Please quote as: Blohm, I.; Ott, F.; Bretschneider, U.; Huber, M.; Rieger, M.; Glatz, F.; Koch, M.; Leimeister, J. M. & Krcmar, H. (2010): Extending Open Innovation Platforms into the real world - Using Large Displays in Public Spaces. In: 10. European Academy of Management Conference (EURAM) 2010, Rome, Italy.

Extending Open Innovation Platforms into the real world - Using Large Displays in Public Spaces

Author: IVO BLOHM - Email: ivo.blohm@in.tum.de

Track: 25. ICT enabling Collaboration, Innovation and Knowledge Sharing: emerging "open" phenomena, organizational models and technological tools

Co-author(s):

- **Florian Ott (Universität der Bundeswehr München, Cooperation Systems Center Munich)**
- **Ulrich Bretschneider (Technische Universität München)**
- **Michael Huber (Technische Universität München)**
- **Markus Rieger (HYVE AG)**
- **Franz Glatz (gate Garchinger Technologie- und Gründerzentrum GmbH)**
- **Michael Koch (Universität der Bundeswehr München, Cooperation Systems Center**
- **unich)**
- **Jan Marco Leimeister (Universität Kassel, Chair for Information Systems)**
- **Helmut Krcmar (Techniche Universität München, Chair for Information Systems)**

Organisers:
University of Rome "Tor Vergata"
EIASM
EURAM

“Extending Open Innovation Platforms into the real world – Using Large Displays in Public Spaces”

Abstract:

This paper reports on a field test that explored how innovative ubiquitous user interfaces can extend virtual open innovation communities into real word settings. In this field test an Idea-Mirror™, a wall-sized, interactive touch screen that displays innovation ideas and features a scale for idea evaluation was compared with a state-of-the-art IT-based open innovation platform. Applying method triangulation and combining multiple, independent data sources it can be shown that ideas exhibited on the IdeaMirror have been invoked and rated significantly more often than on the IT platform. However, the idea ratings performed on the IT platform show a significantly higher concurrence with an independent expert jury. Implications for the use of IdeaMirrors in practice as well as for future research are deducted. To our knowledge this is one of the first studies that empirically investigate the purpose of publicly shared large screen displays for idea evaluation and supporting new product development.

Key Words:

open innovation, IdeaMirror, collaborative filtering, idea evaluation, ubiquitous computing, community support

1. Introduction

In the 20th century, many leading industrial companies generated, developed and commercialized ideas for innovations in self-reliance. Nowadays, companies are increasingly rethinking the fundamental ways of managing their innovation activities. Opening up company boundaries in order to utilize external resources for innovation activities becomes more and more important. For this emerging competitive strategy of open innovation customers are frequently seen as enormous potential for generating innovations (Kristensson, Magnusson et al. 2002; Enkel, Perez-Freije et al. 2005; von Hippel 2005). Thus, most methods of active customer integration into innovation processes like the lead user method (Urban and Von Hippel 1988; von Hippel 2005) or idea competitions (Walcher 2007; Ebner, Leimeister et al. 2009; Leimeister, Huber et al. 2009) focus on engaging customers in generating new product ideas. Prominent success stories such as the IBM Innovation JAM ideas competition in which more than 46.000 participants generated more than 140.000 ideas show the enormous potential of this mode of value creation. However, lacking are methods and instruments for evaluating the ideas submitted in these approaches (Blohm, Bretschneider et al. 2010). In new product development this task is generally performed by a small interdisciplinary group of experts. However, this approach is arduous, time consuming and resource intensive, in particular for a huge amount of customer-generated new product ideas (Franke and Hienerth 2006; Blohm, Bretschneider et al. 2010). Today, most IT platforms for open innovation provide functionalities for idea evaluation (Riedl, May et al. 2009) and first research has already been done in evaluating the accuracy of these rating mechanisms (Walcher 2007; Blohm, Leimeister et al. 2009).

New intuitive ubiquitous interfaces allow extending these IT-based open innovation platforms into physical, real world settings. Publicly shared large screen displays – so-called

IdeaMirrors – can expose new product ideas in semi-public facilities so that the awareness of these ideas can be enhanced and the tasks of idea generation and new product development be stimulated (Koch and Möslein 2006). Moreover, additional customers, business partners or employees could be integrated into the task of idea evaluation. By this means additional ratings could be gathered and the accuracy of the collaborative filtering be enhanced.

This paper reports on a field test which has been carried out with a major software enterprise in order to empirically investigate how IdeaMirrors can create awareness for new product ideas and how they can support the evaluation of customer-generated ideas. In the scope of this field test a set of customer-generated ideas was exposed to the 198 employees of 59 start up enterprises that were all customers of the software company and situated in the same premise of a business incubator using a state-of-the art internet-based open innovation platform and an IdeaMirror. On both instruments all ideas could be viewed, explored and rated by the participants. In this field test we investigated the actual usage, the user evaluation of both instruments as well as the accuracy of the ratings in terms of concurrence with an independent expert jury.

The paper is organized as follows: In Section 2 we present a literature review for describing the state of the art of IT-based open innovation platforms, IdeaMirrors as well as the complex construct of idea quality. Section 3 presents the research methodology. In detail the process of data collection, the design of the field test, the instruments as well as the assessment of idea quality are pinpointed. In Section 4 our empirical findings regarding the usage, the user evaluation and the rating accuracy of both instruments are presented. In Section 5 these results are discussed. Finally, Section 6 gives an outlook for possible future research areas.

2. Related Work

2.1 IT-based open innovation platforms

Today, most IT-based open innovation platforms are based on the toolkit approach (von Hippel and Katz 2002). Toolkits are software tools that help customers to externalize information about their needs and wishes. Recent reviews of IT-based platforms for open innovation activities have been performed by Riedl, May et al. (2009) and Leimeister, Huber et al. (2009). On these platforms ideas can generally be entered using standardized input fields, be mapped to categories and be commented on. Most online platforms for open innovation feature rating mechanisms for the participants reaching from simply binary scales ("thumbs up/down") to more complex scales on which ideas can be rated in various dimensions.

Research shows that most innovations are in general not the result of a single inventor but rather of collaboration processes where many individuals contribute and combine their individual knowledge, experiences, and strengths (Nemiro 2001; Franke and Shah 2003; Gascó-Hernández and Torres-Coronas 2004; Sawhney, Verona et al. 2005; Blohm, Bretschneider et al. 2010). Thus, many platforms seek to build a virtual community among the participants and to foster collaboration using social software like wikis, forums, tags, etc. Moreover, the ideas are presented frequently in idea pools in which the already submitted ideas can be viewed and explored by all participants. Exploring this idea pool, participants can pick up ideas that have been submitted by other community members and/or find fellows that have been working on similar ideas. In this manner, each participant can not only contribute own ideas but also connect with other idea contributors that submitted similar or complementary ideas, and elaborate ideas in collaboration.

2.2 IdeaMirrors

IT-based open innovation platforms are typically build as client/server architectures where information is collected by users with personal desktop or laptop computers from different places. However, these client/server systems are associated with certain shortcomings in terms of availability and modality of information access in virtual communities (Grasso, Muehlenbrock et al. 2003). Ubiquitous and mobile computing, i.e. innovative user interfaces that are integrated into real world settings, can address the boundaries of existing innovation communities and offer possibilities for enlarging the scope of these information systems (Huang and Mynatt 2003; Koch, Monaci et al. 2004; Koch 2005; Bardram, Hansen et al. 2006).

On IT-based open innovation systems ideas are generally stored on server systems as they were written down on index cards and stored in traditional filing cabinets. If someone wants to find an idea from a field of interest or simply wants to know what is going on on the innovation platform, he needs to login and thumb through each idea on the server separately or to perform a goal-oriented search using the given search possibilities. Based on that fact the visibility of valuable ideas and the required ease of access to support the innovation process in an optimal way are insufficient. Furthermore, innovation platforms have a lack of assistance for interpersonal "human" communication between people sitting in front of their local computers at separate offices and working places (cp. figure 1). This is especially debilitating as idea creation is a social process in which people, networks and communities generate and collect information (Perry-Smith and Shalley 2003).

- Figure 1 about here -

Due to the steadily falling prices of LCD hardware, many companies started to acquire large, partly interactive, wall sized screens in the interim in order to install them at various (semi-) public places like lobbies or conference rooms within the company (Behrendt and Erdmann 2003). However, in most of the cases these devices are typically either switched off or don't show content that is conducive for the benefit of the organization. This is mainly caused by missing concepts for properly using large screen displays. For this reason the potential of using these screens for business objectives remains unexploited (Czerwinski, Smith et al. 2003).

As ubiquitous user interface our so-called IdeaMirror™ as part of the CommunityMirrors™ project (Koch 2004) tries to extend the boundaries of IT-based open innovation platforms with wall-sized touch screens that are installed at different semi-public places throughout the organization (Koch and Möslein 2006; Koch and Ott 2008). Such places can be lobbies, besides elevators or at coffee corners, where people usually come together open minded. There they can see, touch and experience the normally hidden content and interesting ideas by chance – or so to speak "out of the box" – without having looked for them explicitly (cp. figure 2).

- Figure 2 about here -

Figure 3 shows that IdeaMirrors do not only improve the visibility of ideas, but also the awareness about what is happening in the underlying information systems. Last but not least the appreciation for information providers or contributors that serves as motivator for further content generation can be enhanced by an intuitive presentation and interaction possibilities (Koch and Möslein 2006). By allowing acquisition of information by chance an IdeaMirror

becomes a tool of social interaction with both the data on the screen as well as with other users in from of the screen (Koch and Ott 2008).

- Figure 3 about here -

Through the generation of serendipity (Roberts 1989; Hannan 2006) this approach is especially helpful for innovative information that is not searched deliberately, but profits a lot from being displayed and consumed peripherally. With the use of IdeaMirrors the process of searching is guided by intuition instead of intention showing the full creative potential that is usually hidden inside traditional IT-based innovation management platforms.

2.3 Assessing idea quality

Since all innovation begins with creative ideas (Kristensson, Gustafsson et al. 2004), the evaluation of new ideas is heavily related to the assessment of their inherent creativity. But creativity and idea quality are both complex constructs. Today there is consensus among creativity researchers about that creative solutions are generally characterized by being new and useful (Amabile 1996; Mayer 1999; Niu and Sternberg 2001; Plucker, Beghetto et al. 2004). Novelty is often defined as being unique or rare. In this context new ideas have not been expressed before (MacCrimmon and Wagner 1994). A closely related trait of novelty is originality. Original ideas are not only new but also surprising, imaginative, uncommon or unexpected (Ang and Low 2000; Dean, Hender et al. 2006) and many researchers see originality as the most important facet of creativity (Besemer and O'Quin 1999; Runco and Sakomoto 1999; Walcher 2007). Another attribute of novelty is their paradigm relatedness (Besemer and

O'Quin 1986; Nagasundaram and Bostrom 1994; Finke, Ward et al. 1996). This refers to an idea's transformational character and describes the degree to which an idea helps to overcome established structures and is radical or revolutionary (Besemer and O'Quin 1986; Christiaans 2002). From a new product development perspective, an idea's paradigm relatedness refers to its innovativeness.

However, an idea's novelty is not sufficient for being unique and useful. Usefulness is the extent to which the idea responds to or solves a problem that is tangible and vital (Amabile 1996; Dean, Hender et al. 2006). This dimension is also named as an idea's value or relevance (MacCrimmon and Wagner 1994; Kristensson, Gustafsson et al. 2004; Dean, Hender et al. 2006). In the scope of new product development this refers frequently to an idea's financial potential (Rochford 1991; Cady and Valentine 1999; Lilien, Morrison et al. 2002; Franke and Hienerth 2006; Soll 2006), the strategic importance in terms of enabling competitive advantages (Rochford 1991; Cady and Valentine 1999; Lilien, Morrison et al. 2002) as well as the customer benefit an idea endows (Piller and Walcher 2006; Walcher 2007).

From the innovator's perspective an idea's feasibility is another vital dimension of idea quality. This dimension captures the ease with which an idea can be transformed into a commercial product (Kristensson, Gustafsson et al. 2004; Soll 2006) and the fit between the idea and the organizer (Rochford 1991; Cady and Valentine 1999; Lilien, Morrison et al. 2002). In this context this fit is two-pronged. From an internal perspective fit refers to the organizer's strategy, capabilities and resources. From an external perspective, this refers to the fit between the idea and the organizer's image. Another trait of a high quality idea is its elaboration which can be seen as the extent of being complete, detailed and well understandable (Dean, Hender et al. 2006). Furthermore, this refers not only to an idea's description but also to its maturity (Franke and Hienerth 2006).

Generally it is assumed that only experts that embody a deep knowledge in the given domain are able to adequately assess the quality of creative ideas (Amabile 1996; Caroff and Besançon 2008; Plucker, Kaufman et al. 2009). However, the quality of non-expert ratings has already been investigated regarding various creative products including artwork (Haritos-Fatouros and Child 1977; Runco and McCarthy 1994), writing (Kaufman, Gentile et al. 2005), music (Hickey 2001) and film (Plucker, Kaufman et al. 2009). Despite the different types of creative products that have been investigated, researchers concluded that non-experts are able to adequately assess the quality of creative products to a certain extent. Moreover, first investigations show that this holds true for customer-generated new product ideas idea competitions as well (Walcher 2007; Blohm, Bretschneider et al. 2009).

3. Research Methodology

3.1 Research Design

The data for this study has been collected in a field test that has been conducted with a major software company and a business incubator. In this field test a set of customer-generated ideas was exposed to the 198 employees of 59 start-up companies that were all customers of the software company and situated in the same premise of the business incubator using a state-of-the-art-open innovation platform and an IdeaMirror.

The field test's target group seemed very appropriate to us as all participants were familiar to the products of the software enterprise. Moreover, the companies that are located in the business incubator are dealing with or developing information and communication technology. The attendants of the field test were all employees of the 59 companies with a high expe-

rience and education in the field of information and communication technology. They are used to work creative and are familiar with common methods of new product development. The field test lasted six weeks from 1th June to 13th July 2009. The participants received no incentives for participating in the field test.

Applying method triangulation and multiple, independent data sources a detailed and holistic picture about the usage, evaluation and rating accuracy of the two instruments shall be rendered (Altrichter, Posch et al. 1996). Method triangulation comprises the use of several different research methods for explaining the same phenomenon (Denzin 1978) allowing to enhance the validity and accuracy of results due to overlapping approaches (Jick 1979). The actual usage of both instruments has been investigated analyzing log file data of both instruments. Both instruments have been evaluated in terms of effort expectancy, performance expectancy and attitude surveying the participants. The quality of the ideas has been assessed with an independent expert evaluation.

3.2 Ideas

Before starting the field test an ideation workshop has been conducted with customers of the software company. In this workshop the 12 participating customers generated more than 100 new product ideas, which have been collaboratively condensed to 40 new product concepts in team work. The final concepts that there used in the field test had an average length of 3 to 5 sentences and were visualized by a professional designer. 38 out of these 40 ideas were included into the analysis. The participants of the workshop have been incentivized by licenses for a computer game for each member of the team that generated the best idea.

3.3 Evaluation Instruments

In the scope of this field test a commercially available, state-of-the-art open innovation platform and a prototype of an IdeaMirror were used. In both instruments the ideas developed in the work shop could be viewed, explored in an idea pool that contained all ideas and rated on a binary scale ("thumbs up/down"). The IdeaMirror was situated in the entrance hall of the premise all participating enterprises had their offices in (cp. Figure 4). The open innovation platform was made accessible to the participants via the Internet (cp. Figure 5). For making sure that all participants knew about both systems they were announced with several posters throughout the building. Moreover, two distinct newsletter campaigns which contained the URL for the Internet platform has been sent in order to promote the usage of both instruments.

- Figure 4 about here –

- Figure 5 about here -

3.3 Assessing evaluation accuracy

The quality of ideas submitted has been assessed using Amabile's (1996) Consensual Assessment Technique (CAT). This method derives from creativity research and has already been used successfully for generating customer-generated product ideas several times (Kristensson, Gustafsson et al. 2004; Franke and Hienerth 2006; Piller and Walcher 2006; Walcher 2007; Blohm, Bretschneider et al. 2010). In this method the ideas are evaluated independently by a group of experts according to specified rating criteria on a rating scale (in this case 1 (very bad) to 5 (very good)). For this purpose an evaluation form has been developed based on the work of Blohm, Bretschneider et al. (2010), which involves the dimensions novelty, relevance, feasibility and elaboration (cp. appendix). The idea evaluation has been per-

formed by 3 employees of the software company's marketing and R&D department. For assuring reliability and validity this expert evaluations has been analyzed using exploratory factor analysis.

Generally, it can be assumed that the participants' evaluations are of high quality if the participants are able to effectively identify the best ideas among all ideas. However, from a company's point of view, these ratings can only serve as preselection for a further internal review phase. So, the particular quality score of a given idea is in principle not relevant. The only thing that counts is that the best ideas are identified correctly by the participants (Reinig, Briggs et al. 2007).

For investigating the concurrent validity of the two instruments an additive quality index has been constructed with the items of the expert rating that have not been eliminated in the factor analysis. In a second step quality indexes for the participant ratings performed on both instruments were constructed subtracting the negative evaluations from the positive ones. Subsequently, all three quality indexes have been dichotomized. Current research about customer-generated new product ideas shows that about 10-30% of these ideas can be regarded as high quality ideas (Franke and Hienerth 2006; Walcher 2007; Blohm, Bretschneider et al. 2010). So, the best 10%, 20% and 30% ideas of the three quality indexes have been classified as „top ideas". Using cross tabulation and contingency tables the concurrence between the expert evaluation as well as the evaluations performed with the two instruments was analyzed.

3.4. Survey

After the field test a paper-based questionnaire was handed out to the participants regarding the performance and effort expectancy, the attitude towards the instruments as well as the participants own innovation experience and technology readiness. The scales for performance

expectancy, effort expectancy and attitude were taken from UTAUT and slightly adapted to the given context (Venkatesh, Morris et al. 2003). For measuring innovation experience the scales from Griffin, Babin et al. (1996) were used that have been adapted to the given context as well. A scale for technology readiness was developed on Parasuraman's (2000) technology readiness index (TRI) and its effect on the technology acceptance (Walczuch, Lemmink et al. 2007).

The population of this survey consisted of all employees of enterprises that were tenants of the business incubator (198 employees). 28 participants returned a completed survey. Which correspondents to a response rate of about 14 %. The survey period lasted from 14th July to 31th July 2009. The average age of the respondents was about 40 years. About 82% of respondents were male and about 71% had a university degree. 15 respondents used the IdeaMirror, 12 the idea evaluation platform and 1 participant made no indication regarding the used instrument. There were no significant differences in group composition and no self-selection effects in terms of innovation experience and technology readiness.

4. Results

4.1. Usage of instruments

The analysis of log data of the two instruments indicates that the IdeaMirror created a higher awareness of the ideas in terms of invocations. On the IdeaMirror the ideas were viewed 16.4 times on average whereas the ideas were viewed only 7.2 times on the internet platform. This difference is significant with $p < 0.01$. Moreover, the ideas have been rated 9.3

times on the IdeaMirror and 6.1 times on the idea management software. This difference is significant with $p < 0.01$, too.

- Table 1 about here -

In Figure 6 the timely distribution of the ideas' ratings and invocations is shown. The two peaks at the beginning and the end of the testing period correspondent with the performed newsletter campaigns. The results reveal that the IdeaMirror was used quite continuously throughout the entire field test whereas the IT platform was only used after the newsletters have been sent. Moreover, more ratings per invocation were performed on the IdeaMirror. On the IdeaMirror a rating occurred on average after 1.8 invocations compared with a ratio of 2.5 on the IT platform

- Figure 6 about here -

4.2 Evaluation of instruments

After the field test the participants were surveyed regarding the perceived effort expectancy, performance expectancy and attitude. The internal consistency of the scales was checked calculating Cronbach Alpha and all scales met the minimum requirement of 0.7 (Malhotra 2007). The mean values of the scales were calculated and compared between the two groups of participants. Both instruments showed no significant differences in terms of attitude and

performance expectancy though all participants rated quite high (cp. table 2). Regarding effort expectancy the IT platform was significantly rated better than the IdeaMirror ($p < 0.01$).

- Table 2 about here –

4.3 Evaluation accuracy of instruments

We performed exploratory factor analysis with SPSS 17.0 in order to assess the validity and the reliability of the idea quality ratings. Already the first iteration mirrored the supposed item structure exactly and with novelty, feasibility, relevance and elaboration four clearly interpretable factors could be identified (cp. table 3). Further, it was checked whether the data was appropriate for explanatory factor analysis by calculating the Measures of Sampling Adequacy (MSA) for the whole data structure as well as the individual items. As all MSA values were above 0.6, exploratory factor analysis was applicable and no items had to be eliminated (Malhotra 2007). However, the items “clear communication” and “customer benefit” showed high factor loadings on other factors so that this item had to be excluded. With Alphas of at least 0.80 all factors showed a satisfactory degree of internal consistency.

- Table 3 about here -

The results of our field test indicate that the evaluations performed on the IT-based open innovation platform were more accurate in terms of concurrent validity with the expert jury than the evaluations performed on the IdeaMirror. At a cut-off level of 30% top ideas the con-

currence between the evaluations performed by experts and on the idea management software is significant. A χ^2-test (Pearson) is significant with $p < 0.05$ and Phi / Cramers V[1] as well as the contingency coefficient are above the recommended threshold of 0.3 (Backhaus, Erichson et al. 2008). Fisher's exact test that is recommended for small sample sizes shows a very small statistical significance with $p < 0.1$. In contrast, the evaluations performed at the IdeaMirror showed no statistically significant concurrence with the expert valuation. The participants using the idea management software were able to identify about 58 % of high quality ideas whereas the participants using the IdeaMirror classified only 25 % of high quality ideas correctly. However, these results are very sensitive to a decreasing cut off level. At cut off levels of 10% and 20% no statistic significant concurrence could be determined for none of the instruments.

- Figure 7 about here –

- Table 4 about here –

5. Discussion

Our results show that ideas exhibited in the IdeaMirror have been invoked and rated significantly more often and that the open innovation platforms has a higher concurrent validity in terms of accordance with the independent expert jury. Moreover, the IT-based open innovation platform has been significantly rated better on effort expectancy.

We think that the lack of concurrence between the participants' and the experts' evaluations on the IdeaMirror could have been caused by its worse effort expectancy. From the field of human-computer interaction it is known that user interfaces may lead to a cognitive overload that inhibits human information processing (Sweller 1988; Sweller, van Merrienboer et

[1] In case that one of variables is binary, Phi and Cramers V are identical (Backhaus, Erichson et al. 2008).

al. 1998). Cognitive load theory assumes that a person has only a limited amount of cognitive resources that have to be allotted to all tasks that are currently performed. The total amount of these mental activities is processed in a working memory that is limited to the number of elements that can be contained simultaneously. If the user has to process too much information at the same time, cognitive overload of the working memory may occur leading to failures in mental information processing and unwanted user actions. In our field test it was the first time for all participants that they have used an IdeaMirror for idea evaluation. So, there has been only little or no training for the participants and the moment they rated the ideas was the first time they used the IdeaMirror (Bederson, Lee et al. 2003). Moreover, the used IdeaMirror was still a prototype that has to be further developed. In this context the IdeaMirror may have caused a cognitive overload that led to a misjudgment of idea quality as the participants' attention was focused on using the screen and not on evaluating the ideas. This assumption ties in with research from political sciences where it is known that different voting instruments is influencing the outcome of elections (Bederson, Lee et al. 2003). For instance, it was found that the use of electronic voting machines led to a higher ratio of residual votes on which no presidential candidate was selected (Caltech/MIT Voting Technology Project 2001).

In our field test, the IdeaMirror was used to engage a group of customers into the process of idea evaluation. However, this is not the only purpose IdeaMirrors could be used for. Our results indicate that ideas were viewed significantly more often in the IdeaMirror than in the IT platform. Existing research where anecdotal evidence shows that IdeaMirrors create a higher awareness for content that is stored in information systems can be supported. On the IdeaMirror the ideas have been viewed continuously throughout the whole testing period whereas the IT platform needed the support of two newsletter campaigns to get used by the participants. Thus, IdeaMirrors can be seen as an effective means for supporting idea generation and new product development with creative potential that would remain unused otherwise. Surprisingly, the second newsletter campaign led to much more idea invocations on the IT

platform than in the IdeaMirror. This shows that the utilization of IT-based open innovation platform can be promoted using concise organizational measures.

Our findings show limitations regarding the small sample size. Moreover the true quality of the ideas submitted is unknown and can only be approximated using expert evaluations. So, the question whether the customer ratings are the "better" ratings as they are reflecting user needs and opinions according to the core principle of open innovation cannot be answered in the scope of this study.

6. Conclusion

To our knowledge this is one of the first studies that empirically investigate the purpose of publicly shared large screen displays for the sake of idea evaluation and supporting new product development in general as well as analyzing the validity of customer ratings. Our findings show that IdeaMirrors can create higher awareness of new product ideas and can support internet-based innovation communities. So, IdeaMirrors can help to make internet based open innovation platforms for customers as well as internal suggestion systems more successful as both require a critical mass of users which can be reached faster using IdeaMirrors.

Further research has to be done in order to develop rating mechanisms for IdeaMirrors that are as valid as the ones performed on open innovation platforms. Designing and testing valid rating mechanisms for user-generated content or other users for the sake of trust building are promising starting points for supporting open innovation activities. Models and theories for understanding the effects and dynamics of user evaluations have to be developed. Future work should also aim at giving further empirical support to our findings in other samples and develop theoretical foundations to give underpinning to these findings. In our field test, the IdeaMirror and the IT platform were used to tap into the collective intelligence of customers

of a major software company. However, in particular IdeaMirrors could be used for connecting the employees of a specific company with an IT based open innovation platform for customers. Doing so, it could be assured that a high awareness of customer-generated new product ideas among employees of the customers can be reached. Moreover, there is a conceptual gap between the generation and selection of ideas and their transformation into innovations. We need to explore further methods, concepts and tools to support the processing of ideas to innovations, also using the wisdom of crowds or collective intelligence.

7. References

Altrichter, H., P. Posch and B. Somekh, 1996, *Teachers investigate their work; An introduction to the methods of action research*. London, Routledge.

Amabile, T. M., 1996, *Creativity in context. Update to social psychology of creativity*. Oxford, Westview Press.

Ang, S. H. and S. Y. M. Low, 2000, "Exploring the dimensions of ad creativity." *Psychology & Marketing* **17**(10): 835-854.

Backhaus, K., B. Erichson, W. Plinke and R. Weiber, 2008, *Multivariate Analysemethoden: Eine Anwendungsorientierte Einführung*. Berlin, Springer.

Bardram, J. E., T. R. Hansen and M. Soegaard, 2006, *AwareMedia: A Shared Interactive Display Supporting Social, Temporal, and Spatial Awareness in Surgery*. 20th Conference on Computer Supported Cooperative Work (CSCW '06), New York, ACM.

Bederson, B. B., B. Lee, R. M. Sherman, P. S. Herrnson and R. G. Niemi, 2003, *Electronic voting system usability issues*. Proceedings of the SIGCHI conference on Human factors in computing systems (CHI 2003), Ft. Lauderdale, Florida, USA, ACM.

Behrendt, S. and L. Erdmann, 2003, *Display-Märkte im Umbruch - Neuorientierungen für Umweltschutzstrategien*. Berlin, Deutsches Zentrum für Luft- und Raumfahrt.

Besemer, S. P. and K. O'Quin, 1986, "Analyzing creative products: Refinement and test of judging tool." *Creativity Research Journal* **20**(2): 115-126.

Besemer, S. P. and K. O'Quin, 1999, "Confirming the three-factor creative product analysis matrix model in an american sample." *Creativity Research Journal* **12**(4): 287-296.

Blohm, I., U. Bretschneider, J. M. Huber, J. M. Leimeister and H. Krcmar, 2009, *Collaborative Filtering in Ideenwettbewerben - Evaluation zweier Skalen zur Teilnehmer-Bewertung in Ideenwettbewerben*. GeNeMe 2009 - Gemeinschaften in neuen Medien: Virtual Enterprises, Communities & Social Networks, Dresden, Joseph Eul Verlag.

Blohm, I., U. Bretschneider, J. M. Leimeister and H. Krcmar, 2010, *Does collaboration among participants lead to better ideas in IT-based idea competitions? An empirical investigation*. 43rd Hawaii International Conference on System Science (HICSS 43), Kauai, Hawai.

Blohm, I., J. M. Leimeister and H. Krcmar, 2009, *IT-basierte, gemeinschaftsgestützte Innovationsentwicklung für Softwareunternehmen*, Lehrstuhl für Wirtschaftsinformatik, Technische Universität München.

Cady, S. H. and J. Valentine, 1999, "Team Innovation and perceptions of consideration. What difference does diversity make?" *Small Group Research* **30**(6): 730-750.

Caltech/MIT Voting Technology Project, 2001, *Residual Votes Attributable to Technology: An Assessment of the Reliabilty of Existing Voting Equipement*.

Caroff, X. and M. Besançon, 2008, "Variability of creativity judgments." *Learning and Individual Differences* **18**(4): 367-371.

Christiaans, H. H. C. M., 2002, "Creativity as design criterion." *Creativity Research Journal* **14**(1): 41-54.

Czerwinski, M., G. Smith, T. Regan, B. Meyers and G. Starkweather, 2003, *Toward Characterizing the Productivity Benefits of Very Large Displays*. Interact 2003, Zurich, Switzerland.

Dean, D. L., J. M. Hender, T. L. Rodgers and E. L. Santanen, 2006, "Identifying quality, novel, and creative Ideas: Constructs and scales for idea evaluation." *Journal of the Association for Information Systems* **7**(10): 646-698.

Denzin, N., 1978, *The Research Act. A Theoretical Introduction to Sociological Methods*. New York, McGraw Hill.

Ebner, W., J. M. Leimeister and H. Krcmar, 2009, "Community Engineering for Innovations: The Ideas Competition as a method to nurture a Virtual Community for Innovations." *R & D Management* **39**(4).

Enkel, E., J. Perez-Freije and O. Gassmann, 2005, "Minimizing Market Risks Through Customer Integration in New Product Development: Learning from Bad Practice." *Creativity and Innovation Management* **14**(4): 425-437.

Finke, R. A., T. B. Ward and S. M. Smith, 1996, *Creative cognition. Theory, research and applications*. Cambrigde, MIT Press.

Franke, N. and C. Hienerth, 2006, "Prädikatoren der Qualität von Geschäftsideen: Eine empirische Analyse eines Online-Ideen-Forums." *Zeitschrift für Betriebswirtschaft Special Issue* **6**(4): 47-68.

Franke, N. and S. Shah, 2003, "How communities support innovative activities: an exploration of assistance and sharing among end-users." *Research Policy* **32**(1): 157-178.

Gascó-Hernández, M. and T. Torres-Coronas, 2004, Virtual teams and their search for creativity. *Virtual and collaborative teams*. S. H. Godar and S. Pixy Ferris. Hershey, PA: Idea Group.

Grasso, A., M. Muehlenbrock, F. Roulland and D. Snowdon, 2003, Supporting Communities of Practice with Large Screen Displays. *Public and Situated Displays - Social and Interactional Aspects of Shared Display Technologies*. K. O'Hara, E. Perry, E. Churchill and D. M. Russel, Kluwer**:** 261-282.

Griffin, M., B. Babin and J. Attaway, 1996, "Anticipation of injurious consumption outcomes and its impact on consumer attributions of blame." *Journal of the Academy of Marketing Science* **24**(4): 314-327.

Hannan, P. J., 2006, *Serendipity, Luck and Wisdom in Research*. Bloomington, iUniverse.

Haritos-Fatouros, M. and I. L. Child, 1977, "Transcultural Similarity in Personal Significance of Esthetic Interests." *Journal of Cross-Cultural Psychology* **8**(3): 285-298.

Hickey, M., 2001, "An Application of Amabile's Consensual Assessment Technique for Rating the Creativity of Children's Musical Compositions." *Journal of Research in Music Education* **49**(3): 234-244.

Huang, E. M. and E. D. Mynatt, 2003, *Semi-Public Displays for Small, Co-located Groups*. SIGCHI Conference on Human Factors in Computing Systems (CHI '03), Fort Lauderdale, Florida, ACM Press.

Huber, M. J., U. Bretschneider, J. M. Leimeister and H. Krcmar, 2009, *Making Innovation happen: Requirements for toolsupport in software related Communities for Innovations*

Jick, T. D., 1979, "Mixing Qualitative and Quantitative Methods: Triangulation in Action." *Adminstrative Science Quarterly* **24**(4): 602-612.

Kaufman, J. C., C. A. Gentile and J. Baer, 2005, "Do Gifted Student Writers and Creative Writing Experts Rate Creativity the Same Way?" *Gifted Child Quarterly* **49**(3): 260-265.

Koch, M., 2004, *Building Community Mirrors with Public Shared Displays*. eChallenges e-2004, Vienna, Austria.

Koch, M., 2005, *Supporting Community Awareness with Public Shared Displays*. Bled International Conference on Electronic Commerce, Bled, Slovenia.

Koch, M., S. Monaci, A. B. Cabrera, M. Huis in't Veld and P. Andronico, 2004, *Communication and Matchmaking Support for Physical Places of Exchange*. International Conference on Web Based Communities (WBC 2004), Lisbon, Portugal.

Koch, M. and K. Möslein, 2006, *Community Mirros for Supporting Corporate Innovation and Motivation*. European Conference on Information Systems (ECIS), Göteborg.

Koch, M. and F. Ott, 2008, IdeaMirrors - Einsatz großer Wandbildschirme zur Förderung diskontinuierlicher Innovation in der Softwarebranche. *Virtuelle Organisation und Neue Medien 2008: Workshop Gemeinschaften in Neuen Medien (GeNeMe 2008)*. K. Meißner and M. Engelien**:** 241-252.

Kristensson, P., A. Gustafsson and T. Archer, 2004, "Harnessing the creative potential among users." *The Journal of Product Innovation Management* **21**(1): 4-14.

Kristensson, P., P. R. Magnusson and J. Matthing, 2002, "Users as a hidden resource for creativity: findings from an experimental study on user involvement." *Creativity & Innovation Management* **11**(1): 55-61.

Leimeister, J. M., M. Huber, U. Bretschneider and H. Krcmar, 2009, "Leveraging Crowdsourcing - Activation-Supporting Components for IT-based Idea Competitions." *Journal of Management Information Systems* **26**(1, in press).

Lilien, G. L., P. D. Morrison, K. Searls, M. Sonnack and E. von Hippel, 2002, "Performance assessment of the lead user idea-generation process for new product development." *Management Science* **48**(8): 1042–1059.

MacCrimmon, K. R. and C. Wagner, 1994, "Stimulating ideas through creative software." *Management Science* **40**(11): 1514-1532.

Malhotra, N. K., 2007, *Marketing Research. An applied orientation*. Upper Saddle River, Pearson.

Mayer, R. E., 1999, Fifty years of creativity research. *Handbook of Creativity*. R. J. Sternberg. Cambrige, Cambrige University Press**:** 449-460.

Nagasundaram, M. and R. P. Bostrom, 1994, "The structuring of creative processes using GSS: A framework for research." *Journal of Management Information Systems* **11**(3): 87-114.

Nemiro, J. E., 2001, "Connection in creative virtual teams." *Journal of Behavioral and Applied Management* **2**(2): 92-112.

Niu, W. and R. J. Sternberg, 2001, "Cultural influences on artistic creativity and its evaluation." *International Journal of Psychology* **36**(1): 225-241.

Ott, F., A. Richter and M. Koch, 2009, Einsatz großer Wandbildschirme als Fenster in Kooperationssysteme. *Mensch und Computer 2009: Grenzenlos frei?* . H. Wandke. München, Oldenbourg.

Parasuraman, A., 2000, "Technology Readiness Index (TRI): A Multiple-Item Scale to Measure Readiness to Embrace New Technologies." *Journal of Service Research* **4**(2): 307-320.

Perry-Smith, J. E. and C. E. Shalley, 2003, "The Social Side of Creativity: A Static and Dynamic Social Network Perspective." *Academy of Management Review* **28**(1): 89-106.

Piller, F. T. and D. Walcher, 2006, "Toolkits for idea competitions: a novel method to integrate users in new product development." *R&D Management* **36**(3): 307-318.

Plucker, J. A., R. A. Beghetto and G. T. Dow, 2004, "Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research." *Educational Psychologist* **39**(2): 83-96.

Plucker, J. A., J. C. Kaufman, J. S. Temple and M. Qian, 2009, "Do experts and novices evaluate movies the same way?" *Psychology and Marketing* **26**(5): 470-478.

Reinig, B. A., R. O. Briggs and J. F. Nunamaker Jr, 2007, "On the measurement of ideation quality." *Journal of Management Information Systems* **23**(4): 143-161.

Riedl, C., N. May, J. Finzen, S. Stathel, T. Leidig, V. Kaufman, R. Belecheanu and H. Krcmar, 2009, *Managing Service Innovations with an Idea Ontology*. XIX International RESER Conference, Budapest.

Roberts, R. M., 1989, *Serendipity: Accidental Discoveries in Science*. New York, Wiley.

Rochford, L., 1991, "Generating and screening new product ideas." *Industrial Marketing Management* **20**(4): 287-296.

Runco, M. A. and K. A. McCarthy, 1994, "Judgments of the creativity of artwork from students and professional artists." *Journal of Psychology* **128**(1): 23.

Runco, M. A. and S. O. Sakomoto, 1999, Experimental studies of creativity. *Handbook of Creativity*. R. J. Sternberg. Cambridge, Cambridge University Press**:** 62-92.

Sawhney, M., G. Verona and E. Prandelli, 2005, "Collaborating to Create: The Internet as a Platform for Customer Engagement in Product Innovation." *Journal of Interactive Marketing* **19**(4): 4.

Soll, J. H., 2006, *Ideengenerierung mit Konsumenten im Internet*. Wiesbaden, Deutscher Universitäts-Verlag.

Sweller, J., 1988, "Cognitive load during problem solving: Effects on learning." *Cognitive Science* **12**(2): 257-285.

Sweller, J., J. van Merrienboer and F. Paas, 1998, "Cognitive Architecture and Instructional Design." *Educational Psychology Review* **10**(3): 251-296.

Urban, G. I. and E. Von Hippel, 1988, "Lead User Analyses for the Development of New Industrial Products." *Management Science* **34**(5): 569-582.

Venkatesh, V., M. G. Morris, G. B. Davis and F. D. Davis, 2003, "User Acceptance of Information Technology: Toward a Unified View." *MIS Quarterly* **27**(3): 425-478.

von Hippel, E., 2005, *Democratizing innovation*. Cambridge, Mass., MIT Press.

von Hippel, E. and R. Katz, 2002, "Shifting Innovation to Users via Toolkits." *Management Science* **48**(7): 821-833.

Walcher, P.-D., 2007, *Der Ideenwettbewerb als Methode der aktiven Kundenintegration*. Wiesbaden, Gabler.

Walczuch, R., J. Lemmink and S. Streukens, 2007, "The Effect of Service Employees' Technology Readiness on Technology acceptance." *Information & Management* **44**(2): 206-215.

8. Appendix

Novely:	The idea is novel.
Uniqueness:	The idea is unique or at least rare.
Surprise:	The idea is imaginative, uncommon or surprising.
Revolutionarity:	The idea is revolutionary.
Radicality:	The idea is radical.
Trendyness:	The idea is trendy.
Customer Benefit:	The idea has a clearly described customer benefit.
Market Potential:	The idea enables the initiator to realize an attractive market potential.
Strategic Advantage:	The idea enables the initiator to build up strategic competitive advantages.
Technical Feasibility:	The idea is technically feasible.
Economic Feasibility:	The idea is economically feasible.
Fit To Image:	The idea fits the initiator's image.

Precision:	The idea is precise, complete and exactly described.
Maturity:	The idea is mature.
Clear Communication:	The idea's utility is clearly described.

Figure 1. Desktop-based interaction with innovation management systems

Figure 2. Supporting social interaction with ideas “out of the box” (Ott, Richter et al. 2009)

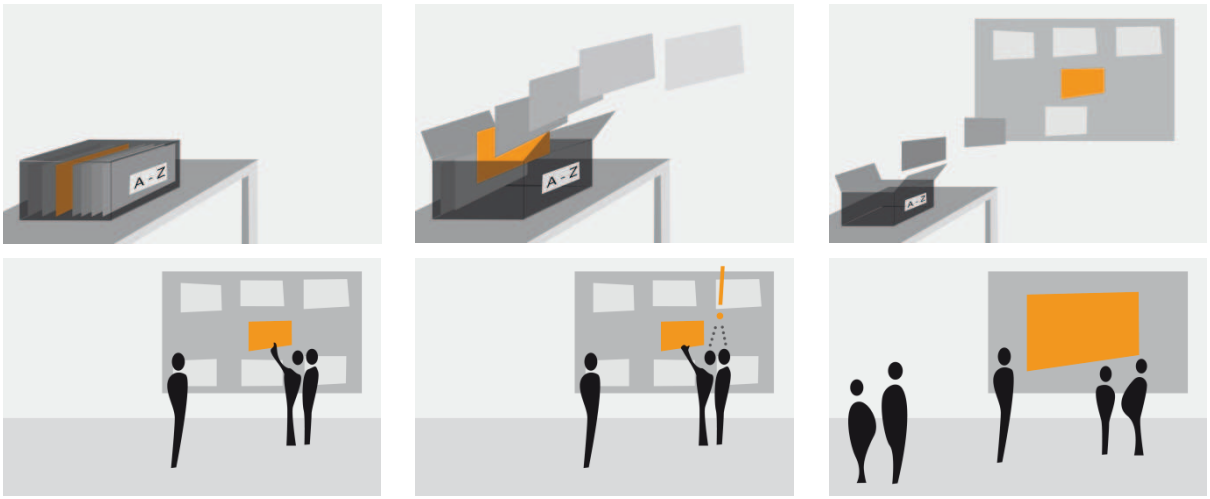

Figure 3. IdeaMirrors embedded in the daily working environment

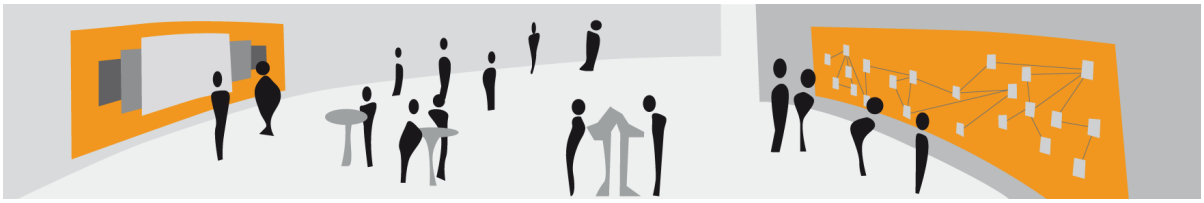

Figure 4. The IdeaMirror

Figure 5. The IT-based open innovation platform

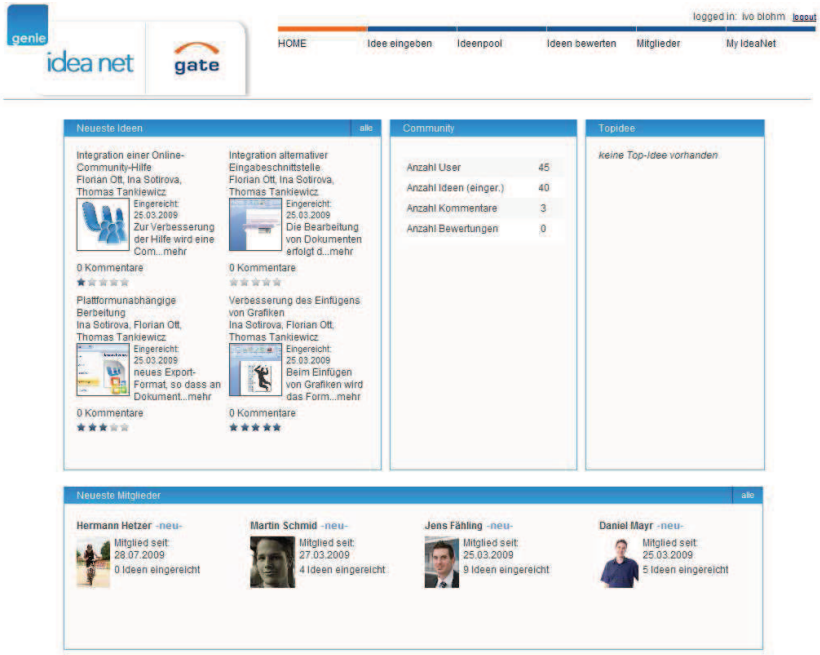

Table 1. Usage of instruments

	IdeaMirror		**IT Platform**		**t-value**
	$\bar{x}$	SD	$\bar{x}$	SD	
Idea invocations	16,44	9.23	7.21	2.76	5,97***
Idea evaluations	9.36	6.71	6.16	1.76	3,01***

n = 38; SD = standard deviation;

*** significant with $p < 0,01$

Figure 6. Timely distribution of invocations and ratings in both instruments

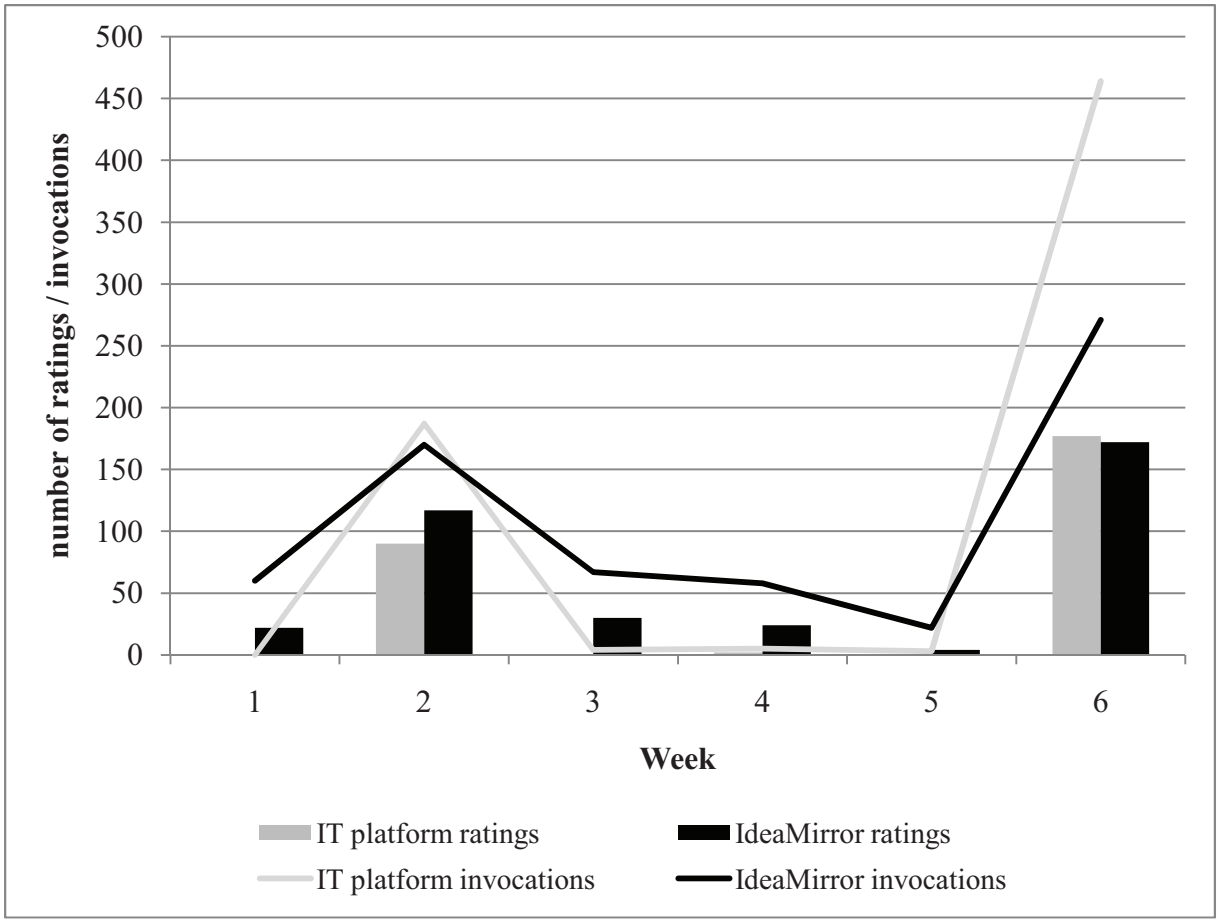

Table 2. User evaluations of rating instruments

	IdeaMirror[1]		**IT Platform**[2]		**t-value**	**Cronbach Alpha**
	$\bar{x}$	SD	$\bar{x}$	SD		
Effort Expectancy	3.51	1.33	4.60	0.49	2.83*	0.90
Performance Expectancy	3.89	1.13	4.31	0.74	1.09	0.93
Attitude	4.05	1.18	3.89	0.84	0.39	0.93

[1]n = 15; [2]n = 12; 1 = lowest; 5 = highest; SD = standard deviation;

* significant with $p < 0,05$;

Table 3. Factor analysis of idea quality

Item	Factor				Cronbach's α
	Novelty (1)	Relevance (2)	Elaboration (3)	Feasibility (4)	
Uniqueness	0.91	0.14	-0.02	0.05	0.96
Surprise	0.90	0.01	0.07	0.10	
Novelty	0.89	0.12	0.07	0.22	
Radicality	0.89	-0.05	-0.08	0.29	
Revolutionarity	0.88	-0.02	-0.06	0.31	
Trendyness	0.83	0.12	-0.03	0.32	
Economic Feasibility	0.08	0.92	0.06	-0.19	0.80
Technical Feasibility	-0.04	0.91	0.25	0.11	
Fit To Image	0.29	0.58	0.44	0.28	
Precision	0.01	0.16	0.92	0.07	0.87
Maturity	-0.10	0.19	0.91	0.12	
Market Potential	0.32	-0.05	0.13	0.87	0.84
Strategic Advantage	0.39	0.07	0.15	0.82	
Eigenvalues	5.95	2.87	1.45	0.79	
Variance Explained	45.74%	22.13%	10.35%	6.08%	

KMO criterion = 0.766; Bartlett-test of specificity: $\chi 2 = \square 478.500$, $p = 0.000$; principal component analysis; varimax-rotation; $n = 40$. The bold values indicate the attribution of the variables to one of the four factors.

Figure 7. Percentage of correctly identified top ideas

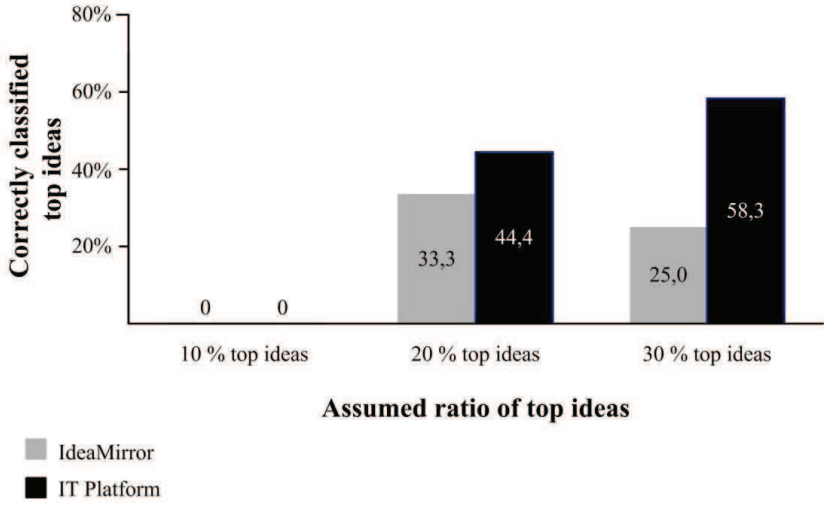

Table 4. Significance of idea evaluations

Ratio of top ideas	Instrument	χ^2 (Pearson)	χ^2 (Fischer)	Phi / Cramers V	Contingency coeffizient
10 % top	IdeaMirror	0,68	n.s.	0,13	0,13
ideas	IT platform	0,53	n.s.	0,12	0,12
20% top	IdeaMirror	1,07	n.s.	0,17	0,17
ideas	IT platform	2,81	n.s.	0,27	0,26
30% top	IdeaMirror	2,11	n.s.	0,23	0,23
ideas	IT platform	4,54*	p = 0,064	0,35	0,33

* significant with $p < 0,05$, n.s. = not significant