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Some Case Studies on Product Life Cycle Management Applied In Engineering Industries

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Abstract: This paper investigates the improvements in business process in some engineering industries after applying the Product life cycle management (PLM) system. In addition to this the prospective trend is also analysed. Some case studies are used to perceive the transformation in business. Case studies indicate a robust association between application of PLM and business process growth. This is recognized as apparent gain for their use in engineering industries

Keywords: PLM, business process, case studies, engineering industries.

I. INTRODUCTION

Product Lifecycle Management (PLM) comprises concepts to manage products and integrate all according product data over their entire lifespan from inception to disposal. Currently a wide range of stakeholders with consumers, shareholders and public bodies are demanding that companies tackle product management through all life cycle in a more inclusive and sustainable method. Nevertheless, even if a company actually desires to explore its processes for improving the way to account for project management, it will face germane difficulties to deal with diverse strategy, tools and methods currently addressing the subject from a range of points of view. A Product Lifecycle Management System (PLM System) is a software system that enables and supports Product Lifecycle Management by integrating data and meta-data from systems involved in all life phases of a product, and, based on this, provide higher-level functionality[1][2][3]. PLM systems includes; Team Centre (Siemens), Wind-chill (Parametric Technology Corporation), Oracle Agile Engineering (Oracle) , SAP PLM (SAP) etc. Product Lifecycle Management (PLM) systems. Earlier engineers had documented things they want to deal with the escalating volumes of design data produced by, and controlled in, a range of automated and semi automated systems, such as Computer Aided Design (CAD) files, specifications and requirement documents, Computer Aided Manufacture (CAM) programs, and Computer Aided Engineering (CAE) analysis. Products Data Management (PDM) allowed them to store and controls all product data, manage document issue levels, maintain Bill of Materials (BOM) and instantly visualize the association between parts and assemblies [4][5]. However, being able to handle the data alone was not enough. There was the clear need to manage the entire product lifecycle, of which product development is just a part. According to reference [6] a product lifecycle can be divided into 5 stages: imagine, define, realize, use/support and withdraw. The first three stages are part of product development but engineers needed a more all-inclusive system to prop up both product development and the full product lifecycle [7].The change in management, document management, workflow management and project management as PLM systems that support concurrent engineering and streamlined product development processes[8]. PLM seeks to enlarge the accomplishment of PDM beyond design and manufacturing into other areas like promotion, sales and after sales service, and at the same time addresses all the stakeholders of the product throughout its lifecycle[9][10].

The intricacy of the industry makes this development a considerable accomplishment. The aerospace products have long lead times and they are frequently in place for quite a few years. It means that, when a business gets a agreement, it will time and again be developing that product for several years[11][12]. Business contest require aerospace firms to illustrate high production efficiency past on time deliveries and also engineering throughput to pre-calculate the product and approximation time and costs in order to get a new business. Though, with recent market growth, engineers have often found themselves too hectic with the day-to-day actions, so that it has been complicated to take utmost benefit from market chance. Making use of more staff could be a answer, but the industry has been facing a workforce and skills scarcity [13]. Therefore, one potential solution is to increase engineering capacities by improving production processes. The claims that business processes can also be improved by deploying new Information Technology systems. This paper explores the development in business process in some two engineering industries after applying the Product life cycle management (PLM) system. In addition to this the prospective trend is also analysed. Case studies point towards a strong association between application of PLM and business process development.

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II. METHODOLOGY

The Foundry industry is known as an industry with rigid processes difficult to be improved. One of the core processes Of that industry is new product introduction, which aims to design, engineer and manufacture a new product. This paper aspire to respond three research questions: What is the existing new product development method in the foundry industry? What parts could be improved to pace up the new product development process? How can information technology help process development? The two methods used are as follows:

A. Research Method

Research Method indicates that qualitative and inductive research can be done in dissimilar ways surrounding case studies, grounded theory .The agreement that case studies are probable to be used as part of an inductive research advance [14]. It can be defined that case study research as a "detailed investigate of one or more organizations, or groups within organizations, with a view to provided that an analysis of the circumstance and processes involved in the phenomenon under study". The research method employed here is based on an in depth case study research of new product development process improvement. The assessment of results was done comparing the responds of the interview and the clarifications made by the author. This was analyzed in combination with the conclusion of an widespread literature review, allowing experimental generalizations and a string of apparent report to be developed

B. Data Gathering Technique

There are several customs to accumulate qualitative data that have a case study research centre of attention. Examples include questionnaires, interviews and observation [15] [16]. After vigilantly analyzing data collection methods, interviews and observation were noticed as the most appropriate approaches for data gathering due to the occasion of the author to go to the company every day.40 people were identified as being potential sources of information for this research. The first lot of interviews involved 20 of the 40, and the main purpose was to record the modern development process and computer systems used to support the process. They involved people from all levels in the company. The second batch of interviews which involved another 20 of the 40 people identified, meant to gather and analyze problems related to present new product introduction processes and procedures. Figure 1 demonstrate the procedure used for the second lot of interviews: For this second lot, 'the appropriate subjects' were estimated to be people who had a complete information of the business, and who would be in a situation to categorize the exertion the organization has to introduce new products. It proposes that topic must be in a situation to generalize about business performance. Merely employees at the level of manager or higher cadre were considered for contribution in the study.

Figure 1. Second batch of interview and analysis process

Every responses from both lots of interviews were acknowledged in detail. In addition, based on observation was also documented by the authors, which helped the research by stressing facts that were not get together in the interviews.

III.CASE STUDIES

A. Engineering Industry Case Study

The company case study has more than one strategic business unit or branch. According to its saying, it is considered as a cluster of companies with dissection. The branch employs around 190 people in Bengaluru. This foundry group is considered the manufacturer of non ferrous castings with world- wide export. At present, the foundry is accredited by a number of recognized institutions. It has got ISO 9001:2000.accredition. It has Marketing Purchase, HRD, NPD, Design, R&D, Chemistry lab Melting, Pouring, Fettling, Machine shop, Heat treatment, and Inspection facility.

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B. Present New Product Development Method

The extent of the research was the new product growth process. Nevertheless, since the manufacturing process depends on the component that is being developed, the foremost centre of attention was on the upstream process before introduction a product part to the shop floor. Consequently, it drawn in the client, design, and manufacturing stages, surrounding techniques, quality, purchasing, production planning and the administrative tasks on the shop floor. A file of computer systems was documented and the process was presented using a workflow diagram. The list of computer systems which sometimes hold important business information. Table 1 summary how many actions were allocated to each company area .Despite having a total of 89 activities in the shorter path, the process can have an overall shorter path of 2 activities and one decision if the designers realize it is a product that the company cannot design. Therefore, there is not much significance in the total of activities, because a process can have multiple paths.

TABLE I NEW PRODUCT DEVELOPMENT PROCESS SUMMARY

Business domain	No of activities in the longer path	No of activities in the shorter path	No of decisions
Customer	**5**	**5**	**3**
Design	**34**	**21**	**16**
Methods	**33**	**19**	**8**
Quality	**13**	**13**	**1**
Purchasing	**7**	**5**	**5**
Production Planning	**12**	**8**	**1**
Shop Floor	**19**	**18**	**2**

C. Areas for development

The issue of the second lot of interviews was devised to get the right information to load in a table parallel to table 2. For each setback that an interviewee mentioned, a metric had to be found to gauge the setback and recognize what would be the basis of how it could be enhanced. Finally 13 interviews, 88 issues on processes were established. For each problem, the authors had proposed one way of development and for each development had one or more benefit which totalled 131.

TABLE II BENEFIT TABLE

Interviewee	setback or requisite	Metric	projected development	projected promote
Person's name Job title	**Description of a mentioned crisis**	**A metric that measures The problem**	**A possible way to improve the problem**	**A list of benefits if the proposed improvement was implemented**

Most of the issues were related to finding information which seems to be a general issue within foundries the criterion used in to make the list of genuine and agreed question were if it has been mentioned by three or more interviewees. More than 20 were considered settled issues and a additional detailed analysis was performed on them. Firstly, an association analysis was completed to find out the connection between the issues and three vital areas of development that were found: data capture and reuse, communication and teamwork and finally product and process management and visibility.

1) Data Capture and Re-use

One issue usually mentioned during the interviews was how much disruption key staff members have during a day. The design manager, for instance, estimates that his department is intermittent for 40% of the normal day of work; and the Production engineering manager estimates a 30% disturbance. This means that there are a high number of non-value-added activities manipulate their delivery of value-added activity. The cause that they were broken up was because of their information of either the business or the products. Information, expertise, experience is often just in employee's heads, and not properly recorded or documented. Erstwhile company information was also hidden contained by documents, emails and stretch across dozens of material cabinets. This abandoned situation included 80% unstructured data and related decisions, based on 20% of the available facts. With all that accumulated knowledge there is a clear need to effectively document this data and make it handy to erstwhile. The deployment of a Product Life-cycle Management (PLM) system facilitates to have a single basis of product and process information. Therefore, data can be stored in an clear way, available by the related people which should result in a decrease in day-today disruptions. Table 3 shows a summary analysis of data capture and re-use.

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TABLE II DATA CAPTURE AND RE-USE OUTLINE

Proposals	**Single, central source of product and process information** **- Design Automation utilising Templates** **- Consistent Tools and Methods across Engineering**
Impact on Output	**Automated creation of best-practice deliverables** **- Faster Reaction to change**
Impact on Dealing Risk	**- Knowledge management** **- Efficient backup and disaster recovery**
Impact on Knowledge reuse	**Capture agreed best practice approaches (Always one way to perform the process)** **- Ongoing review and development of best Practices**
Vital benefits	**Reduced Business Risk** **- Increased Engineering Capacity** **- Improved Knowledge Re-Use**

2) Communication and teamwork

Usually, the growth of a new foundry product requires a lot of attempt to manufacture the accurate and precise information to flow from upstream processes to deliverables [17]. Figure 2 provides an instance of some vital data that are in general shaped in the new product development process.

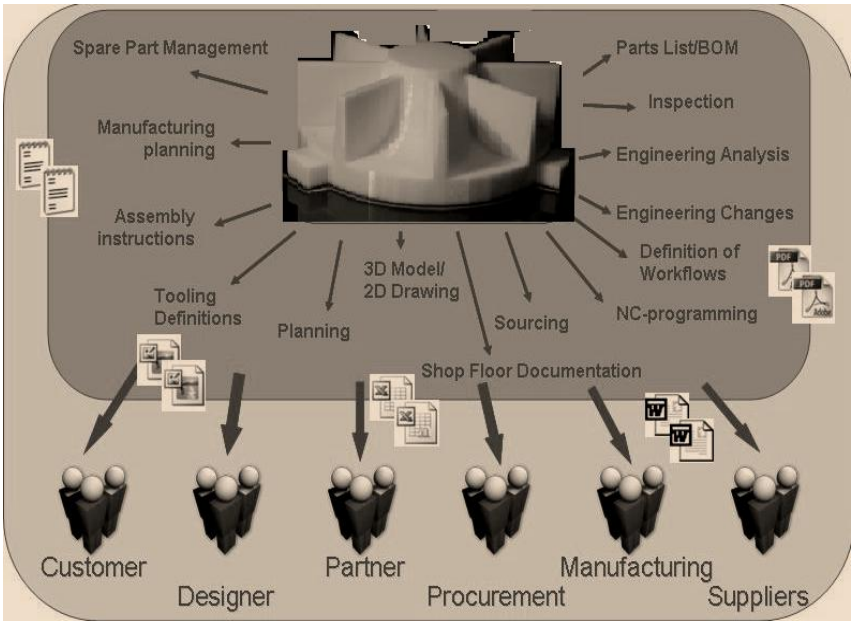

Figure 2. Data produced in the new product development process

With this quantity of information, even with correct computer systems to hold and bear the process, communication has a major consequence on process efficiency and product superiority. Having a solitary basis of information assists, but what is most vital for both communication and teamwork is a way to manage digitally the new product development process and actions .Table 4 summarizes the findings related to communication and teamwork.

TABLE III COMMUNICATION AND TEAMWORK. OUTLINE

Proposals	**Single, central source of information** **- Aligned Tools and Methods across Departments** **- Workflow Managed Processes**
Output	**Streamlined communication between departments** **- Concurrent working processes**
Dealing Risk	**- Effective handover between departments** **- Improved consistency of methods**

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Knowledge reuse	**Multi-disciplinary Involvement - Wider access to product information**
Vital benefits	**Reduced Product Development Lea Time - Improved Collaboration with Customers, Suppliers and Partners**

3) Product and practice Management and Visibility

An instance of how complicated it is to get artefact and process visibility and data consistency in the foundry is the quantity of vital statistics that can recognize a artefact. Works order quantity, part number, assembly number, change numbers, customer number, are diagram of this composite question. Tracking a lot number, a raw material reference number and a supplier number via a traceability system is often a composite and incompetent job .Information Systems have been under-utilized in manufacturing companies, which has an effect on finding related information about product development. In this case study, it was established that an casual scheme sketch was developed and immediately a few participants of the team knew its inside. In addition, the company was not capturing process performance information through process metrics, and even with some events documented, staffs were not following them nor did they know of their existence in some instances.. Table 4 below summarizes the Product and Process Management and Visibility findings and . Things to see that a project planning tool, integrated with a workflow management tool, aid to impose processes and give visibility to product progress.

TABLE IV PRODUCT AND PRACTICE MANAGEMENT AND VISIBILITY OUTLINE

Proposals	**- Project Planning - Ongoing capture of business metrics - Process Enforcement**
Output	**- Increased visibility of project status - Improved Resource efficiency Measurement**
Dealing Risk	**- Clear and agreed project prioritisation - Missed milestone alerting**
Knowledge reuse	**Provision of KPIs to enable to focus Business Improvement. - Early indication of processes bottlenecks**
Vital benefits	**Support Business Process Improvement - Improve Capacity to deal with increased workload**

IV. CONCLUSION

In termination, the in-depth case study research supports the view that PLM systems have a sturdy association with business process development. The development was apparent in organization everyday jobs as well as technical actions used by all departments and functions scoped in this research. Results powerfully propose that PLM systems adoption has a positive impact on business processes within manufacturing. Within the company case study, a new business culture is being introduced based on findings have previously documented. In easy conditions, the novel mores is base on doing things in the accurate manner, first time around - "there are many ways to do tasks but only the company way can be used".

The research found that the functioning of a new workflow management system could support and enable the introduction of this new culture. The questionnaire, interviews and observations that were at the heart of this learn confirmed that improvements were to be delivered in the case study by planned PLM systems implementation in a number of areas, including Knowledge capture and reuse Communication and teamwork Product and practice management and visibility .Consequently, capturing the information of both engineers and shop floor staff has become an vital task and the research showed that by having a workflow management system integrated with a single central source of product information will help to alleviate the problem.

Market pressures are forcing companies to get better their efficiency and in particular the effectiveness to develop new products The study concluded that the usage of pattern and captivating on of industry best practice, specially on design, methods and quality, would hustle up the overall process in blend with development of appropriate PLM systems.. Overall, a superior thoughtful of the role of PLM systems in industry was achieved showing that PLM will allow an engineering and manufacturing based company to be more competitive in today's market. The use of PLM systems is one way to achieve process improvement and the integration between them accelerates time to market, reduces the risk associated with human error, thereby improving new product development quality.

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