Information Flow and Simulation Support in the Product Development Process - A Case Study

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Abstract

This paper consists of a case study of the product development process at Indexator AB, manufacturer of rotators for heavy equipment. The process has been studied concerning the information flow and computer support in the engineering design department and its interacting departments. It is shown that the company has a clear view of how information flows and which computer tools they use in the different parts of the processes. The advantage of using computer tools for analysis and planning is seen. Ways of communication and information flows concerning the design processes can sometimes happen in unplanned ways. Lack of integration between the different computer tools leads to unnecessary regeneration of the product information in the different parts of the development process.

Keywords

Information Flow, Product Development Process, Computer Support

1 Introduction

The competition between manufacturing industries has increased during the last decades, newer and better products must be released faster and more often to the market. Development capability has even become a competitive asset [1]. Therefore has the importance of an efficient product development process significantly increased within the companies. Research has lead to a variety of theories and methodologies to increase the efficiency of the process. Especially the systematic approaches of the product development process are wildly accepted [2,3,4]. The process is continuously changed as new and better technologies are implemented.

The usage of computer based tools have made a great impact on the development process, such as the usage of virtual prototypes and analysis tools. In order to get more efficient, accurate and save time it is preferable to create the product information once and then reuse the information. This is a difficult question since the tools for the different tasks in the process are often not connected with each other [5].

A structured information flow within the product development process is therefore important when the amount of information grows due to increasing usage of computer tools. In order to establish an understanding of the problems connected to the implementation and usage of virtual prototyping and analysis in the product development process it is important to understand the existing processes at the company.

This is a case study report of the product development process at Indexator AB. The study was focused on the information flow and the computational support within the engineering department and its interacting departments. The intention with the study was also to determine if the existing development process is based on any recognised theory or methodology. If so, to what extent are they using it? How well do they think it works?

2 Collaborating company

The study of the product development process was conducted at Indexator AB, situated in Vindeln, Västerbotten. Indexator develop and manufacture rotators for heavy equipment. The most important function with the product is the possibility of limit-less rotation of a mounted tool without end stop.

Figure 1. The product families: Rotator and Rototilt.

Indexator uses advanced computer based tools in order to stay competitive. Some of these tools are aids for engineering design and analysis. In combination with a fully automated flexible manufacturing system, FMS, assembly is in principle the only manual operation.

One of the reasons to do this project at Indexator is their aim to continuously improve the product development process. Another reason with the co-operation is that they are one of the collaborating research partners in the Polhem laboratory, which is a NUTEK centre of excellence at Luleå University of Technology.

3 Gathering information

Information was gathered by interviews with some of the people involved in the product development process at Indexator. Totally eight employed were interviewed, four from engineering design, two from management, one from marketing and one from production planning.

4 Results

A chart of the product development process was plotted, according to figure 2, using the information gathered by the interviews. The identified development process was then compared with Indexators official process.

4.1 Product development processes

The result from the comparison was that the similarities between the two processes were remarkable great. One of the reasons to this might be that Indexator is a rather small company, and the people interviewed have a good picture of the process.

4.2 Theory and methodology

The product development process at Indexator AB is not based on any recognised theory or methodology. The company has however started to examine different methodologies to find what suits them best, both in the terms of design and of manufacturing.

They are investigating the work of Ulrich & Eppinger [5] and Ullman [6], regarding the product development process. Also the theories of better product structuring is one important subject for the company, such as Modular Function Deployment [7]. The work seems to fit the products of Indexator perfectly, and the structuring has already started.

The product development group, which is like a spider on the web in the product development process, does not use any guiding tools in their decisions. Their decisions are based on their gathered experience and common sense.

4.3 Computer support at Indexator AB

The information extraction from the interviews gave a clear picture of the use of computer tools within Indexator. The focus was set on the engineering and manufacturing departments.

Indexator is using advanced computer aided tools in the product development process, which is unusual for a company of this size. Almost all of the information exchanged in the development process is transferred in digital formats.

4.3.1 The administration organisation

The administration organisation that is mentioned briefly in this study is using a product data management system, PDM, called Movex [8]. Movex includes, for example, tools for order, purchase, shipping and customer registration. All of the company's functions are not integrated with the PDM-system. This makes, for example, that a product design change is not automatically implemented in the system.

4.3.2 Brochures and manuals

The department that produces brochures and manuals for the products uses a desktop publishing program called PageMaker [9]. Product information is collected from the engineering department that also supplies them with pictures extracted from the mechanical computer aided engineering system, MCAE.

4.3.3 The engineering department

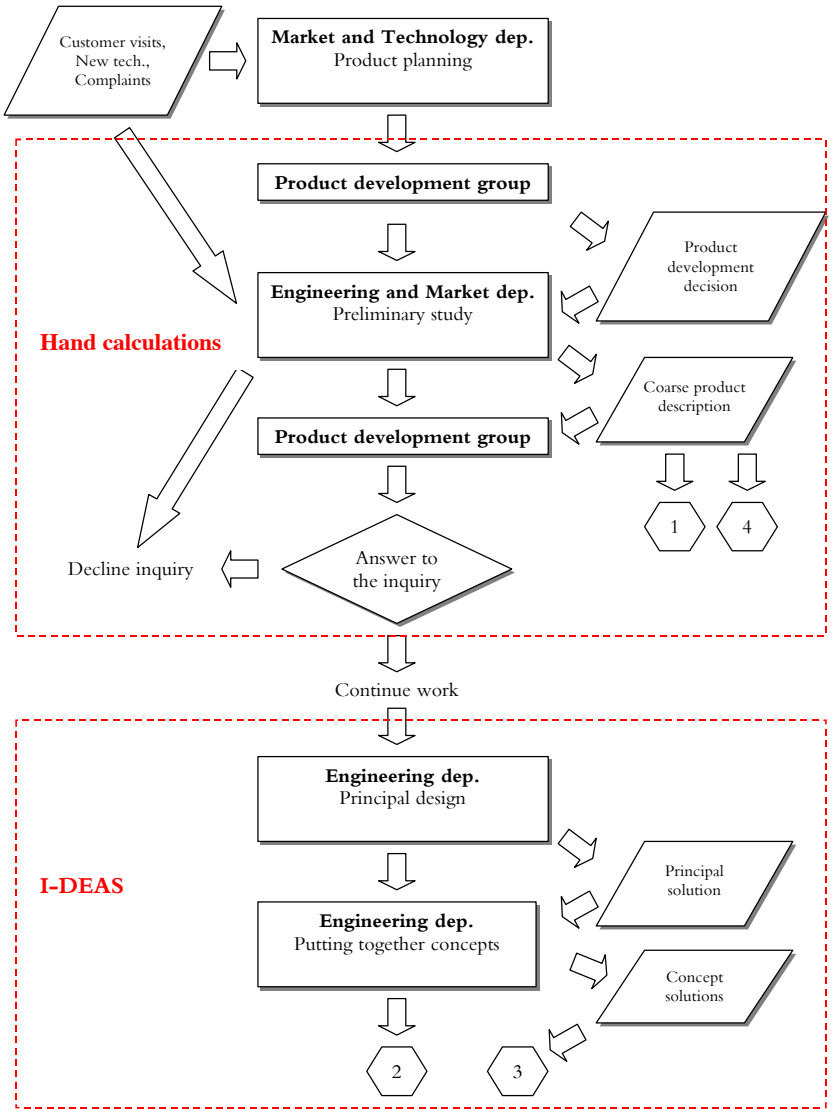
Indexator started to use the 3D-solid modelling MCAE-system I-DEAS [10] within the engineering department for about three years ago. The change from 2D-drawings to 3D-modelling has then been implemented stepwise. Rototilt is today the only product that is totally modelled solids. When the Rototilt development project started, solid models were used from the beginning. When new series of Rotators are being developed, these will also be modelled.

There are a number of application modules to I-DEAS. Many of these are simulation tools, such as tools for kinetic analysis, finite element analysis and production simulation. With external solvers it is also

possible to calculate dynamic behaviour and non-linear finite element analysis. Indexator invested in the linear finite element extension and have used it for approximately six months, it is discussed more thorough in chapter 4.4.

4.3.4 The production department

To start manufacturing of a new product, the manufacturing department receives product information from the engineering department. This information is extracted on DXF format because the manufacturing department uses AutoCAD [11]. With AutoCAD they produce production sequences for the NC-machines. This is then exported into the FMS–system together with the fixture information and production plans.



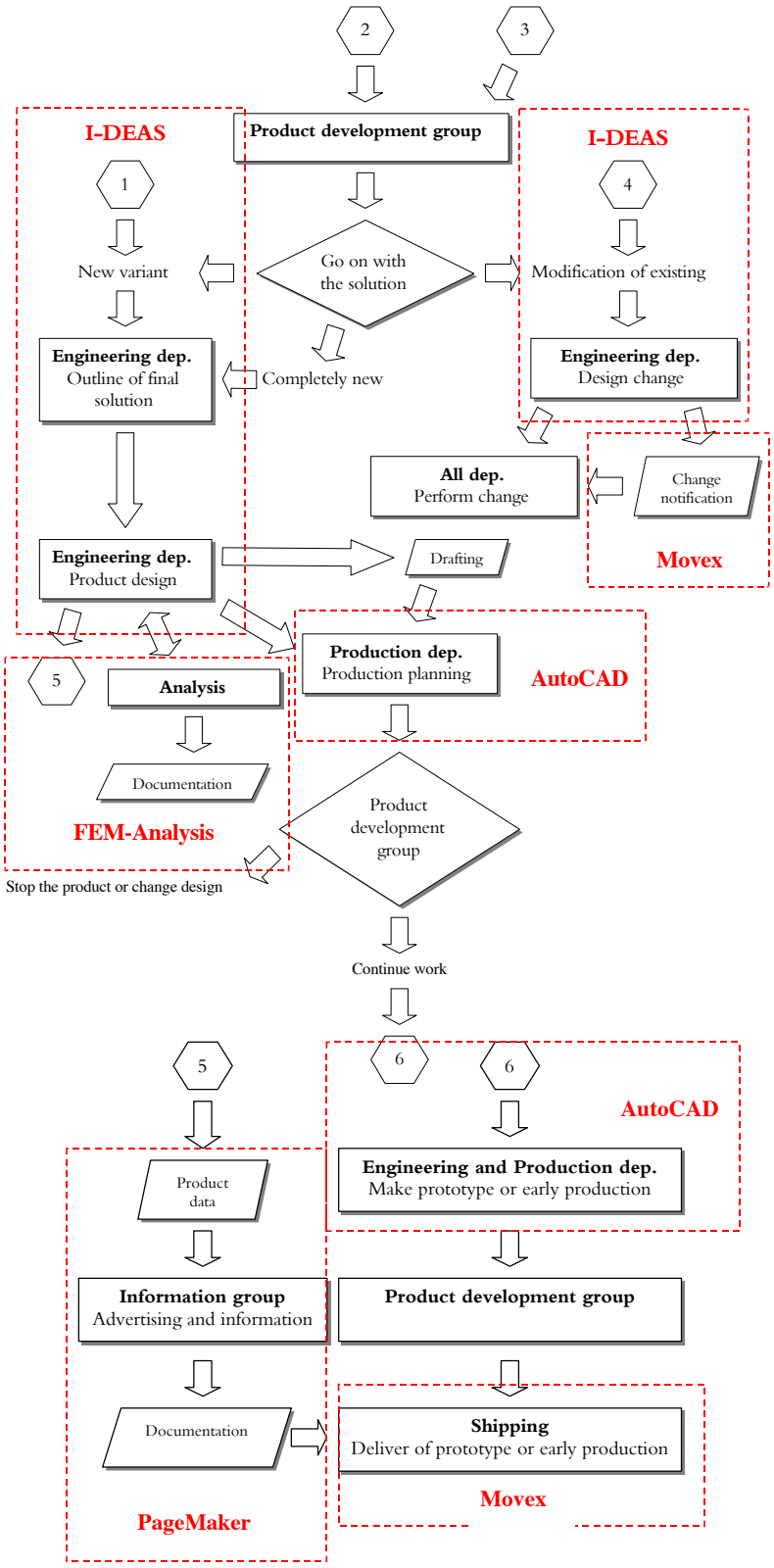


Figure 2. Information flow and computational support within the product development process at Indexator AB.

4.4 The finite element extension to I-DEAS

Six months ago Indexator invested in the application module that makes it possible to perform finite element analysis within I-DEAS. It did not take long time before they had recover the cost for the application. Instead of paying much money and wait for weeks on an analysis done by a consult, they could now perform it themselves in a rather short time.

It was a great advantage that the application saved money and speeded up the development process. But the greatest advantage was that the engineers became more aware of the product weaknesses and strengths. For example, optimisation of the material thickness can be done earlier in the development process. Drawings are therefore more accurate when they are sent away for casting. The lead-time for casting and test afterwards is about two months. One iteration less therefore decreases the lead-time by two months.

5 Conclusions

Most of the interviewed people work in the engineering department. Conclusions and results from only this department can therefore be drawn with enough accuracy to be presented in this report.

5.1 Identified problems

The information that the engineering department produces is the foundation for the work in many departments. Only the engineers have the knowledge and possibility to deliver this information, due to that it is somewhat unstructured and difficult to extract. The burden to extract the information tends to be big. Here are two examples:

- Delivering of product information for the text in the manuals and advertising material. They also deliver views and pictures from the MCAE-system.

- The engineers have to extract and convert the product models in DXF-format, that AutoCAD can read, for the manufacturing department.

5.2 Solving problems

Decreasing the workload on the engineering department, and thereby giving them more time to develop new and improve existing products, is an important matter for the company in the long run. Here are two possible examples mentioned in the previous chapter:

- The problem with delivering information to the manuals and advertising material can be solved by giving the public relations department the possible to extract pictures and views from the MCAE-system. An external VRML-viewer can be an easy and cheap solution. By attaching a text file containing product specification the manual can be created with a minimum help from the engineers.

- Indexator is examining the "Generative Machining" application to I-DEAS that can solve the problem with exporting product information to the manufacturing department. The application makes it possible to generate NC-code within the MCAE-system and thereby avoiding going through DXF-files. But the process can also be improved by letting the manufacturing department extract DXF-files themselves, and thereby ease the burden on the engineering department.

6 Results

The case study shows that Indexator uses advanced computer tools within the product development process. But lack of integration between the different computer tools leads to unnecessary regeneration of the product information in the different parts of the development process.

This product information is not connected and distributed over the different departments that are involved in the development process. Indexator is trying to connect and reuse the same information in different departments. One possibility is the "Generative Machining" application, which Indexator is examining.

Indexator is "on top of the situation" and they are investigating several possible ways to improve both the product development process and the products.

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