

idPeo a Multidisciplinary Approach to Innovative Product Realization

ABSTRACT

The need for effectiveness and efficiency in product development is increasing and learning organizations need to deliver knowledge and people with the right mindset to society. IdPeo is a suggested model to support innovative product realization. The model focuses on a collaborative approach of needed expertise knowledge, key activities, and decisions.

Keywords, Innovative product development, Art and design in – collaborative engineering, – decision making, – concurrent engineering, idPeo.

INTRODUCTION

Global competition is a fact. Economic growth and future jobs are therefore dependent on how the industry will be able to transform new ideas into successful products and improved processes. Further, where products conjugate towards the same performance, quality, and functionality, product development is becoming increasingly dependent on successful release of innovative products, and to do so in shorter time than the competitors [1]. Ekman and Jackson describe the current situation as,

“Fragmented markets stress the need for abilities to continuously adapt to new demands and to integrate new technologies. Thus is it vital that companies develop innovative product development skills” [2].

It is increasingly important to develop processes for successful product development and Balanchandra and Friar have made an extensive survey and mapped success factors in product development literature [3]. Categories such as market, technology, environment, and organization were found to impact the success of product development. Organization was found to be the category that contained the most important factors which influenced success.

Leading companies are realizing that it takes more to stay competitive than before. They need to develop processes for handling, e.g., enormous amount of information, communication, people, and decisions. However, the explicit decision-making process is one of the areas in which most companies do not have a generic model or methodology for. This developed approach for innovative product realization in concept development, if implemented correctly into the companies' product development process, could contribute to increased flexibility, creativity and tolerance for change. It could also decrease lead time, increase product performance, and decrease uncertainty.

The objective of this paper is to discuss and explore an “innovative” approach towards product concept development methodologies by focusing on creativity, multidisciplinary teams, and decision-making.

This paper is structured according to:

- Methods used to perform the study
- Theoretical framework, where the theory used will be presented
- Results and discussion of the study
- Conclusion

METHODS

This paper is based on action research, semi structured interviews, and literature studies, along with a reflective dialogue through all projects with the project and process leaders. The purpose of this has not been to try existing theories but to explore and develop new methods of dealing with multidisciplinary projects.

MAIN BODY

Theoretical framework

Through a theoretical review of current literature the following important factors for conducting a multidisciplinary approach to product realization needs attention.

- The most important source is the people involved in the process
- The Medici Effect, the diversity of the members in the group
- Communication through the process for common understanding
- Visualization for the handover situations and common vision
- Design processes as an iterative approach to the problem at hand
- The Road for implementing continuous innovation in an organization

These factors are presented as follows:

The Most Important Source

“The most important source toward innovation is people with their free opportunities to use their skills, express their ideas, develop inventions and create intra- and entrepreneurship for innovations and companies” [2].

However, today it is often too complex to handle innovation unless one is using larger groups of people. This stresses the importance of a multidisciplinary team, where people differ in their roles, have the freedom to think big in a creative and innovative environment.

Richard Florida describes how technology, talents and tolerance for diversity are closely connected. Today, more often than not, multidisciplinary teams are responsible for successful innovations – in the research and in the company world [4].

Gardner describes in his book “five minds for the future”, a way of looking for the right people or creating the right people [5]. His “five minds” give us something to start up from when we assemble a development team for a new project. It also gives us a forecast of the knowledge of minds that the future is demanding for people to be able to take part of the future, not only as passengers but also as drivers. It is time to educate individuals to be disciplined, synthesized, creative, respectful, and ethical.

The Medici Effect

“When you step into an intersection of fields, disciplines, or cultures, you can combine existing concepts into a large number of extraordinary new ideas”[6].

Today, increasingly more innovations originate from a phenomenon, the so-called Medici Effect. It is the cross-road where ideas, or disciplines, from different knowledge areas and cultures meet, resulting in an explosion of innovation.

The “Medici Effect” has reference to what the Medici family accomplished in Florence in Italy during the 1500s. By sponsoring people from different disciplines – architects, artists, sculptors, philosophers, scientists, and bringing them all together in Florence, they made Florence the epicenter of one of the most creative eras in Europe's history, the Renaissance.

By combining different knowledge areas and supporting the work with innovative tools and methods, it is possible to increase creativity. Use of idea management, ethnographical studies of customers, rapid prototyping, and other creative tools, can inspire integrated development teams explore opportunities they otherwise would not.

Communication

All kinds of communication has to be effective and efficient. First of all, an external representation can carry understanding in multiple interpretations, in terms of creating a common mental image in the project. Communicating this mental image between different parts in a development process is hard and demands a dialogue that does not flinch for analogies and metaphors, and that the receiver interpret from his or hers experiences. The challenge is to, among the coworkers, create this common, mental image of the project, not only of the result, but the way to the result [7]. The lack of information and the need to communicate this “mental image” of the project to the next group of people, who continue the work process, is considered a difficult step. This handover situation is described by Eckert et.al. in *Design Process Improvement* [8].

When we discuss different strategic decisions, it is important to have tools designed for understanding. In this paper we want to take a step forward in developing a sustaining model, including interpretation. From an information designers perspective we will make an effort in understanding the receivers of information, to provide them with the right information at the right time in an adequate way. Here is deep knowledge in perception, cognition, and esthetic important. This itself speaks for a cross-functional development team.

Visualization

Successful external cognitive tools compensate for limitations in human memory and information processing, at the same time that they take advantage of them. [9]

The creativity is enhanced by allowing designers to interpret sketches. The designer views this as interacting with the sketches as in a conversation: the designers see more in their sketches than they put in when they drew them, and these insights drive further designing. [10]

Design Processes

The design process is a model for the application of design in product development. It is part of the company's entire development process and is used to achieve successful, creative results through the medium of design skills and know-how. The design process can be applied to many different areas and projects that concern processes, messages, goods, services, or environments. One problem in communicating this model is the complexity of the iterative process that characterizes the design process. However, that is partly solved by design firms by communicating the linear stage-gate-model to their customers, but applying an iterative process when designing the solution.

“Swedish design firms claim that they follow processes that are mostly standard and linear: some firms use specific tools and metrics. (In reality processes are not always linear, but there is a feeling that clients wish to see understandable logic.)” [11].

“The use of stage-gate-models is actually built upon the assumption that one actually learn gradually as the project develops, however, gate decisions are often applied as locking mechanisms for the end result from the very beginning. During high uncertainty projects the gate model should be used to set up hypotheses that are tested and evaluated in the next coming phases” [7] translated by author.

The design process rests upon three parallel sub processes:

- The creating of a satisfied customer
- The knowledge about team processes and multidisciplinary work
- The continuing development of processes and ensuring of an efficient and well carried out process [12]

The Road

Dobni [13] describes eight areas that are of the highest interest for organizations to become operative innovative.

“The innovation blueprint describes the environment and behaviors necessary for ongoing innovation in an organization. The innovation environment, being management-centric, describes the context in terms of intentions and infrastructure that must be created by management to support innovation. Behaviors, on the other hand, are employee-centric, and identify the temperaments and characteristics necessary to drive the market orientation of employees and the implementation of innovation” [13].

The goal according to Dobni is to create a continues innovation and to make a innovation nexus where innovation becomes the organizations mantra. It is a stage where competitive interaction is an opportunity to discover value-creating ideas. These teams should be market-oriented and proactive and the mindset should be “if one succeeds, all succeed”.

Discussion

The process presented here has been built upon an general design process and focuses in the three different areas of competence within the Centre for Product Realization at Mälardalen University, namely Engineering design, Innovation Design, and Information Design. From these areas and from evaluating the cases above we have created a new process that not only focuses on the process itself, but also supports areas like collaboration and team development, and we are also suggesting a physical environment that supports our process with special care of the mental environment. We also have a concrete proposal for the system that is required to carry out product development projects in collaboration between academy and organizations.

We have divided the model (idPeo:s eight steps) into three areas:

- Preparation
- Realization
- Reflection

Where step 1-3 is the preparation area, step 4-7 is the realization area and step 8 is the reflection area. Although the reflection area mainly is in the last step, but it is of highest importance that the reflection is a part of all steps in the process.

The need of leadership in these projects is high but one must be aware of the differences between various kinds of projects.

In our case the learning project is the most common project. The leader must be able to have an open mindset and to use flexibility in the process, as well as having a clear structure and progression in the project.

The pedagogy platform to our process is the key factor for gaining value to the three “customers” namely researchers, students, and surrounding society.

By using different methods and creativity tools, we can maintain a high level of involvement during the whole process. The process leader is very important in the pedagogy. To be process leader means that you know the process and can support your team according to the need they have at the moment. You should be able to give individual coaching as well as group meetings and workshops, you should also be able to inspire enthusiasm, engagement and stand for credibility.

To be aware of shape and function during the whole processing time, and in every step of an innovative progression, will surely make the final result improved in every sense.

So both esthetic and functionally considerations during the whole process must be a part of this innovative collaboration model, idPeo.

What is the value for this pedagogy? For our three core customers, researchers, students, and the surrounding society, we believe that the learning itself, that come out as a result of this process of developing new products, is the most important value. For the students this is obvious, for the researcher, this iterative process can come up with new empirical data, and for the surrounding society this means that they learn “know-how” and can implement the knowledge into their own organization. One other thing that comes out at as a value is the cooperation between society and university.

The process supports the three parallel sub processes as follows

- A. The creating of a satisfied customer
- B. The knowledge about team processes and multidisciplinary work
- C. The continuing development of processes and ensuring of an efficient and well carried out process

These three sub-processes add different value to each of our “customers” such as (A) for the surrounding industry, (B) for students and researchers, and (C) for researchers and students. Besides that, all “customers” gain new and concrete knowledge about how an innovative product development process ought to be carried out.

The theoretical framework means that the team for every project must understand implementation of innovation and the influences of innovation in a way that are complex and difficult. By making the behaviors in our process understandable with tools that support the important questions, knowledge management and sphere of influence, it can be done in a understandable way and easy to use with a

minimum of time to set up. This combined with a management that support the team and creates the condition for ongoing innovation makes this work. For the management it is also important to have an intention of being what the team should be to make their behavior impact on the teams intent. The management must also have time to determine whether a member of the team have the right characteristics and skills for the project, this is however not a big problem in our model since we take this into consideration while manning the team.

Supporting structures

The environment is one of the things that we found important for supporting our process. It is both the physical environment and the mental environment. Other important supporting structures are the lab environment, both the user experience lab, the rapid prototyping lab, the robot lab, and the wood- and metal workshop. These labs support the process in a concrete way and give substance to our projects.

The physical- and mental environment is important to create in such a way that they support the process. It is important that this environment is unexpected and “clean”. To be able to set the mindset for each purpose, one could have mobile solutions for everything and possibility to change the environment quickly or move to a completely different room, next door, using senses to stimulate and inspire the team by music or humor. In the mental environment we mean that it is important to make the team members trust each other and to have fun.

A reference library inspires, as well with literature, supporting the steps in the process and material samples to feel and test along with a library of form. This library is for applying known form to new applications, turning things upside down.

Regarding an “innovative” approach towards product realization, it was argued that there is a need to establish multidisciplinary teams of people, with different skills and frames of reference on the innovation ideas as a result of the backgrounds, experiences, and activities.

Examples of possible competences are mechanical engineering, information-, product- and industrial design, business and marketing, innovation management, ergonomics and applied psychology.

This formed the initial ideas and problem statements on a model, including planning and manning the team. The research then continued through two new projects where the aim was to explore and identify gaps in the model and to form the management of projects. After that a literature review within design theory, project management, and product development processes was carried out. A total of eight semi structured and open interviews was held with PhD students and researchers at the Mälardalen university to identify a common model for product development according to the differences in competence. These results were then incorporated into the suggested model, idPeo.

All key activities are supported through developed workshops, dedicated to focus on shared key factors and decisions for successful product development. Some of these key factors/decisions are common in design theory, but they are being researched and developed continually. In contrast to other product development methodologies, idPeo is composed by workshop packages and does not constitute a continuous full process, but is rather a complement to various product development processes.

The model is workshop-based to fit into the diversity of development processes in industry today and has a broader focus on the decision-making process itself. It manages the focus of shared decisions, organization, and creative tools for exploration and decision-making. Decision management together with creative thinking and tools – idPeo – is an option to a wide range of industries engaged in, e.g., product innovation and service design.

The composition of the development team is the single most important factor for the success of the idPeo model. idPeo encourages diversity of expert knowledge within the work groups and is consequently a great and flexible tool for use in Concurrent Engineering and Integrated Product Development. The process leaders should have extensive experience within team management, creative methods/tools (idea management), and decision management to facilitate an effective and efficient product development process.

The goal is to eliminate traditional barriers and to foster good communication and cooperation. The process should be made explicit to facilitate development and the possibility to become increasingly flexible and creative, as well as robust to changes in the market, organization, task, and team.

The suggested approach, called idPeo, is a methodology for innovative product development and successful cooperation. It focuses on management and flexibility of creative product development within organizations that are dependent on creativity, quality, and time-to-market. The process consists of the following eight key activities;

idPeo

1. Analysis and Assembly of Team – Analysis of necessary expertise and knowledge areas for the project, assembly of development team with necessary skills.
2. Project Plan Development – A generic plan for important shared decisions in the project at hand.
3. Project Definition – This is where the collective goal is visualized and described to serve as common direction throughout the project execution.
4. Knowledge Gathering – Need finding and benchmarking etc.
5. Analysis of Information – The interpretation of the gathered material so it may be translated from the language of the customer to the language of the engineers. Use of creative tools for decision making.
6. Concept Development – In this phase “design thinking” dominates the process. Concepts are generated which corresponds with the needs of the customer. Idea management is utilized.
7. Evaluation – Evaluation and selection of appropriate solution to the customer need. Use of creative tools for decision making.
8. Final Presentation – In this phase the final selected product is visualized and described to best show the advantages.

The basis of this research was first developed through a workshop after the first step in a project called “Sportrulle”. The aim of the project was to make design concepts of multi sport wheelchairs and an exhibition to show the wheelchairs. The students and researcher involved in this project were from different areas of competence, the aim of the workshop was to explore the common approach in working with projects and how to execute the projects. The result of the workshop became a model of how to execute projects like this.

Conclusion

This paper has discussed and explored an innovative approach towards innovative product development methodologies. To support the development of the next generation products and services within industry, it was concluded that there is a need to develop and implement new innovative methods and models that will support and strengthen industry to generate new ideas and realize these into successful products and improved processes. The need for a responsible process leader who can use the process with flexibility and make the team work together towards a common goal is of highest importance. The suggested model has been tested and proven. Further research within this area will be the use of visualization during a concept design process that could be mapped upon this process.

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