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Title	Creativity toolkit for R&D managers
Author(s)	Cormican, Kathryn
Publication Date	2004
Item record	http://hdl.handle.net/10379/3992

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Hennelly, F. and Cormican, K. (2004) Creativity toolkit for R&D managers. Proceedings of the 10th International Conference on Concurrent Enterprising, 14th-16th June, Seville, Spain.

Creativity Toolkit for New Product Development

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Abstract

In this, the twenty first century, innovation has become one of the most important and effective ways of obtaining and sustaining competitive dominance in the market place over the past number of years. Many firms are engaging cross-functional teams composed of individuals from a variety of functional areas to spearhead new product development. The aim of this paper is to examine the critical success factors involved in the area of creativity and knowledge communication within cross-functional product development in R&D departments. To facilitate this existing literature was reviewed and organisational case studies were conducted to understand the social and cultural contexts within which people in an R&D department of medical device and pharmaceutical companies work. Some of the key findings from the investigation included topics involving knowledge management, project management, employee selection and departmental systems.

Keywords

Product Development, Creativity, Innovation, R&D Departments

1 Introduction

According to Gupta and Singhal [1993] successful organisations create competitive advantage through innovation and creativity. In today's marketplace organisations' emphasis is changing from visible assets (such as equipment or technology) to invisible assets (like creativity and capability). Companies of all sizes increasingly recognise that ideas are their most precious commodity and employees who produce them are sought-after resources. Competitive advantage depends heavily on their ability to capitalise on employees' ideas and unleash creativity within their working environments. An organisations success is often measured by the annual profits, level of sales and/or position adjacent to competitors. Without a product to market an organisations position becomes untenable. Products stem from innovation, which in turn stems from creativity. There are numerous forms of innovation, which exist, in modern organisations incremental to radical, product or process [Wheelwright and Chark, 1992], [Cooper and Kleinschmidt, 1996]. The main focus of organisations has initially been product innovation as this yields the maximum opportunity to develop competitive advantage. However, in order to maintain and capitalise upon this opportunity an organisation must develop the innovation process. In other words, they must focus on the processes and systems that enable systematic product innovation to occur. Most large-scale product related innovation occurs within a structured environment of a Research and Development (R&D) Department. This department usually consists of technically competent individuals who work in team structures on product specific projects. The involvement of individuals from other departments is determined by company policy and project requirements. Organisations are constantly faced with the need to alter their systems, following external developments as "*change is the very essence of business growth; ... and is*

inevitable and unavoidable” [Clarke 1994]. The proficiency within an organisation to effectively encourage creativity within innovation does not diminish over time, but instead grows in importance for organisational success. Organisations must adopt proactive practices in order to mobilise creativity within their working environments. As a result the aims of this paper are to establish current innovation practices and procedures and investigate the common shortfalls between the ‘ideal’ scenario and the ‘actual’ working environment. People drive creativity and creativity drives innovation. Therefore enhancing the creative output of individuals involved in an innovative working environment will increase the level of innovation.

2 Existing Theories and Work

The innovation process in an R&D department begins with the idea generation process or problem recognition stage, which is where creativity primarily occurs [West and Farr, 1990]. Creative ideas, which are generated by the human resources within the organisation, are the seed of innovation [Ettlie, 2000]. Thus, the organisation that neglects the importance of creativity, risks a future of no new products or process improvements and will possibly depend on buying in the methods of others. There is a cycle, which occurs between creativity, knowledge and communication. This is illustrated in figure 1.

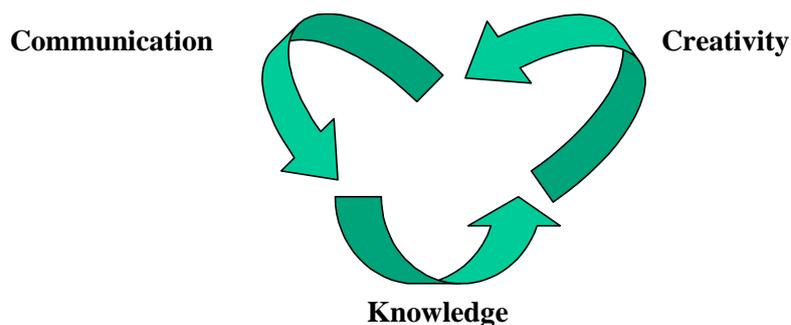


Figure 1: Creativity Cycle

All innovation generates knowledge and this knowledge is reused for subsequent creative ideas [Tidd et al., 1997; Cormican and O’Sullivan, 2003]. Thus the transfer of knowledge within an innovation environment becomes a critical factor. As such the methods of communication and knowledge sharing between the cross functional product development teams, which is a composition selected by many organisations becomes vital [McDonough et al., 2001]. To achieve innovation there must be ideas and these initially appear from the individuals in the team. Cross functional work teams provide increased flexibility and creativeness stemming from the dispersed nature of the skills of the members involved [Takeuchi and Nonaka 1986]. However, personal inhibitions and environmental pressures can prevent employees in the organisation from utilising their latent capability for creativity, which in turn curbs the innovation process [Drucker, 1993; Amabile, 1988]. The ability of an organisation to recognise and unleash its creative power and deploy the resulting innovation as a competitive, profitable strength depends on the structure of the organisation. In other words it is responsibility of the organisation to ensure a culture, which encourages creativity, is established. Rapid change means quicker knowledge obsolescence and entails constant internal adaptation including new strategies, structures, processes and tools.

Knowledge management concerns innovating, spreading, sharing and using of knowledge. Research on knowledge management concerns the management aspect including organisational learning, personal management, cultural, etc. [Drucker 1998] and the technical aspect including models, support tools and environments [Zhuge, 2002]. Knowledge management must ensure that those who know, can share their knowledge with those who do

not have this knowledge, yet need it, and that both personal and tacit knowledge is maintained within the organisation, in the event that the people with the valuable ideas, information and knowledge move on and take it with them [Drucker, 1993; Davenport and Prusak, 2000]. Through effective communication, teams facilitate the exchange of information and create new knowledge and insights [Tidd et al., 1997]. There is a tendency to assume that what is relayed through the spoken word in communication with others is fully understood. However, there exists distortion in meaning as communication occurs such as the understanding of the terms 'goals', 'actions' [Cummings and Ting, 2003]. The job of achieving understanding and insight in mental processes of others is actually quite difficult. Technical change, product life cycles, market shifts and global competition affect some industries more than others. Effective communication is essential to the timely availability of information required by the various members from the different functions and disciplines present in the team.

3 Research Approach

The research approach selected for this study was field-based research, which is deemed to be a method of gathering rapidly changing technical and managerial processes [Lewis, 1998]. Case studies are considered to be a form of field based research and are also a form of research considered to be useful in studying the product innovation process [Workman, 1993; Dougherty, 1992]. This approach is suitable for exploratory, theory building research where the emphasis is on sense making and meaning. The strength of case study research is that it employs various sources of evidence to improve the accuracy and comprehensiveness of resulting theory [McCutcheon and Meredith, 1993]. The case studies involved in this study, were compiled from information collected in a selection of semi-structured interviews. This form of interview is conducted on individuals who are quiet clear about the research objectives; the questions are usually more open ended to allow for the collection of as much information as possible through the elaboration of the interviewee. The interviews were conducted with the directors of research and development departments of three medical device and pharmaceutical companies based in Ireland, resulting in the completion of a survey and a company profile. It was important to get a clear image of the methods of project team selection, task and resource delegation and administration of the research and development department from the actual person in charge of these duties.

4 Research Findings

Each of the companies involved expressed difficulties in developing a culture of creativity within their R&D departments. Each company admitted that the focus is directed towards problem solving instead of encouraging an atmosphere of creativity. The R&D departmental structure is such that the emphasis is placed on the individual to develop creativity. The organisations that participated in the case studies stated that there are no formal systems departmentally to encourage creativity. It fell to each individual core team leader to select an approach. Some held structured brainstorming sessions, however these were based on an invitation only system and as a result the same few individuals always attended. There are individual innovators employed by the organisations, however when they leave there is a void left within the development section of the innovation process.

There is open access, for all employees to project information. Upon completion a successful project is scrutinised for all knowledge. Retrieval of this information is seen to be important as it may add to future projects, however since information from failed projects is not collected employees often waste time on repeating the same mistakes. Another factor, which impedes the employee access to important within the department, are the storage methods selected by the organisations.

There is no effort made to identify possible creative personality types at the recruitment stage of employment positions within the R&D department. The emphasis is placed on technical skills and abilities. If an employee is hired for their creative ability, this is based on years of experience, past inventions and revenue from products developed. This person then takes responsibility for all creative idea generation within the department.

All of the organisations involved expressed difficulties managing project resources. Often the organisation will suffer from resource shortages, in terms of people, time and equipment, due to the prioritisation and size of certain projects. The projects are often timed so as not to collide with each other with regard to resources, however if there are any problem or delays there is often a pressure in spreading resources. There are often difficulties in the semantic language chosen by each department. There are conflicting priorities allocating resources (staff and equipment) when attempting to coordinate with other functional departments. All of the key practices and issues are illustrated in table 1.

Practices/Issues	Company A	Company B	Company C
Employment	No system to identify possible creative personality types at the recruitment stage.	Will employ one key innovative person with experience for the entire department.	Employees hired based on technical ability only.
Structure	Employees are encouraged to utilise the expertise of employees from other departments if required	Team structure rigidly adhered to, to the point of hindering interaction.	Loose team structure with emphasis on openness.
Knowledge Retrieval	Difficulty tracking past project team members to access information.	Past project members' identity stored in database in project finance forms.	No centralised method of accessing past project employees.
Information Analysis	There is no analysis conducted on unsuccessful projects.	Unsuccessful projects analysed for mistakes; information not reused.	There is no analysis of conducted on unsuccessful projects.
Idea Generation	Encourage use of creative tools, ideas consistently stems from the same few individuals	All managers adopt different approaches towards idea generation	Cannibalise other organisations to gain new products and processes.
Idea generation vs. problem solving	Proactive towards idea generation, experiencing difficulty selecting methods to encourage in all R&D employees	Reactive approach of problem solving except for the one innovative employee	Effort on incorporating best practices from cannibalised organisations
Management	Resource shortages due to mismanagement of project deadlines	Resource shortages due to language differences and possessiveness between departments	Resource shortages due to mismanagement of project deadlines

Table 1 Company Findings

5 Research Analysis

Innovation is a key-determining factor in the success of modern organisations and creativity is a key aspect of innovation. As such the importance of managing individual creativity supported by the acquisition, dissemination and use of knowledge is a critical factor in the innovation process. For the purposes of this paper the organisational procedures of each organisation were captured in the form of structured interviews. The purpose of the

interviews was to generate a sample of the practices of the population being researched to identify some characteristics, attitudes or behaviours, this enabled a direct comparison of the findings from each organisation to highlight either similarities or differences if they appeared. It was imperative to establish a clear representation of the methods of project team selection, task and resource delegation and administration of the R&D department from the management perspective. The preliminary research findings indicate that innovation is an activity, which cannibalises information from various sources and transforms it into a marketable new concept. The superlative asset of the innovative process is the human resource involved but these have to be encouraged and nurtured. The entire process depends on the transfer and understanding of knowledge and as such it is imperative to facilitate and enhance this. Given the importance of creativity and innovation in the realm of today's organisations, the development of a creativity toolkit to aid in this process was deemed to be appropriate. A useful starting point for considering a toolkit for creativity is to consider characteristics of the individuals involved. Examples of personal qualities of creative individuals have been collated by and described as: openness to experience; independence; self-confidence; willingness to take risk; sense of humour or playfulness; enjoyment of experimentation; sensitivity; lack of a feeling of being threatened; personal courage; unconventionality; flexibility; preference for complexity; goal orientation; internal control; originality; self-reliance; persistence [Gardner 1993], [Sternberg and Lubart 1999]. The cognitive repairs literature suggests that organisations can institute practices and procedures that can overcome these cognitive limitations [Heath et al. 1998]. Thus, although individual and organisational creativity mechanisms can individually impact innovation performance, the hypothesis is that the effectiveness at making innovation happen will be greater when both individual and organisational creativity mechanisms occur simultaneously. The findings of this study revealed that the key to successfully managing creativity in innovation in organisations is multifaceted. However, an organisations' attributes or characteristics can have a significant impact on creativity initiatives. Therefore organisations must purposefully construct strategies and structures so as to enhance creativity.

The toolkit will support the organisational effort to manage the creative process more effectively and maximise its output. The function of the toolkit is to develop a structure that traps the potential creative drivers and nurtures a creative culture. It also strives to bring together supporting elements of creativity and provide an infrastructure that will prevent potential creative ideas being lost. The ultimate aim of this approach is to provide an organisation with a method for both enhancing the creative abilities of its employees and allowing the organisation itself to develop a corporate attitude with respect to ongoing product innovations. Through such a consciousness, an organisation may remember and learn from past experiences, and thus enhance the likely success of creative initiatives within the innovation process. The toolkit will utilise information technology to facilitate its objectives.

6 Creativity Toolkit

The toolkit has been designed to provide organisations with an infrastructure for managing and enhancing their creative output. It is a customisable portal that allows the knowledge worker access repositories of knowledge, support tools and communication channels that will facilitate their creative efforts. The toolkit utilises the power of information technology applications such as intranets, notice boards and email to achieve its objectives. The homepage, as seen in figure 2, is the main page the application and allows the user access to all modules and sub-modules in the application. The content of the page is divided into three main areas; the logo of the application, the name of the Toolkit and the mission statement and imaginary organisation name. On the left hand side of the page a 'Quick Launch' toolbar is shown. This toolbar contains hyperlinks to homepage, contact list, schedule and Internet links. There is also the capacity to search for relevant documents.

The right hand side is divided into two sections. On the top the main menu is displayed. This menu comprises of four modules: Orientation, Repository, Creativity and Community. This space is aimed at the entire R&D department. There is the ability in each module to filter the information so that only the topics relevant to the user appear on screen. Each user can input creative thoughts and possible product development suggestions, the effective development of the emerging concepts and secondly as a knowledge repository to facilitate the development of the concept to an idea for the innovation process.

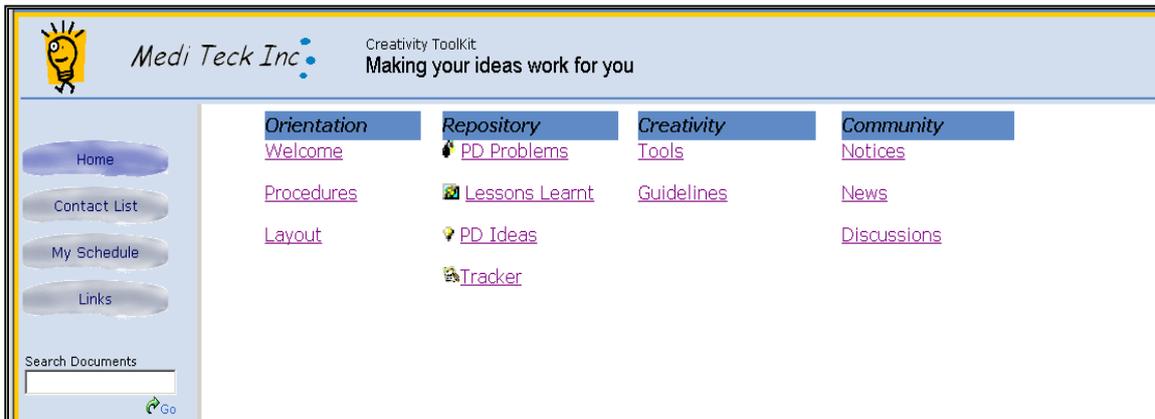


Figure 2 Toolkit Homepage

6.1 Procedures

The aim of developing a climate is to codify team efforts and build an open and supportive atmosphere. This module documents the organisational vision, requirements, strategies and targets that have been defined. This allows individuals understand where the organisation is striving to get to and thus to align their creative efforts to coincide with the demands of the organisation. This sub-module consists of a list of departmental procedures and ethics to enable new team members to understand the approach adopted by the organisation. Establishing a set of norms, attitudes, and expectations that individuals perceive to operate in a specific social context develops a team climate. Thus individuals are knowledgeable as to organisational direction but also have an avenue for having their 'alternative' creative acts considered.

6.2 Tools

This sub-module consists of a collection of tools that are available to the individual to facilitate the development of idea concepts. These tools include such techniques as brainstorming, mind mapping, affinity diagrams and cause and effect. The purpose is to generate ideas, which feed the strict development phase of the innovation process. This area contains all of the information to develop and links to the tools. The user is free to play with any of these tools that they feel may facilitate in progressing the concept development. It is possible to add and edit the items in the tools section, this will enable team members to enhance to the list with other methods and tools that they may encounter or which may have proven successful.

6.3 Product Development Problems:

This sub-module allows the user to record problems that they have encountered, either within their concept development or just within their day-to-day environment. The user is allowed to post this problem to one of their Discussion Groups or else to the Problems\Issues space for comment and suggested solutions. Thus, the individual is broadening their network and attracting individuals of similar interest towards their creative nodes. Thus, over time groups

will tend toward a collective and enhance the creative output through cross-functional benefits.

6.4 Developing Ideas:

This is a module that details the status of the developing ideas and highlights when their time window has been exceeded. The purpose of this functionality is to remind the user of their developing ideas within the think tank and to flag up when these ideas are being neglected. This feature also has inbuilt functionality to send the user a message via email that ideas are exceeding their time window and require attention. The functionality allows the user extend the time window but hopefully succeeds in focusing their creative effort without applying too much negative pressure.

6.5 Contacts

This module allows for access with team members for past projects or on current product development projects. There are various views available such as my items and Product Involvement. It is possible through the contacts section of the toolkit to receive notification of any changes that may occur. The contacts area can be filtered to generate only specific views. This allows team members to track previous project members to access information. The contact list can be viewed a project 'yellow pages', possible sources of tacit knowledge are at team members fingertips. One of the issues that the organisations that partook in the case studies stated was their inability to access past team members quickly. The majority of past project team members identities are stored in the project budget forms for the purposes of payment.

6.6 Lessons Learnt

This section of the toolkit allows the user to read and submit lesson learnt while working on projects. Knowledge is a crucial element of creativity and affects areas of the creative process such as idea generation. New knowledge is created within an organisation by converting between the tacit, explicit and cultural knowledge. Thus, through the sharing of tacit and explicit knowledge with other team members, creativity can be enhanced

6.7 Discussion Group:

This provides a list of all discussion groups ongoing within the department, their area of interest and their members. Thus an individual can apply to a particular group convenor to participate in their discussion group. This functionality helps in overcoming organisational boundaries and ensuring that the individuals comfort zone is constantly being stretch by alternative perspectives. This functionality also succeeds in widening the individual's creative network, which is advantageous for future creative potential. This module allows the user establish networks of individuals around common themes, with whom they can discuss issues. This functionality encourages individuals to stretch 'outside of their comfort zones' and to avoid 'concept myopia' by discussion their thoughts with others. The application of technologies such as email, notice board and chat rooms overcomes geographical boundaries and allows creative individuals interact through cyberspace to develop concepts.

7 Conclusion

Innovation is a key-determining factor in the success of modern organisations. As such the importance of managing individual creativity supported by the acquisition, dissemination and use of knowledge is a critical factor in the innovation process. The research findings indicate that innovation is an activity, which is based on the collection, dissemination and regeneration of information from an assortment of sources which morphs into a novel viable

idea. The human resources involved in the innovative process are impulsive and perceptive and therefore have to be motivated and encouraged. The goal of this research was to focus on the element of creativity involved in new product development process. The aim is improve the success rate of creativity involved in innovation efforts. The focus of the research incorporated all aspects of creativity. It analysed the role of the individual, the management employees and of the innovation process and finally the Research and Development Departmental Structures. The creativity toolkit software demonstrates the key findings of the research.

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