PRODUCT LIFECYCLE MANAGEMENT. AN OVERVIEW ON CONCEPT AND ITS IMPLEMENTATION

Alexandru-Viorel PELE

Oradea University, FIMT, apele@uoradea.ro

Abstract: Adopting a PLM system in an organization may be a difficult task if the concepts and ways of implementation are confused. In this paper some frequent aspects of this process are discussed and some examples are presented.

1. CONCEPT DEFINITIONS

There are a lot of definitions proposed for activities under PLM acronym. They come from different actors of economical, business, IT, research or educational environments. Starting from first formulation, the concept had an increasing complexity and today on agrees, in a very large way, that *"Product Lifecycle Management is all about controlling how people work together to develop ideas or customer requests into finished products or services"* [3]*.*

As in the above definition, the PLM processes are tightly linked with the hybrid or *extended product* which, according to Thoben et al. (2001) includes *tangible entities* (materials, manufacturing shell) and as well *intangible assets* (services). If on considers also manufacturing modularization and its horizontal integration, globalization and environmental, safety and reliability legal regulations, enterprises are vital interested to an optimal management of lifecycle costs via PLM systems [4].

PLM concept had a dynamic evolution in a relatively short time period. Some important milestones were: PERT system (1962), projects management new techniques (1965), production and supplies planning systems (1970), computer aided design (1985), flexible manufacturing systems (1988) and computer integrated manufacturing (1990).

Since 2002, when the PLM concept appeared in a modern statement, different approaches were suggested:
- *PLM as a set of capabilities* (that allows to an enterprise effectively and efficiently innovate products and services related to the business life cycle www.wikipedia.com);
- *PLM as a business* (objectives are to increase benefits, reducing production cost, maximizing the value of product range, John Stark,www.johnstark.com);
- *PLM more than a software package* (a strategic business way, integrating people, processes, software and information technology, www.cimdata.com);
- *PLM without a general consensus* (according different software vendors the concept is too vague and very difficult to be defined, Purdue University, www.tech.purdue.edu).

If summarize, PLM is an integrated business approach, based on information, made up of people, processes, practices and technology, covering all aspects of the lifecycle of product, from idea, design, production, use, maintenance, removal and recycling, in order to increase efficiency and business productivity. How an organization or enterprise succeeds attempting to implement the system depends on many internal factors and may be a heavy task.

2. IMPLEMENTATION

For an enterprise, adoption of a PLM system supposes a considerable list of implementation challenges and concerns. Expected benefits aimed projects, products and processes, but also the people. The major changes must be very well specified and categorized in order to be managed and achieved an accepted return of investment.

The expectations of companies looking to implement PLM may be focused in areas of business and financial performance related to time reduction of project overrun, change management and all aspects of quality improvement.

However the new system will interact with existing organization structure like ERP (Enterprise Resources Planning), CRM (Costumers Relations Management), SCM (Suppliers Chain Management) and with all organizational departments.

Relationship between PLM and ERP may be approached in terms of product development costs. The expenses incurred in design phase are relatively small compared with those who will follow in the manufacturing processes. Instead, at this early stage are planned the all costs incurred in the process of production, representing 85% of product cost. In other words, with PLM constitutes (CAD, CAM, CAE, robot programming, manufacturing lines programming, PDM, etc.) and 85% of product cost is managed, and with ERP / CRM / SCM on controls 15% of total product cost.

Implement and sustain a successful PLM solution involves a few steps phase demarche (www.gerbertechnology.com):
- *discovering* – underlines the requirements of business objectives, processes, users, documents, training, budgets etc.;
- *designing* - a project plan of solutions once the business teams have defined goals, expectations, budget, timelines and the requirements; a comprehensive and specific project plan is developed which maps out how to achieve the required results;
- *developing* - the PLM application and its components are developed, built, configured and installed based on the requirements defined in the Design phase;
- *deploying* - tests and validates the application with a pilot group.

A more elaborated PLM matrix to be used in companies wishing to improve any aspect of their own PLM process is proposed by Society of Manufacturing Engineers (http://www.sme.org). The matrix defines the process steps associated with a product from concept through design, production and obsolescence as they pertain to small, medium and large companies.

Moving from a system to another, it is necessary to overcome challenges and concerns. Some PLM implementation challenges can be categorized as below:
- *decision and vision document* – methodology, steps, checkpoints, negotiated by main forces in a company involved into the process of PLM decision making: executive management, IT department, engineering/R&D management etc.
- *people support for change* – how to convince employers to cooperate in current and new systems, to be ready for change, enthusiastic to learn how to use new procedures;
- *software selection* - before making a decision on buying software, a clear understanding is needed of the infrastructure requirements;
- *management of implementation* - define a clear PLM roadmap, prioritization and customizations of components etc.

The conclusion of above considerations is PLM needs to think about how to make an enterprise transformation to get out of concerns and to pass challenges.

3. SOFTWARE PLATFORMS

A specific PLM software system requirement refers centralized product data information, process specific tools, global and particular standards or procedures. Current PLM applications work through a web-based interface that allows all parties involved in design and manufacturing, marketing and deployment and others, to work on the same platform and communicate and share data on a real-time and collaborative ways. Choosing a vendor from hundreds offers become a very analytical tasks, following specific software evaluations methods.

In historical sense, the software solutions have watched the last stages of developing the concept product lifecycle management, initially aimed to increase productivity of individual skills of participants in the design/development processes. After 1990, on has developed integrated solutions that embed CIM manufacturing, software products like CAE, CAD, CAM, CAP, CAQ, etc., have switched from individual productivity to team productivity.

The next step was the concept of "Faster to market", focused on data and processes management, the integration of product development teams and the globalization of the productive process. The year 2006 brought a significant change in the PLM, software development, moving from purely managerial approach to business and market. The main objective of the PLM concept has became the profitability, in compliance with aspects of design, technology, manufacturing, and environmental legislation.

PLM solutions incorporate product data management (PDM) functionality and allow support to create, communicate, and store knowledge for effective collaboration. More than that, today PLM software applications offer functionality for product innovation, product development, portfolio management, manufacturing process management, service data, regulatory and compliance criteria.

First two categories of platforms divide the solutions for *process* or *discrete* enterprises. Process industry companies are interested to reduced time to market, gains in engineering productivity, increased revenue, increased reuse, reduction of redesign activity in the discrete industries. In addition, process companies require a standard process specification in order to create consistent product worldwide.

The needs of discrete companies may concern Computer Aided Design (CAD), configuration management, parts and product structures and more. The keyword for discrete enterprises is to integrate new system with existing structure and may be from SME to large manufacturing companies.

After the requirements and most important features are gathered in a PLM vision document, the different solutions coming from various vendors must be evaluated and scored. There are some software products evaluation methods as suggested at *Centre for Software Engineering* (http://www.cse.dcu.ie). An useful matrix developed to offer a list of the process steps associated with a product, from concept through design, production and launch as they pertain to small, medium and large companies is proposed by *Society of Manufacturing Engineers* (www.sme.org).

Buying software licenses, leasing and hosting are ways to acquire a PLM system from many *software as a service* producers: UGS, Dassault, Enovia, PTC, SAP, eMatrix and so on. A more and more interesting alternative is to adopt *free or open source solutions*, like Aras Innovator.

As a conclusion, choosing a right PLM software solution may be critical and complex task to enterprises. It is recommended also to consult some external points of view to evaluate and select the best enterprise software solutions (e.g. www.technologyevaluation.com).

4. COLLABORATIVE TEAMWORK

Human element is essential in migration to a PLM system in an organization. By creating new system in which the people depends on change, they are exposed to very long adoption cycle, expensive marketing and complicated implementations. As named "people PLM", they should be open to use new concepts in collaborative environment.

Forming a teamwork involve to gather the knowledge and capabilities in a map and also to use different techniques to verify members compatibilities.

Collaborative work environment should ensure a rapid establishment of a dedicated group of professionals to carry out a project. For that it must be through three steps:
- creating *ontology* - a list of specific terms and knowledge to facilitate collaboration among geographically dispersed individuals and different cultures ();
- *creation of knowledge map* - collect information on the skills and expertise of each member of the partner teams;
- *selecting the best design teams* - development of algorithms for focused on specific objectives.

Creating a detailed knowledge map with a determined hierarchy of a network generates premises for automatic search methods. However, the question of the composition of a group dedicated to a project based on specific skills coming from a network teams is a combinatorial problem that may have a huge amount of possible solutions. In this situation it is suitable to use data mining and artificial intelligence methods and algorithms, and as proposed in [1].

5. CONCLUSIONS

PLM is an integrated business approach, based on information, made up of people, processes, practices and technology, covering all aspects of the lifecycle of product, from idea, design, production, use, maintenance, removal and recycling, in order to increase efficiency and business productivity

Implementing a PLM system needs to think about how to make an enterprise transformation to get out of concerns and to pass challenges.

Choosing a right PLM software solution may be critical and complex task to enterprises. It is recommended also to consult some external points of view to evaluate and select the best enterprise software solutions.

Human element is essential in migration to a PLM system in an organization. Forming a teamwork involve to gather the knowledge and capabilities in a map and also to use different techniques to verify members compatibilities.

References:
1. **CEEX 243/2006,** *Reţea naţională de cercetare în domeniul ingineriei integrate a produselor şi proceselor,* **Raport final, 2008.**
2. **Alain Bernard, Serge Tichkiewitch,** *Methods and Tools for Effective Knowledge Life-Cycle-Management*, **Springer-Verlag, ISBN: 1-85233-810-5, Berlin Heidelberg, 2010.**
3. *****,** **www.datastay.com, 2011.**
4. **Julius D. Golovatchev, Oliver Budde,** *Next Generation PLM - an integrated approach for the Product Lifecycle Management*, **Proceedings of ICCPR2007:International Conference on Comprehensive Product Realization 2007, , Beijing, China, June 18-20, 2007.**