12 Collective intelligence and practice-based innovation: An idea evaluation method based on collective intelligence

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Abstract Users and customers are becoming increasingly important sources of knowledge due to changes in innovation policies and paradigms. Simultaneously innovation is becoming more of a networking activity. New methods are needed for processing information and ideas coming from multiple sources more effectively. For example, the whole personnel of an organisation are seen as a great potential for innovation. The recent development of communication technologies such as the Internet has increased interest towards the multidisciplinary field of collective intelligence. To investigate the possibilities of collective intelligence, the nest-site selection process of honeybees was used as model for an idea evaluation tool, a prototype of which was then tested in a case organisation. The results were promising; the prototype was able to evaluate ideas effectively, and it was highly accepted in the organisation.

12.1 Introduction

This study focuses on the front end of innovation, and more specifically on utilising the principles of collective intelligence in idea evaluation. The topic is very relevant in rapidly changing environments, where new sources of innovation are needed. For instance, the emphasis of Finnish innovation policy is changing from a science-based approach to a more practice-oriented one (Government's Communication… 2009). The change can be described as a shift from the Science, Technology and Innovation (STI) mode towards an approach including also the Doing, Using and Interacting (DUI) mode. While the STI mode relies strongly on the use of codified knowledge and science-based learning, in the DUI mode the focus is on tacit knowledge, organisational learning, and user needs (Jensen et al. 2007). The shift of focus is very welcome indeed, as it is suggested that only 4% of enterprises consider universities important for producing innovations (Office for… 2004). The knowledge environment has become more fragmented, and as a result, the traditional approach to innovation with centralised R&D is replaced by other forms of creating innovation.

These changes in innovation policies and paradigms have major effects on the front end of innovation, which is defined as the activities taking place before the formal, well-structured development process begins. Activities in the front end of innovation process are often unpredictable and unstructured, and therefore hard to manage. Nevertheless, these activities have a major role in determining which projects to execute, and they affect strongly the definitions of quality, costs and time frame of the project. (Herstatt et al. 2004) Effective documentation and evaluation of ideas at the front end are necessary for the innovation process to be successful (Harmaakorpi and Melkas 2005; Tidd et al. 2005; Forssen 2001; Desouza et al. 2009). Changing paradigms are increasing the importance of customers, users, and shop floor employees as sources of knowledge and ideas, which makes these tasks challenging. In the STI mode of innovation, the transition from research to development is relatively easy and straightforward, but under the DUI mode the matters are more complex. The large amount of information increases the strain on idea processing mechanisms (Bjelland and Wood 2008; Bothos et al. 2009). These issues could be relieved by decentralising the tasks; in principle, anyone could evaluate ideas. Furthermore, the emerging fifth generation innovation processes demand flatter, more flexible decision making structures (Rothwell 1994).

The present study acknowledges the great and often hidden potential of the entire personnel of organisations for innovation. This potential remains often unexploited due to lacking methods of fostering different phases of innovation. There have been serious efforts to assess different kinds of, for example, High-Involvement innovation approaches (see e.g. Bessant, 2003; Hallgren, 2008), but the subject is still to a great extent untouched.

The aim of this study is to develop an idea evaluation tool capable of utilising collective intelligence. Employees on the shop floor form the main target group for the tool. Relevant literature on collective intelligence is first reviewed and theoretical insights are used to develop a prototype of an idea evaluation tool, which is based on the nest-site selection process of honey bees. The prototype is then tested in a case organisation. The study contributes to knowledge on the applicability of collective intelligence on innovation processes.

12.1.1 Collective intelligence

Collective intelligence is an age-old phenomenon, but it's the recent changes in technology that make it highly relevant now. Constantly decreasing costs of communication enable new forms of decentralisation and collaboration in organisations (Malone 1997). The vast possibilities of collective intelligence are demonstrated by the indisputable successes of such systems as the Google search engine and Wikipedia (MIT Center… 2009). As the aim of collective intelligence is to integrate the knowledge of large groups, it seems like a promising approach to dealing with current issues of front end of innovation.

Collective intelligence can be defined broadly as “the general ability of the group to perform a wide variety of tasks” (Woolley et al. 2010) or as “Groups of individuals doing things collectively that seem intelligent” (Malone et al. 2010). The term is closely related to swarm intelligence, which means collective behavior emerging from self-organising groups of insects (Bonabeau and Meyer 2001). Even if one individual is not capable of much, collectively a swarm of insects can solve difficult problems of nest-site selection and nest building, foraging, task division, and route optimisation (e.g. Bonabeau and Meyer 2001; Camazine et al. 2001; Conradt and Roper 2005; Visscher 2007). Many artificial systems have been designed on the basis of swarm intelligence, including Internet traffic routing algorithms and logistics and production line management systems (Bonabeau and Meyer 2001). Wikis, open source software development communities and prediction markets are further examples of the potential of collective intelligence (e.g. Bonabeau 2009; Tapscott and Williams 2006; Wolfers and Zitzewitz 2004).

Even though various human networks and communities are often very effective at their tasks, it should not be assumed that the performance of a group is automatically intelligent. Information processing and decision making of human beings are susceptible to many biases, which can take place both on individual and group levels (Sunstein 2006; Hinsz et al. 2007; Iandoli et al. 2008; Asch 1955). Although complete theoretical framework does not yet exist, certain features of decision-making systems such as the diversity of viewpoints, independence of opinions, decentralised decision making and self-organisation are considered to facilitate collective intelligence.

The diversity of opinions is considered to be a critical factor in collective intelligence. Adding new perspectives to a subject matter is valuable as it brings in new ideas and viewpoints, which would otherwise probably remain absent in a group. (Surowiecki 2004; Bonabeau 2009) Homogenous groups tend to be good at what they do, but they often lack the capability to explore for new solutions (Surowiecki 2004). Simulation models have shown that diverse groups of problem solvers can outperform homogenous groups of highly skilled problem solvers (Hong and Page 2004).

Diversity can also help to reduce the negative effects of individual and group-level biases trough the addition of perspectives and by making it easier for people to voice their opinions (Surowiecki 2004). Nevertheless, the right balance of diversity and expertise is required when tapping into the collective intelligence of crowds. While some problem-solving situations benefit from adding more perspectives, this beneficial effect is prevented if the problem solvers do not have any knowledge about the topic whatsoever. (Bonabeau 2009; Page 2007)

A certain level of independence is another major factor enhancing collective intelligence. Independence produces random errors in individual estimates, which can be filtered out through aggregation. Individual assessments always contain some errors, but unless the mistakes the people make do not become correlated and are not systematically pointing in the same direction, the errors do not harm the collective decision making. Independent individuals are also more likely to have new information, which increases the diversity of the group. (Surowiecki 2004)

To avoid the group decision-making biases, the collective intelligence system should support the independence of the estimations produced by the group members. For a group to be collectively intelligent, the availability of diverse information and the ability to make individual aggregations are required. (Surowiecki 2004)

The decentralisation of decision making has potential to yield many benefits through increased efficiency, motivation and creativity of individuals, and higher flexibility of organisations. Good decisions require accurate information, and information technology makes the structures requiring high levels of communication feasible; it is now economically feasible to transfer large amounts of data to decentralised decision makers, for example through the internet. As the transferability of knowledge varies, it would make sense to transfer the easily communicated explicit knowledge to the decision makers possessing sticky and tacit knowledge (Malone 1997). Decentralisation also allows many minds to work on the same problem simultaneously (Malone 2004). The energy and creativity of people often depend on who makes the decisions about their work. Even though physically hard or routine work may benefit from supervision from above, creative work flourishes when the external control is reduced (Amabile 1998; Malone 1997). This way the decentralised decision making can increase motivation and creativity.

Self-organisation can be defined as “a process in which [a] pattern at the global level of a system emerges solely from numerous interactions among the lower-level components of the system. Moreover, the rules specifying interactions among the system’s components are executed using only local information, without reference to the global pattern” (Camazine et al. 2001). Self-organisation is considered to be one of the facilitating factors of collectively intelligent phenomena because it increases the flexibility and robustness of a system (Bonabeau and Meyer 2001; Gloor 2006). A flexible system is able to adapt to changes in the environment, and robustness means that even if a part of the system fails, it is still able to perform its tasks. Social insects use self-organising systems extensively to solve complex problems, such as foraging route optimisation, nest-site selection and division of work (Camazine et al. 2001). Self-organisation results from a set of mechanisms relying on easy-to-use components at hand. The main components include simple rules of thumb, multiple interactions, positive and negative feedback loops, and the constraints of the environment (Camazine et al. 2001).

12.1.2 Assessment of existing systems

Various approaches have been used to capture the collective intelligence of groups of different sizes. Some well-known examples of such systems are listed in Table 12.1. After that, a few selected approaches for idea generation and evaluation are discussed in more detail.

Table 12.1 Examples of systems utilising collective intelligence (Handbook of Collective Intelligence 2009; Bjelland and Wood 2008; Bonabeau 2009; Tapscott and Williams 2006)

Example	Description
Amazon Mechanical Turk	A marketplace for small tasks developed by Amazon.com
Collective Intellect	Summarises information from blogs and web pages to produce knowledge for marketing
Digg	A news discovery service integrating submissions and evaluations of many people
Google	Search engine based on aggregated implicit human evaluations
Gwap	Games with the purpose of training computers to solve problems
IBM Innovation Jam	A massive-scale collaborative innovation session
InnoCentive	A marketplace for innovations connecting solution seekers to problem solvers
Lego Mindstorms	A robot toy. Users can participate in development through a forum
My Starbucks Idea	A web page for collecting ideas from customers of Starbucks
Intrade	A prediction market in which people buy and sell predictions about the future
reCHAPTCHA	CHAPTCHA service that helps to digitise books
Salesforce IdeaExchange	An open and direct channel of communication for Salesforce customers
Sermo	A closed community of health care professionals
SourceForge	One of the leading open source software community environments
Threadless	Clothing retailer selling t-shirts designed and chosen by users
Wikipedia	Free encyclopedia that anyone can edit
YourEncore	Connects companies with retired scientists and engineers

Various group decision support systems have been used to improve the quality of teamwork. Group decision support systems are electronic systems designed for supporting meetings and group work (Dennis et al. 1988). They have been shown to be capable of facilitating opportunity identification, idea generation and assessment, customer need assessment, and concept evaluation in small groups. Especially various voting features have been described as very useful, allowing the users to see which ideas are viewed as the most important. (Elfvengren 2006)

On the other end of the scale is the IBM Innovation Jam. It is a massive-scale (up to 150 000 participants) collaborative innovation session held over the Internet. Advantages of the IBM Innovation Jam are that it takes every comment seriously and is capable of aggregating many mediocre ideas together. The Innovation Jam has been successful in generating significant new businesses for IBM, but it can only be used periodically due to the ineffective evaluation of ideas. The evaluation process is time consuming and requires lots of resources; at IBM, the generated content was first evaluated by volunteers, and then top management spent a week reviewing the results. (Bjelland and Wood 2008)

Relatively simple information aggregation methods can be employed to improve both the accuracy and capacity of the evaluation process. Prediction markets have been found capable of producing accurate predictions about future events (Berg et al. 2008; Cowgill 2005; Wolfers and Zitzewitz 2004). Applying them for collecting and evaluating ideas has also yielded encouraging results, but information overload has been found to be an issue. Deciding which suggestions by users to introduce on the market is difficult. Democratising the decision process thoroughly is suggested as a possible solution for this issue. (Bothos et al. 2009)

A fully democratised approach has already been adopted by websites such as Digg and Salesforce IdeaExchange, which ask visitors to vote on the content submitted to the pages continuously. The items getting the most votes are displayed at the top of the page and visitors are encouraged to comment on them. The main advantage of these systems is that when a good idea is submitted, the discussion can evolve fast as to how the idea could be put into practice. These systems can also be scaled up easily and can handle large amounts of information. The moderate accuracy of the evaluations is an issue though, as these systems are known to produce plenty of false positives, and on the other hand ignore some of the valuable content. (Bjelland and Wood 2008) A balanced compromise between the speed and accuracy of evaluations is needed to increase the usability of such idea management systems.

12.1.3 Nest-site selection by honeybees

Human beings are not the only species on our planet who face challenging decision-making tasks. Nest-site selection is a crucially important decision for social insect colonies. While in most cases this decision is made individually by the founding female, in some species of ants, bees, polistine wasps, and stingless bees, the colony moves to a new nest as a whole. In these cases, the decision about the nest-site is made collectively. Studies in the field of biology have found striking similarities between the nest-site selection processes of these species, although they have all evolved the mechanisms of social behaviour independently (Visscher 2007). Separate species are converging towards the same solution from differing initial conditions. The decision-making process is also scalable and fits well for different sizes of insect colonies (Franks et al. 2006).

On honeybees, the nest-site selection process has been studied thoroughly and it is also one of the most complex known examples of self-organising group decision making among social insects (e.g. Seeley and Buhrman 1999; Seeley et al. 2006; Passino et al. 2007; Visscher 2007). Like other species, honeybees use cognitively demanding weighted additive strategy in their decision making (Seeley and Buhrman 1999; Visscher 2007). All the relevant attributes of each alternative are evaluated and given different weights, depending on their relative importance. Then the weighted evaluations are combined and the best overall option is chosen.

The phases of the nest-site selection process of honeybees are the following (Seeley and Buhrman 1999):

1. Swarming. A colony of bees forms a cluster on a tree branch.
2. Search. Scouts start searching for suitable nest sites in the environment.
3. Evaluation. When a scout bee finds a possible nest site, it evaluates the site and returns to the swarm to announce the finding by means of a waggle dance.
4. Competition. Scouts following the dance fly to the described site and repeat the evaluation process.
5. Decision. A final decision is made at a nest site when the number of scouts reaches a threshold value.

During the nest-site selection process, individual evaluations are aggregated to the collective opinion on the dance floor. The total number of dance rounds a scout bee performs depends on the quality of the site on a near-exponential scale: 15, 45, 90, 150, 225, and 315 dance rounds on average (Seeley et al. 2006). The higher the number of dance rounds, the higher the probability that another scout will follow the dance. As a result traffic to high-quality nest sites increases faster than traffic to lower-quality nest sites. When the number of scout bees evaluating a particular nest site simultaneously reaches a threshold value of about 15, the scouts interpret that the decision has been made. After that the scouts return to the swarm and stimulate it to take off and fly to the new nest site. (Seeley and Buhrman 1999)

Simulations have shown that natural selection has tuned the different parameters of this process near the optimum compromise between the speed and accuracy of the decision (Passino and Seeley 2005). The attention of the swarm turns quickly to better-quality sites, while the poor-quality sites are dropped from consideration relatively fast (Passino et al. 2007). That is, the resources of the swarm are directed to the evaluation of the higher-quality sites. At the same time, the likelihood of a bad decision remains low (Passino and Seeley 2005).

The decision-making process has many interesting features from the point of view of collective intelligence. During the process, individual scouts use only local information and no direct comparison of nest sites is necessary. All the available information is taken into account in the process, but none of the bees has to hold all the information. The exponential scale used in the evaluation amplifies the perceived differences in nest site qualities (Seeley et al. 2006). Even while each individual follows only simple rules of thumb and uses only local knowledge, the self-organising system manages to integrate available information in a meaningful way. (Conradt and Roper 2005; Visscher 2007)

12.2 Methods

This study aims to develop an effective idea evaluation tool for the front end of innovation processes capable of utilising collective intelligence. The study is carried out as a case study research using a constructive research approach (see Kasanen et al. 1993), where the focus is on designing new constructs and testing them in real-life applications. After a tool for evaluating ideas emerging from the course of everyday work is developed, it is tested in a case organisation. Typically for a case study, multiple sources of evidence are used to increase the reliability of the results (Yin 1994).

12.2.1 Building the construct

A clear need exists for effective tools for collecting and evaluating ideas emerging from multiple sources. Such a tool should enable easy documentation and evaluation of large amounts of ideas in order to avoid the common issue of information overload. Evaluations should be accurate enough to discriminate promising ideas from mediocre ones. A more complete list of the requirements derived from the relevant literature is presented in Table 12.2.

Table 12.2 Requirements for an idea evaluation tool

Requirement	References
Users as a source of knowledge	Government's Communication… 2009; Jensen et al. 2007; Kallio and Bergenholtz (forthcoming); Von Hippel 2005; Bessant 2003
Effective documentation, evaluation and processing of ideas	Harmaakorpi 2004 ; Forssen 2001; Tidd et al. 2005; Bessant 2003
Support for bringing up problems and incomplete ideas	Bessant 2003; Paalanen and Konsti-Laakso 2008
Capacity to process a large amount of ideas	Bothos et al. 2009; Paalanen and Konsti-Laakso 2008
Feedback from co-workers	Dominic et al. 1997
Integration of the organisation and systems	Rothwell 1994; Gloor 2006
Flat and flexible organisational structures	Rothwell 1994; Gloor 2006; Malone 1997; Surowiecki 2004
High connectivity and interactivity	Rothwell 1994; Gloor 2006

Decentralised decision making	Rothwell 1994; Gloor 2006; Malone 1997; Surowiecki 2004
Motivation to participate	Harmaakorpi and Melkas 2005; Gloor 2006; Malone et al. 2010; Bonabeau 2009; Gloor and Cooper 2007; Tapscott and Williams 2006; Bessant 2003
Diversity	Surowiecki 2004; Bonabeau 2009; Hong and Page 2004; Page 2007
Independence	Surowiecki 2004; Asch 1955
Modularity	Malone 2004
Self-organisation	Bonabeau and Meyer 2001; Camazine et al. 2001; Gloor 2006

A tool utilising the collective intelligence of large groups could be able to fill these requirements. In this study, the nest site selection process of honeybees is used as a model for the idea evaluation tool. The issues in nest site selection and idea evaluation are very similar. In both cases the number of alternative options is high, and a good decision requires accurate assessment and integration of multiple attributes of each option. In nest site selection, important attributes are at least the sizes of the nest cavity and the entrance, while idea evaluation should take into account economic, technical, and organisational viewpoints. It is likely that abilities and knowledge needed to evaluate different attributes are dispersed among various individuals.

The nest site selection process of honeybees is an effective solution to attention-perception-choice type of problems, as demonstrated by simulation models and the convergent evolution of various social insect species. The nest site selection process also utilises all the facilitating factors of collective intelligence: diversity of opinions, independence of evaluations and decentralisation of decision making in a modular, self-organising process.

12.2.2 Features of an idea evaluation tool

A constructed evaluation tool uses a strictly standardised procedure with a random allocation of evaluation tasks to ensure the equal treatment of all the ideas, to optimise the use of resources and to minimise the negative effects of systematic biases.

The phases of the idea collection and the evaluation process are the following:

1. A user generates an idea and feeds it into the system.
2. The system selects evaluators for the idea randomly.
3. Selected users evaluate the idea on a linear scale from 1 to 5 (1, 2, 3, 4 and 5).

4. The system transforms the evaluations to a non-linear scale (0, 0.5, 1.5, 3 and 5). The ratio of the scale is the same as in the nest site selection process of honeybees
5. The scores on the non-linear scale are averaged and ideas listed in the order of superiority.

In theory, the advantages of such an evaluation tool are numerous. Emphasis on the ease of use and on a light workload enables documentation and evaluation of all the ideas emerging during everyday work. The diversity of users increases both the likelihood of new ideas emerging and the accuracy of evaluations by aggregating information from multiple sources. The randomised selection of evaluators makes evaluations independent of each other, which should reduce the typical issues of group decision making, such as conformity to opinions of others in group decision-making situations. At the same time, the accuracy is improved by introducing a random error in evaluations, which can then be eliminated through aggregation. Furthermore, the independent evaluations and users being unaware of the origin of the ideas or opinions of other users should reduce the influence of politics, hierarchies and harmful cascade effects.

By decentralising the decision making, tacit knowledge otherwise difficult to transfer can be utilised. Dividing the evaluation tasks helps to avoid overloading the system and allows faster feedback to users about their ideas. Decentralisation also spreads ideas further in the organisation, which could stimulate new ideas from other users. Combined with fast feedback and appreciation of employees' opinions demonstrated by empowerment, the tool could help to activate employees to participate more enthusiastically in the innovation process.

The use of a non-linear evaluation scale borrowed from bees improves the results of evaluations in two ways: the differences at the top of the scale are emphasised and the variance of the evaluations is automatically accommodated. Because of the non-linearity of the scale, ideas with high variance receive higher scores than the ones with low variance. This should be beneficial for the accuracy of evaluations, because logically the ideas dividing the opinions should be more likely to be valuable than the ideas unanimously assessed as average. In other words, it is assumed that evaluators have knowledge about the value of ideas, and low variance in evaluations implies that all available knowledge points to the same value. High variance implies that in some viewpoints the idea has high value, and further investigation might be needed to assess the actual potential of the idea.

12.2.3 Case study

The developed construct was tested in a multidisciplinary research organisation. The organisational structure of the unit is typical for scientific units: researchers work more or less independently with centralised management. Formal tools for idea collection or evaluation have not been used in the organisation before, but instead ideas have been put forward more or less randomly. As Figure 12.1 shows, in recent years the unit has grown and as a result, a need for more formal methods for promoting ideas has been recognised by the management of the unit. This finding is in line with the notion that the marginal limit for the size of collaborations in team form is typically around 25 (Lipnack and Stamps 2000).

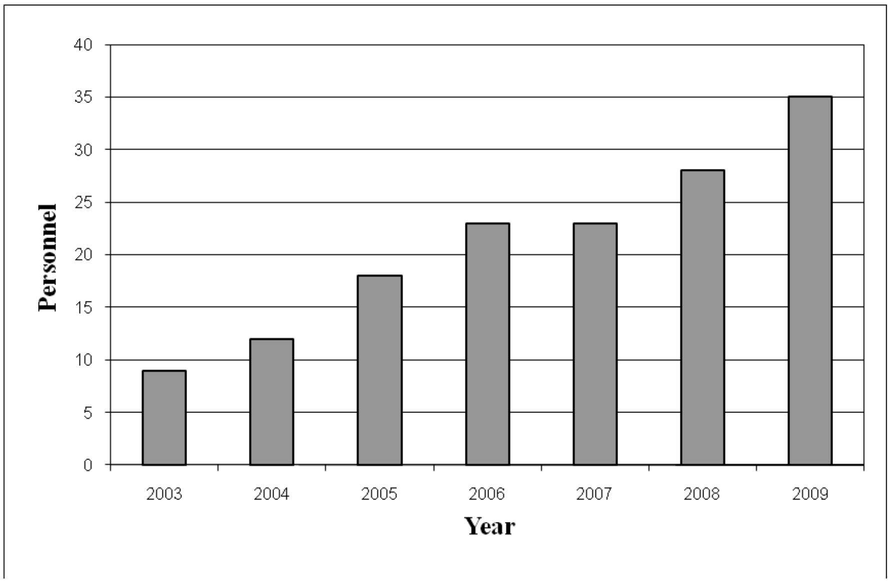

Fig. 12.1 Development of staff resources at the case organisation

In order to test the developed construct in a research organisation, a manually operated prototype of the idea evaluation tool was set up. Email was used to facilitate the idea collection and evaluation processes. The types of accepted ideas were not limited in any way and evaluation criteria were left vague in order to ensure diversity. The instructions given to participants can be found in Appendix 1. Items submitted by the users were divided in four categories: ideas, problems, observations and development ideas. The ideas category consisted of ideas and general suggestions for improvements. The problems category was used for announcing detected issues demanding further attention and solutions. Interesting findings from newspapers, television, Internet or other sources were posted in the observations category. The development ideas category was used for suggestions concerning improvements for the idea evaluation tool. The items were collected via email and from informal conversations. Each idea, problem or observation was sent to ten randomly chosen users for evaluation. The evaluations of the users on a linear scale (1, 2, 3, 4 and 5) were transformed to a non-linear scale (0, 0.5, 1.5, 3 and 5) according to the specifications of the tool and the average scores for each idea were calculated. Finally the ideas, problems and observations were listed in order of superiority in the corresponding categories. The updated list was published weekly.

Even though further development or implementation of ideas was not in the scope of this study, it was found necessary to take actions on surfacing issues during the testing period. Each week a couple of the best new ideas were discussed at a meeting with all the employees, and decisions about further actions were made.

The effectiveness and efficiency of the prototype was evaluated using three methods. The performance of the prototype was observed, users were asked to fill in a questionnaire after the test period and two representatives of the unit's management were interviewed.

12.3 Results and discussion

The prototype of the idea evaluation tool was tested from March 17 until June 15, 2009. 29 employees of the research organisation participated in the test by evaluating ideas at least once. Ideas, problems and observations originated from 24 different employees. 31 ideas were submitted via email, while the rest came up during informal face-to-face conversations and were submitted for evaluation by the facilitator of the prototype. Each item was sent for ten randomly chosen employees for evaluation. On average, 7 of them responded. The quantitative results from the idea evaluation prototype testing are summarised in Table 12.3.

Table 12.3 Summary of quantitative results from the idea evaluation tool prototype testing

	Ideas	Problems	Observations	Development ideas
All ideas	48	14	7	5
Average score	2,95	2,82	2,52	2,83
Standard deviation	0,91	0,95	0,60	0,93
Ideas in development	15	6	0	3
Percent of all ideas	31,25	42,86	0,00	60,00
Average score	3,51	3,17	0,00	3,43
Standard deviation	0,64	1,21	0,00	0,44
Ideas with no action	33	8	7	2
Percent of all ideas	68,75	57,14	100,00	40,00
Average score	2,70	2,56	2,52	1,92
Standard deviation	0,90	0,66	0,60	0,59
One-tailed t-test	0,0005	0,1474	0,0000	0,0527

The idea evaluation tool managed to collect and evaluate 48 ideas, 14 problems, 7 observations and 5 development ideas, totalling 74 items altogether. The idea and problem categories yielded the most of useful content. Observations did not lead to any further actions and due to the limited number of development ideas, a separate category for them was quite unnecessary. The average score of all evaluated items on the non-linear scale was 2.88. At the end of the test period, 24 of the items collected by the tool had proceeded to the implementation phase or were seriously considered for further development. 19 of these items had scored at least 3. The average score of the items in the implementation phase was 3.42, as opposed to 2.62 for the items that had not caused any actions. The difference between the scores is statistically significant (one-tailed t-test, $\alpha = 0.0001$). An item was considered to have proceeded to the implementation phase when a decision about implementation had been made, the proposed actions had been taken or the search for a solution to an announced problem had begun. Table 12.4 summarises the qualitative results from the prototype testing.

Table 12.4 Summary of qualitative results from the idea evaluation tool prototype testing

Type of innovation	Ideas	Development ideas	Total
Product / Service	2	5	7
Incremental	2	2	4
New to organisation	0	3	3
Radical	0	0	0
Process	44	0	44
Incremental	30	0	30
New to organisation	13	0	13
Radical	1	0	1
Position	2	0	2
Incremental	0	0	0
New to organisation	1	0	1
Radical	1	0	1
Paradigm	0	0	0
Incremental	0	0	0
New to organisation	0	0	0
Radical	0	0	0

In the case organisation, the vast majority of ideas were related to processes. 64 percent of all items suggested incremental improvements, 32 percent dealt with matters new to the organisation and only two ideas could be considered to be quite radical. It should be noted that these categorisations of ideas are only suggestive, providing a view on what sort of ideas were generated during the test.

Based on the results of the prototype testing, the idea evaluation tool seems to be able to bring up process innovations in particular. It is difficult to tell, however, whether this is a feature of the tool or of the case organisation. The main focus of the work done in the organisation is on research and it is possible that the results would have been different in an organisation aimed strictly at product or service development. The degree of novelty involved in the ideas was generally low. The majority of them were incremental improvements or solutions that are broadly used outside the organisation. Even though radical innovations should be expected to be much rarer than incremental ones, the lack of wild and outstanding creativity among submitted ideas suggests that the idea evaluation tool might be better suited for facilitating gradual improvements. This is in line with the literature stating that different methods are needed to support incremental and radical innovations (e.g. McDermott and O'Connor 2002).

The efficiency of evaluations was estimated qualitatively by using three factors: the accuracy of evaluations, the speed of evaluations and the processing capacity of the system. The results of testing the idea evaluation tool show that ideas receiving high scores are implemented much more frequently than ideas with low scores. Considering the number of participants, the idea evaluation tool managed to collect a reasonably high number of ideas. Many of them were unfinished, indicating a low threshold for submitting ideas. The idea evaluation tool seems to be capable of recognising promising ideas and important issues with sufficient accuracy.

The results from the evaluations were usually gathered in a few days after submitting an idea. An updated list of evaluated items was published every Monday; users got feedback about their ideas within a week. The number of ideas did not load the idea evaluation tool notably during the testing period. The sufficient accuracy and speed of evaluations with adequate processing capacity indicate that the idea evaluation tool is efficient in its task.

It should be noted that technical functionality alone is not enough for a tool to be useful. Users' willingness to participate in idea generation and evaluation is one of the critical factors determining the success of the idea evaluation tool. In the case organisation, the lack of motivation to participate was not found to be an issue.

The documentation and evaluation of ideas was found to be of major importance for the successful management of the front end of the innovation process. This was demonstrated when several old issues surfaced during the testing of the idea evaluation tool prototype. Many of the issues had been known for years and were discussed every now and then in the organisation, but without effective documentation and evaluation they were forgotten before any actions were taken. Additionally, without prioritisation it can be difficult to decide on which issues to concentrate on. The introduction of the idea evaluation tool managed to provide some formalisation to the chaotic front end of the innovation process.

The idea evaluation tool was found to be able to stimulate idea generation. Many times the participants responded to evaluation requests by submitting new ideas for evaluation. Unfinished ideas were improved and solutions were suggested for problems. On one occasion, submitting an idea for evaluation generated a chain of new ideas about varying topics. Some of these ideas were then developed further by suggesting improvements for them. The end product of this emergent process was a fully developed concept ready for implementation. The people with the necessary skills and willingness to take care of the execution were also found during the successive idea evaluations. In this anecdotal case, the whole process seemed to emerge very naturally.

The acceptance of the idea evaluation tool in the case organisation was evaluated with a short questionnaire for employees and with more detailed interviews with two managers: one in charge of the unit and another responsible for the operational management of the unit. The questionnaire and interviews took place after the prototype testing was finished. 19 participants (including the two managers) responded to the questionnaire, giving the response rate of 66 percent. The results of the questionnaire are summarised in Figure 12.2.

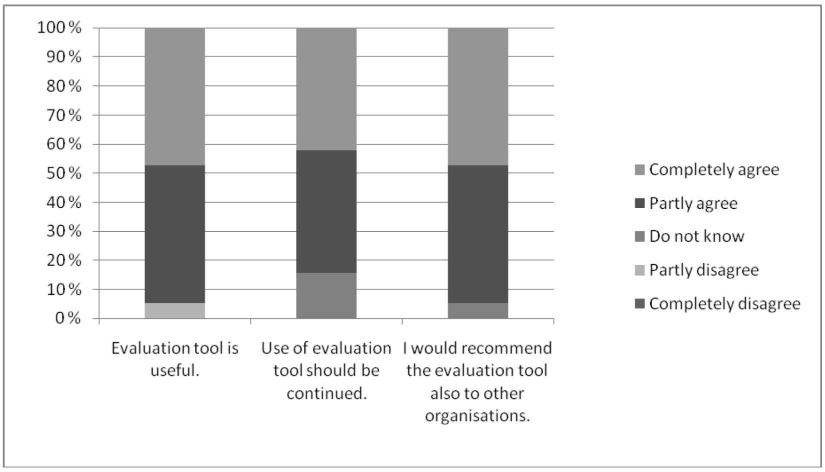

Fig. 12.2 Results of the questionnaire

Generally the results of both the questionnaire and the interviews were very positive and encouraging and indicate acceptance of the idea evaluation tool in the organisation. In consequence of the implementation of the idea evaluation tool, the whole issue of idea generation has surfaced, leading to many beneficial changes in idea management. The process was considered much more visible, giving everyone a possibility to participate in idea generation. The idea evaluation tool allowed the development of ideas to be spread further in the organisation; tasks that previously were in the responsibility of a single individual could now be divided. The documentation of the ideas made it possible to observe the types and the amount of ideas the organisation was able to produce.

The implementation of the idea evaluation tool was not considered to have serious disadvantages. A few participants viewed aggregating personal knowledge to a single numeric evaluation as difficult and possibly too simplified to capture the often complex nature of problems. Evaluating ideas in simplified form was also suspected to increase the risk of misunderstandings, especially if the user is not familiar with the context of a particular idea. Some of the evaluations were viewed as unnecessary; duplicates, minor issues or ideas that can be put into practice straight away would not require a formal evaluation process. This raised suspicion about the organisation losing some of its spontaneity and creativity if things are not just done anymore. All these previous issues were each mentioned only a few times in the interviews and the questionnaire. On the other hand, the lack of effective implementation after the evaluation process was brought up in both interviews and it was the most often mentioned issue in the questionnaire. Ineffective implementation makes even the best ideas worthless and can reduce the motivation to participate in idea generation. The important question here is what happens after the front end of the innovation process. Answering the question is not in the scope of this study, but it would nevertheless be interesting to examine this topic more thoroughly.

The continuation of the use of the idea evaluation tool in the case organisation is supported by the personnel and the management of the unit. The prototype is viewed as very promising but it naturally requires further development. Idea generation and evaluation should be made even more visible and implementation issues should be resolved, allowing a smoother transition from the front end to the later phases of the innovation process.

The findings of this study are in line with the theoretical background of collective intelligence. The diversity of users contributed to the emergence of new ideas and viewpoints. The modularity of the system allowed the decentralisation of the evaluation tasks and the combining of results in a meaningful way. Self-organisation was demonstrated when only two simple rules (1. submit an idea if you get one, 2. evaluate an idea if you are requested to do so) were needed to collect and organise ideas emerging from the organisation. In this case, the intrinsic motivation of users was enough to ensure sufficient participation, as no forms of external rewards were offered. Still, as the feedback from the users suggests, the lack of effective implementation could greatly reduce the motivation to submit ideas. This issue should be contemplated more thoroughly. In theory, the independence and decentralisation of evaluation tasks should reduce the biases of decision making and utilise tacit knowledge, but without comparison to a more centralised and dependent system these effects could not be measured.

At the time of writing (late 2010), the first software version of the idea evaluation tool has just been installed at the case organisation. Simultaneously, some new features could be added. Users now have the possibility to comment on ideas, as the feedback from users indicated that this feature would be essential. A search function and alternative listings of submitted ideas based on category, time of posting and ratings are now also available, allowing easier browsing of the collected content.

There are also some features that have been considered but have not been implemented yet. A mechanism for grouping or combining ideas could be useful. Many ideas do not work as stand-alone solutions, but they could be feasible when combined with other similar ideas. Tags or categorising could help facilitate this function, as well as improving the usability of the tool in larger organisations. In addition to collecting only emerging bottom-up ideas, it might be useful to be able to request ideas on pre-specified topics and to use identified problems to direct idea generation. In large organisations, it could make sense to create user profiles and divide the employees in different groups. Instead of purely random allocation, users with specific profiles could be chosen to carry out evaluations; an idea connected closely to a production line could be evaluated solely by the production line employees, or a certain amount of evaluators from each group could be chosen to ensure sufficient representation of all the relevant viewpoints. In this case, the idea evaluation tool was used in a rather small organisation, but it could presumably be scaled to fit organisations of different sizes by changing the number of users evaluating each idea and the number of evaluation rounds. Similarly the trade-off between the speed and accuracy of evaluations could be adjusted.

So far the idea evaluation tool has been shown to be usable in collecting inputs inside an organisation. An interesting question is whether it could also be used as a link to external knowledge from customers, users and other organisations. Due to its low need for cognitive or ICT skills, the idea evaluation tool could prove to be valuable in capturing the insights of a large user group and in facilitating their more active participation in practice-based innovation activities.

12.4 Summary and conclusion

The focus of this study was on the front end of the innovation process. The recent shift from the STI mode towards the DUI mode and the changing paradigms demand new approaches to the management of the front end of innovation. The main objective of this study was to construct an effective tool for collecting and evaluating ideas at the front end of the innovation process. The problem of idea evaluation was approached from the point of view of collective intelligence. Interest in this relatively new multidisciplinary field is rising and it is not surprising that many alternative approaches are being explored at the moment. Only time will tell which solutions are the best, but one thing seems obvious already; attention to details is crucial when designing a system aiming at facilitating collective intelligence. Most systems include at least some self-organising properties and as a result, apparently trivial changes in details may generate huge differences on the system level. Millions of years of evolution have optimised the decision making process of bees, which was therefore chosen as a model on which the development of the idea evaluation tool was based.

The prototype of the idea evaluation tool was tested in a case organisation and the results were encouraging. The prototype managed to distinguish promising ideas from mediocre ones and to point out important issues. Additionally, spreading ideas around the organisation was found to stimulate the generation of new ideas. The common wisdom about the importance of proper implementation was strengthened up once again; even the best ideas are worthless if they are not properly put into practice. The usability of the developed construct was demonstrated by the acceptance of the idea evaluation tool in the case organisation.

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Appendix: Instructions for the users of the idea evaluation tool prototype

Translation from the original Finnish instructions used in the test.

The idea evaluation tool

Instructions

The purpose of the tool is to collect all the occurring ideas, as they are most of the time forgotten instantly. Forget self-criticism, because all thoughts are accepted. The ideas are divided in four categories:

1. Ideas: all general development suggestions and ideas
2. Problems: observed problems and things requiring improvements
3. Observations: observations about the surrounding world that others might find interesting, for example newspaper articles
4. Development ideas: suggestions and observations concerning this evaluation tool

Submitting an idea

Follow these instructions when you are submitting an idea for evaluation:

1. Write either IDEA, PROBLEM, OBSERVATION, or DEVELOPMENT IDEA in/as the topic of a message.
2. Describe the idea, problem, observation or development idea briefly in the message.
3. Send the message to (address of facilitator).

Evaluating an idea

When you receive a message with IDEA, PROBLEM, OBSERVATION or DEVELOPMENT IDEA in the topic, follow these instructions:

1. Evaluate the importance of the idea, problem, observation or development idea according to your best knowledge on a scale of 1 to 5. 1 means poor/unimportant and 5 means good/important.
2. Send your reply to (address of facilitator).

Results

The evaluated ideas can be viewed in a common network folder.