might find the definition of social media as being too generic in order to allow the participants of our study to give a sound recommendation. This is because social media is a relatively new 'thing' and therefore participants might struggle in giving a precise recommendation. In contrast to fields like "project management" "activity based costing" or "excel", the term "social media" tends to be very broad and therefore recommendations in such a broad field might exhibit a high variance. As such a variance has the potential to bias the calculation of our spreading losses, future studies should try to replicate our studies in more mature research fields.

Third, we are aware of the fact that the results of our online research endeavor are not directly comparable with the results of an offline pyramiding search. Although we have been able to show that online pyramiding can be an effective way to identify people with rare characteristics, the comparison of

our results with those of an offline search implies several shortcomings. Clearly, in an offline setting, the researcher has the possibility of learning step-by-step. Moving up the pyramid, the researcher has the possibility of interviewing all individuals and considering their knowledge about the subject at hand. Future research should therefore elaborate on the question of how these learning processes can be implemented in an online pyramiding search. Doing so may make it possible to realize the full potential of the pyramiding approach. Furthermore, the effectiveness and efficiency of online pyramiding should be compared to those of the original pyramiding approach. Future studies should therefore compare both approaches in a controlled setting. In this regard, the qualification of the identified individuals should not only be evaluated by a self-assessment, but also by letting participants perform an innovation task. Doing so would enable a more detailed comparison of both approaches and therefore would enrich our knowledge whether online pyramiding is of equal value than traditional pyramiding when searching for individuals with rare characteristics.

Future research endeavors could also elaborate on the question of whether the high participation rate of our endeavor could be maintained throughout multiple searches. In addition, future research might elaborate in greater detail on the characteristics of successful search chains. Do they flow along special kinds of acquaintances (e.g., business partners) or do they make use of special hubs within the VSN that are highly interconnected? Answering these questions might help us not only in improving the efficiency of our pyramiding search but also in contributing to different marketing measures that are trying to make use of personal linkages within VSN.

Appendix

Appendix 1: Message that was sent to participants

Dear [Name of the recommendation],

I am writing you on recommendation of [name of the predecessor], who has identified you as an expert in the field of social media. First, I want to introduce myself. (…). Currently, we are running an idea competition with the topic "SAP and Social Media".

With SAPiens we want to give SAP interested people and users the possibility of forwarding requests and suggestions directly to SAP. For this purpose, our members can contribute their ideas within the community and elaborate on them with the help of other community members.

We are continuously looking for new input for SAPiens in order to provide our members with the opportunity to collaborate with experienced partners from different fields. For this purpose, we search for social media experts.

As you have been identified by [name of the predecessor] as a social media expert, we think you know a lot of Xing members who are social media experts as well. For this reason, I would like to ask you the following question:

Which of your contacts in Xing has the most knowledge and experience in the field of social media and would be interested in creating new ideas for a platform like SAPiens?

To give you some assistance in recommending a person, we have listed some characteristics that the recommended person should possess:

Your contact has knowledge about different social media applications on the market and how this interaction is above average

Your contact has technical background knowledge regarding different social media applications

Your contact is very familiar with social media applications and uses them regularly

It does not matter in which field of social media (e.g. Twitter, Xing, Facebook, Skype) your recommended contact has experience. The points above should just be an orientation and are not mandatory for your recommendation.

I would appreciate very much if you would recommend some of your contacts. Further, I would be very pleased if you became a member of SAPiens and contributed your ideas to the community.

Thank you very much for your support.

Yours sincerely,

XXX,

Appendix 2: Questionnaire that was used to control the participant's characteristics

Dear [name of the recommended person],

Thank you very much for your positive feedback. As discussed, you will find an attached questionnaire to identify social media experts. With the help of this questionnaire, we want to assess your skills and expertise in the field of social media.

In assessing yourself, how far do you agree with the following statements:

Compared with acquaintances and friends, I know much about the use of individual social media applications.

totally disagree ☐☐☐☐☐ totally agree

I have an overview of particular social media applications on the market.

totally disagree ☐☐☐☐☐ totally agree

I have knowledge about the context and impact of different social media applications and solutions.

totally disagree ☐☐☐☐☐ totally agree

I have much experience with the use of different social media applications.

totally disagree ☐☐☐☐☐ totally agree

I am very familiar with the use of different social media applications.

totally disagree ☐☐☐☐☐ totally agree

I have technical background knowledge regarding different social media applications.

totally disagree ☐☐☐☐☐ totally agree

I regularly use different social media applications.

totally disagree ☐☐☐☐☐ totally agree

Thank you very much for your support in the study!

Best regards,

XXX

Appendix 3: Overview of the operationalization of the two personality traits

Personality	***Operationalization***
Product Experience	I regularly use different social media applications. *(PE1)*
	Compared with acquaintances and friends, I know much about the use of individual social media applications. *(PE2)*
	I am very familiar with the use of different social media applications. *(PE3)*
	I have much experience with the use of different social media applications. *(PE4)*
Product Knowledge	I have knowledge about the context and impact of different social media applications and solutions. *(PK1)*
	I have technical background knowledge regarding different social media applications. *(PK2)*
	I have an overview of particular social media applications on the market. *(PK3)*

Appendix 4: Rotated Component Matrix

Items	*Components*	
	1	*2*
Product Experience		
I regularly use different social media applications. *(PE1)*	**0.897**	0.183
Compared with acquaintances and friends, I know much about the use of individual social media applications. *(PE2)*	Excluded, as item did not reach critical squared multiple correlation	
I am very familiar with the use of different social media applications. *(PE3)*	**0.637**	0.553

I have much experience with the use of different social media applications. *(PE4)*	**0.816**	0.340
Product Knowledge		
I have knowledge about the context and impact of different social media applications and solutions. *(PK1)*	0.179	**0.934**
I have technical background knowledge regarding different social media applications. *(PK2)*	Excluded, as the item did not reach critical MSA value	
I have an overview of particular social media applications on the market. *(PK3)*	0.406	**0.705**
Cronbach's Alpha	0.737	0.818

Appendix 5: Values for Individual Item Reliability, Composite Reliability, and AVE

Factor	Item	Individual Item Reliability (>/= 0.4)	Composite Reliability (>/= 0.6)	AVE (>/= 0.5)
Product Experience	PE1_1	0.587	0.832	0. 630
	PE3_1	0.641		
	PE4_1	0.687		
Product Knowledge	PK1_1	0.514	0.755	0. 611
	PK3_1	0.681		

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