

CREATIVE PROCESSES IN PRODUCT DEVELOPMENT: UTILITY AND APPLICABILITY

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ABSTRACT

To survive in competitive environments, companies must be able to deliver new products and services to the market. Creativity is a key element in this product development process. This paper is a case study of the use and application of a creative methodology and creativity techniques in six Norwegian SMEs. The study found that the SMEs could quickly learn and use specific techniques and the techniques were deemed useful because they were relevant and powerful tools, easy to adjust to specific needs and made the companies able to identify possible solutions to real-life problems. Further, the study revealed the importance of integrating creativity and business processes to fully exploit the potential of creativity techniques. This creativity integration process was found to be affected by four factors: focus, consciousness, implementation and flexibility and full integration can only be obtained through a focused approach supported by managers responsible for relevant business processes.

Keywords: Creativity, Product development, Innovation

INTRODUCTION

Succeeding in product development is essential to be able to deliver successful new products and services to the market. The product development process requires skills in generating a creative environment in the organisation that enable high idea generation and transforming ideas into viable products and services.

Researchers have found creativity to be a vital in the product development processes (e.g. Stevens *et al.*, 1999) and that creativity techniques can be useful in the process. However, there is little research on the challenges met by companies when introducing creativity techniques in their key business processes. Many large, multinational firms have a long tradition for applying creativity techniques in their product development process (Kiely, 1993), but little is known about challenges met by smaller companies in the application of creativity techniques.

This paper is a case study of the use of a creative methodology and creativity techniques in product development processes in Norwegian Small- and Medium-sized Enterprises (SMEs). The paper explores the utility and applicability of creativity techniques and how creativity can be successfully integrated in the total innovation process.

Background

The University of Údine in Italy initiated research on creativity techniques in 2002. In their work, they analysed more than 80 creativity techniques proposed by several experts and researchers on creativity. In order to select the most effective techniques, the researchers employed a comparative analysis where the techniques and ranged and classified based on the following criteria; the

technique's level of detail, difficulty of application, level of analysis, range of application, time required to train the team and availability of information.

From this classification, the six most appropriate techniques were selected for a methodology for application of creativity techniques encompassing five phases: predisposition, external mapping, internal mapping, creative processes and evaluation.

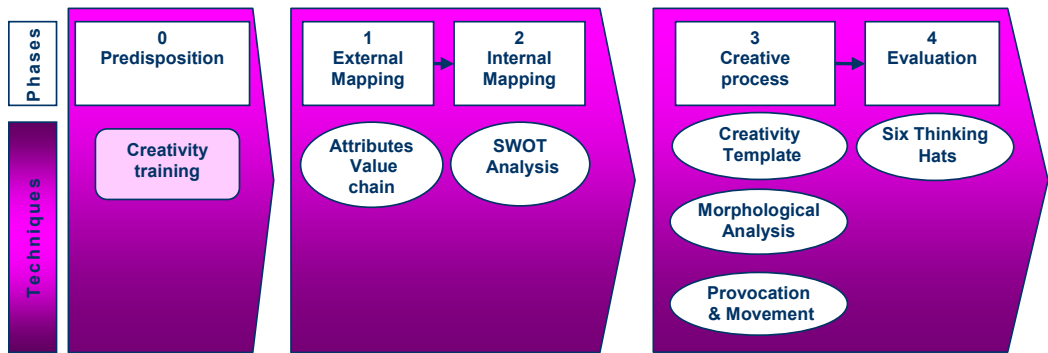


Figure 1 – CREATE Methodology for creativity in enterprise innovation

Based on this work, the EU-supported project CREATE was initiated in 2004 to study *the use of* creative processes in enterprise innovation. The goal of the project was to increase awareness of existing techniques, enable European enterprises to create a creative climate in their organisation and to test and validate the proposed approach through theoretical sessions and practical exercises.

Extensive dissemination activities aimed at industry, academia and research communities were carried out in Italy, Slovenia, Spain and Norway. This paper presents the results from the analysis of utility and applicability of these creativity techniques in Norwegian SMEs.

THEORETICAL FRAMEWORK

The business environment of today is rapidly changing due to the pace of technological development and ever-changing customer needs. This forces companies to become innovative and focus on renewal of products and business process in order to stay competitive. An essential way for companies to stay ahead of competition is to focus on continuous product development.

In this paper, product development is defined in a broad sense. The definition from Smith and Morrow (1999, p. 237) is adopted, stating that product development is “the process converting an idea, market needs or client requirements into the information from which a product or technical systems can be produced”. This definition is chosen because it focuses on the process itself. Smith and Morrow (1999) describes product development as a complex process due to the variety of people and organisational structures that must be employed over time. This paper is focused on creative processes that can enhance the generation of product ideas in a company.

Product development often requires interaction from a group of people representing different roles in the organisation. Therefore it is important to arrange for organisational creativity, which refers to “the creation of a valuable, useful new product, service, idea, procedure, or process by individuals working together in a complex social system” (Woodman *et al.*, 1993, p. 293).

Creativity is the thinking process that helps us to generate ideas (Majaro, 1992). Creativity is also defined as the capability to think out of scheme, achieving new and functional conclusions, suited to solve a problem or catch an opportunity (Bertone, 1993). Creativity is necessary to achieve problem-solving abilities and thus continuous improvements (de Bono, 1996).

However, it is the impression of the authors that creativity techniques are mostly used in larger companies. A study by Kiely (1993) found several examples of this. A subsidiary of PepsiCo trained all 25,000 of its employees in creativity, Exxon trained nearly 7,000 employees in selected

divisions and Texas Utilities trained its top 400 executives to use an array of creative thinking techniques. In fact, surveys conducted by Training magazine, a Minneapolis-based trade publication, show that more than one-fourth of all U.S. companies with more than 100 employees offer some kind of creativity training (Kiely, 1993).

Little research has been found on the degree to which SMEs are applying creativity techniques. It is assumed that creativity techniques are employed to a small degree due to lack of resources (time, money and information) to learn such techniques and to implement them successfully in the organisation. Therefore it is interesting to see how creativity techniques can be introduced and applied effectively in SMEs.

In this paper, SMEs are defined to be companies with fewer than 250 employees and an annual turnover not exceeding EUR 50 million and/or an annual balance sheet total not exceeding EUR 43 million (European Commission, 2005).

Although creativity techniques are often considered useful, it is interesting to investigate how SMEs view the usefulness of creativity techniques. This paper addresses two aspects in this regard: the utility and the applicability of creativity techniques. In order to be precise about the terms, the following definitions are provided:

- Utility: “the quality of being useful; fitness for some desirable purpose” (Oxford English Dictionary). Related synonyms are usefulness, value, practicality and helpfulness.
- Applicability: “the quality of being applicable; capability of being fitly applied” (Oxford English Dictionary). Related synonyms are relevance, appropriateness and aptness.

Integration of creative techniques in product development

Formal processes for developing new products are documented to influence how development processes are performed, managed and controlled. The implementation of New Product Development (NPD) processes has led to considerable improvements in product development efficiency through higher success rates and fewer failed product launches (Cooper, 1994). The key concept behind NPD is to have an integrated framework for product development encompassing company functions that traditionally were separate, such as R&D and marketing.

It can be argued that the same key concept is true for creativity; integration of creativity techniques with other key business processes will be essential for the effective use of the techniques. Creativity has been found to have a positive impact on business excellence. For companies to achieve business excellence it must create an environment where creativity is nurtured and sustained through education and training, involvement and teamwork (Eskildsen *et al.*, 1999).

METHODOLOGY

The following questions were defined as the starting point for the study:

- What makes creativity techniques useful for Norwegian SMEs? (utility)
- How can creativity techniques best be applied in Norwegian SMEs? (applicability)
- How can creativity be an integrated part of the total innovation process?

Research method

Our study focuses on the application of creativity techniques. Despite numerous studies on creativity in organisations, research exploring the utility and applicability of creativity techniques in SMEs is limited. The research problem required an exploratory research approach using multiple methods for data collection.

Case study was found to be the most appropriate research method. A case study is “an empirical enquiry that investigates a contemporary phenomenon within its real-life context when the boundaries between phenomenon and context are not clearly evident and in which multiple sources of evidence are used” (Yin, 1989, p. 23). A study of the utility and applicability of creativity techniques is a highly contemporary phenomenon which requires presence in companies trying to apply the techniques to real-life problems. Further, using multiple data sources was essential for the

researchers in order to achieve full insight of the research problem. The researchers have studied relevant literature, collected web-based information, made observations during sessions introducing the techniques and made open-ended group interviews.

Research design

When forming a research design in case studies, it is essential to give careful consideration to how the cases are selected (Yin, 1989). In order to select suitable cases, some criteria were defined. First, the case companies had to be SMEs. Second, it was necessary for the case companies to have a strong focus on product development. Third, cases were selected in order to study a variety of companies, both in terms of company size and type of business. Providing a variety of case companies was important to provide higher reliability of data. One of the major weaknesses of case studies is that results can not be generalised across populations (Yin, 1989). However, it can provide important insight for companies with a profile similar to those of the case companies. Therefore it was important to collect information from companies with different profiles.

Awareness sessions

To study of the utility and applicability of creativity techniques, awareness sessions were held in each case company. Each session lasted 8 hours and was given by researchers participating in the CREATE project. These workshops started with a general training session on creativity in enterprise innovation, followed by the presentation and testing of four creativity techniques:

- **Creativity Template:** four templates (or schemes) used to foresee potential new products by substituting or combining product components.
- **Morphological Analysis:** Systematic research of combining all possible solutions (1...n) with all functions (A...X) of a problem.
- **Provocation & Movement:** A mental exercise of contradicting known facts (provocation) in order to find new solutions (movement).
- **Six Thinking Hats:** Analysing and evaluating ideas through separating perspectives of: objectivity vs. emotions, negative vs. positive and creativity vs. control.

Special attention was given to the composition of the team in each case company for the awareness sessions. In order to provide a realistic approach to product development, the teams comprised representatives from different company functions, such as top management, sales and marketing, operations and logistics, product development etc.

When the four techniques had been presented and tested, the session concluded with a discussion where the participants provided feedback on the techniques and general comments on how creativity could become a part of their product development process.

After the awareness sessions, a case report was written for each of the six companies. In addition to documenting real-life product ideas that emerged during the sessions, the reports documented the companies' overall feedback on creativity and creativity techniques.

CASE DESCRIPTIONS

The study was carried out in six Norwegian SMEs. The case companies are classified according to company size. Each case firm is presented below, focusing on how they organise their product development activity and their approach to creativity.

Table 1 – Overview of case companies

Small-sized companies	Medium-sized companies
SEAS (loudspeakers)	Stokke (furniture)
SeaBed (seismic services)	Nobø Electro (electrical heaters)
K8 (industrial design)	Laerdal Medical (CPR training)

SEAS Fabrikker AS

SEAS (Scandinavian Electro Acoustic Systems) is a manufacturer of loudspeaker drivers. The company has 45 employees and an annual turnover of approx. € 4 million. From its foundation in 1920, the company has been devoted to renewing its product line and now offers products ranging from standard drivers for radio and TV sets to innovative, tailor-made hi-fi drivers.

SEAS is facing tough competition in the market, particularly from international competitors and has a strong need for continuous generation of new product ideas to keep and increase market share. A selected group of SEAS employees collaborate in the product development process to ensure new products meet the demands of the marketplace and the requirements of the various company departments involved in production, quality control, logistics and customer service. Even though team members are encouraged to contribute with their enthusiasm and creativity, the company does not have a deliberate approach to ensure creativity in the product development process.

SeaBed Geophysical AS

SeaBed Geophysical is a Norwegian company specialised in seabed seismic services. The company has 12 employees and an annual turnover of approx. € 5 million. The company delivers a new technology called CASE (CABLEless SEismic system) and provides all aspects of seabed seismic services; feasibility studies, data acquisition, on-site quality control, data processing and interpretation.

SeaBed aims to be a market leader and operate worldwide with implementation of this emerging technology. The aim is to solve problems that are virtually impossible to solve with traditional surface marine seismic. Therefore they give particular attention to developing innovative products to a demanding market. The company has limited experience with introducing creativity techniques. However, the Chief Technical Officer has previously worked with creative processes and was eager to learn more about how creativity techniques could be applied in their business process.

K8 Industridesign AS

K8 Industridesign is a small industrial design company founded in 1998. The company has four employees and an annual turnover of € 0.2 million. K8 delivers design solutions to several of Norway's largest companies and has its main expertise within concept development, user analysis, model-making, packaging design, CAD and rapid prototyping.

The staff of K8 is used to thinking in terms of creativity and employ creativity techniques in their work as product designers. The company has received several design awards and has participated in several national and international design exhibitions.

Stokke AS

Stokke is a producer of sitting solutions for children and adults and is renowned in Norway for high-quality and innovative products. The company has a balance sheet total of € 13 million and is selling on four continents. Stokke has a strong focus on design and continuous product development. For more than 60 years Stokke has worked together with some of Scandinavia's most important furniture designers.

Nobø Electro AS

Nobø Electro is one of Europe's largest manufacturers of electrical heaters. Nobø Electro has approx. 180 employees and an annual turnover of € 27 million.

Nobø has a longstanding tradition for high quality products with timely design. Further, the company has a tradition for developing new product ideas and reinventing company strategy. The company started manufacturing metallic buckets in 1918 and used their knowledge within treatment of steel plates to start production of electrical heaters in 1948. Today they also produce automatic control systems for electrical energy-saving and thermostats for room and floor heating.

Laerdal Medical AS

Laerdal Medical delivers both products and services for medical rescue training. The company has approx. 420 employees in Norway and an annual turnover of approx. € 80 million.

Laerdal Medical exceeds the definition of SMEs with regards to total number of employees and annual turnover. However, the company was included in the study because it has a strong focus on product development, creativity and lateral thinking. The cooperation with Laerdal Medical encompassed only three departments of the company: Product Development, Production and Sales and Marketing.

RESULTS

Some key results emerged from the awareness sessions with the case companies. The results below are based on observations from researcher and direct feedback from each session. All of the companies provided useful feedback on the contents of each of the presented techniques. These are documented in the case reports, but will not be presented here. This section focus on results relevant to the research questions of utility, applicability and integration.

Utility of creativity techniques

The overall feedback from the case firms was that the techniques proved to be very useful. The techniques were stated to be highly relevant and powerful tools. Several companies made different suggestions on how the technique could be adjusted to the specific needs of the company. Some of the companies were able to identify potential solutions to real-life problems during the sessions.

All companies showed a great enthusiasm for the presented techniques. The companies showed signs of commitment to continue using the techniques. SeaBed suggested a forum could be set up where companies using the techniques could share their experiences, knowledge and ideas about the application of the techniques (this feature was later introduced as part of the CREATE-project, available at www.createproject.net). Nobø Electro suggested a follow-up seminar where the techniques are applied in specific projects in the company. Laerdal Medical has already planned to buy consulting services to properly implement creativity techniques.

As a note, it can be mentioned that during dissemination activities aimed at Norwegian academia and research communities, an article in the popular science magazine Gemini (Evensen, 2005) generated great interest from various organisations, among them Norway's largest industrial company and a Norwegian University College.

APPLICABILITY OF CREATIVE TECHNIQUES

In general, the presented techniques were considered to be easily applicable. Both Nobø and SeaBed commented that there seemed to be a very low threshold to employ the techniques. It should be noted that this also was part of the criteria in the selection of techniques for the CREATE methodology. Still, some important insight emerged from the sessions on how the techniques could best be applied:

Firstly, the companies stressed that it crucial to keep focus during the exercises, especially since the methods generated a large number of ideas. The companies also found it essential to have a clear definition of the purpose of the discussion when starting to employ a specific technique.

Secondly, it was found paramount to work with real-life problems for succeeding with creativity training. Several of the SMEs found that the training sessions should have a strong focus on practical application of creativity in the product development process.

Thirdly, the companies suggested a visualising tool for the creativity techniques. Two of the companies proposed simple fact sheets about each technique to be posted on meeting room walls. This way, employees could be reminded of the contents and procedures of each technique. This could be a cheap but powerful tool supporting the implementation and application of the techniques.

Integration with key business processes

Several of the case companies made comments that reflected the need for a broad perspective on the use of the creativity techniques. Several companies pointed out that the need for sufficient time to implement creativity in the development process has to be acknowledged and that the awareness of knowledge, timing and quantity of creative methods in the product development process is crucial.

Two of the companies made interesting comments on how one of the techniques could be more closely linked to other business processes. Morphological analysis is a technique that requires the company to structure the knowledge it has about the chosen focus area. The result is a table with problem parameters and variables. Several of the companies saw this table of structured information as something that could be developed continuously and become a knowledge resource in itself for planners and developers.

DISCUSSION

The creativity integration process

The unique contribution from this work is neither specifically related to the use of the techniques nor to their potential positive effects for the SMEs. The innovative part is the search for seamless integration between the use of the techniques and some key business processes at SMEs.

SME personnel who get creativity training encounter difficulties in linking the methods and techniques to their daily work tasks. During the training sessions understanding the way techniques work might be easy, but their application in the real world can, for several reasons, be difficult. Consequently the creativity techniques might be quickly put away and sometimes forgotten. On the other hand, it is when people master and use them without conscious effort that the techniques can be exploited to their full potential. The implementation of the techniques as a totally integrated part of business processes, e.g. production development processes, is referred to here as the “creativity integration process”. From the observations in the case companies, four key factors for a successful creativity integration process were identified: focus, consciousness, flexibility and continuity.

Focus

The SME has to focus on the creativity integration process itself. Just as focus is a vital part of creative thinking, it is also a fundamental part of the introduction of the creativity techniques in an SME. The management has to define a set of key performance indicators for measuring the effects of the creativity integration process.

Traditionally, the most used key performance indicators have been product related, such as number of new patents or the number of new products brought to the market. Each company should choose adequate performance indicators. New indicators that should be considered as performance indicators are product quality, customer satisfaction from product, market share and perceived competitiveness.

Consciousness

The creativity integration process shall be done with full consciousness of the nature and effects of creativity. This requires companies to be open for new methods for problem solving. An example would be the importance of accepting how awkward it can be for some people to start using the techniques. For instance, SeaBed first found it difficult to state illogical provocations but concluded that “having a planned approach on how to use creativity is essential”.

It is essential to understand the full potential of creativity techniques. This in turn is fundamental to create the motivation necessary for training and support in consequent learning process. Laerdal has strong traditions for product development and lateral thinking. Still, they recognise the need for a more structured approach to integrate creativity in product development and are now considering starting a project to fully implement selected techniques from the CREATE methodology.

Flexibility

The companies came up with numerous suggestions on how the techniques could be adapted to fit the needs of their company. It is essential to be flexible in the adaptation of the techniques and procedures suggested in the techniques do not need to be followed strictly.

SeaBed found a good adaptation of Morphological Analysis, where one person prepared the matrix in advance and then bringing in the team to work together on the idea generation. SEAS saw the technique as a potential for becoming a knowledge resource in itself for planners and developers. Nobø Electro found Six Thinking Hats to be a great tool for management of group process and wanted to adjust it from its intended use of idea evaluation to a group discussion technique. This illustrates that flexibility in adapting the techniques to specific company needs is essential for effective integration of creativity in business processes.

Continuity

Experts on creativity have stated that successful implementation of creativity techniques requires a step-by-step approach. Rolf Smith, co-developer of Exxon's innovation program, stresses that “you have to start with the basics, then introduce these techniques slowly” (Kiely, 1993, p. 39).

The creativity integration process must be followed up and progress must be constantly monitored. The creativity integration process is a process that does not depend on intensive use of consultants, but continuity and willingness to integrate creativity into daily business processes.

As an underlying factor, it is essential to establish an environment that embraces creativity. A study of creativity among corporate research scientists in the late 1980s suggests that the work environment itself is a critical factor in stimulating or blocking creativity (Kiely, 1993). In this study, factors like ownership to ideas, autonomy, stimulation and management encouragement were found to be essential factors for nurturing creativity.

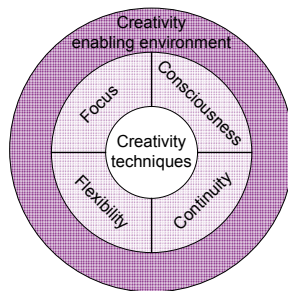


Figure 2 - The creativity integration process

Effects from company profile

Looking at the creativity integration process from an enterprise size-view, it could be argued that the larger the enterprise, the easier to invest in such a process. Large companies normally have more resources available for product development and one might think that the probability to achieve a successful creativity integration process is higher for larger enterprises.

The cases studied show that the techniques work mainly at the “team level”. The size of the company can consequently be argued to be less significant than the size and complexity of the processes and the size of the teams working on them. Small companies have fewer employees and hence it is easier to disseminate information about the technique throughout the company. Thus, the company-wide effect is much easier to achieve for an SME than for a larger company.

Suggestions for further research

Creative thinking is acknowledged as an important strategic factor that affects a company's competitiveness. However, the use of creativity techniques seems uncommon in Norwegian SMEs and these techniques are far from being considered as tools for enhancing the overall performance of the company. The reason seems to be threefold; Firstly, there is a lack of basic knowledge of creativity among SMEs. Secondly, there is a lack of understanding of the potential for business development that creativity techniques represent. Thirdly, there is a general lack of competencies necessary to integrate creativity techniques in the regular business processes.

Integration is a key word in this context. For most SMEs creative thinking tends to remain a process restricted to specific persons and functions and isolated from the rest of the business. The attention of the researchers in this field should be focused on how companies can integrate creative thinking and organisational learning with key business processes in a company. A multidisciplinary approach is required. The fields of psychology and educational science are needed along with those of strategy and business development.

Another key issue for future research is related to the measurement of the effects of implementing creativity techniques in companies. According to Kiely (1993), one has not yet found definite ways to evaluate whether creativity training improves workplace performance. Creativity researchers have not yet found good measures of the benefits from creativity training (op cit.). It would be interesting to identify and validate effective parameters to measure the utility and applicability of creativity techniques in product development and evaluate their effectiveness.

CONCLUSIONS

By studying the utility and applicability of selected creativity techniques for structured creative thinking at companies of different sizes and business sectors, this work has contributed to understanding the factors influencing SMEs' utility from and application of structured creative thinking integrated in their business processes.

The study showed that the SMEs could quickly learn and use the specific techniques and that most techniques were deemed useful. Among the factors that contributed to the utility (usefulness) of the techniques were:

- Relevant and powerful tools
- Easy to adjust to specific needs
- Ability to identify possible solutions to real-life problems

Factors that could increase the applicability of the creativity techniques include:

- Clarification of the terminology (essential to clearly define "creativity")
- Having a clearly defined goal for the exercises
- Extensive use of *examples* (essential when presenting the techniques)
- Visualising tools

From the cases studied arose the necessity to integrate creativity with the usual business processes of the company. This seems necessary to fully exploit the potential of the techniques. The process of integrating creativity and business processes was labelled "creativity integration process". The creativity integration process is suggested to compose of four factors: *focus, consciousness, flexibility and continuity*.

Integration of creativity to key business processes can only be obtained through a focused approach supported by the managers responsible for the relevant business processes. Most of the companies also acknowledged a need for a more deliberate creative process in the product development phase. The techniques can be used to address key business issues, which give a decisive contribution to the utility of these creativity techniques for the companies. A structured and systematic implementation to creativity as an integrated part of a business could take up to a year. In this period of time it will be necessary to identify key performance indicators that are to be

followed up through regular monitoring. In addition, it is important to be flexible in adopting the techniques to specific company needs.

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