Computers in Industry 59 (2008) 833–841

Contents lists available at ScienceDirect

Computers in Industry

journal homepage: www.elsevier.com/locate/compind

Key performance indicators for PLM benefits evaluation: The Alcatel Alenia Space case study

Marco Alemanni [a], Grimaldi Alessia [a], Stefano Tornincasa [b], Enrico Vezzetti [b,*]

[a] Alcatel Alenia Space, Italy
[b] Politecnico di Torino, Italy

ARTICLE INFO

Article history:
Received 4 February 2007
Received in revised form 25 March 2008
Accepted 23 June 2008
Available online 31 July 2008

Keywords:
Product lifecycle management
Product development management
Extended enterprise
One-of-a-kind company
Collaborative management

ABSTRACT

From a theoretical point of view, people are used to think that the adoption of innovative business solutions, for optimizing the product lifecycle, should always guarantee a sufficient return on the investment (ROI), even if the concrete benefits that the investment has given to the company are sometimes difficult to evaluate. Looking at the technical literature it is possible to find a lot of ROI's estimation metrics for the evaluation of business strategies, even if after the analysis of the theoretical concepts no one faces with a real implementation of the methodology proposed.

This paper proposes a solution, based on the key performance indicator (KPI) method, for evaluating the benefits introduced by the adoption of a Product Lifecycle Management (PLM) tool in a one of a kind company. The methods have been validated with its implementation into an Aerospace and Defence company (Alcatel Alenia Space), highlighting the improvement created by the implementation of the PLM solution in the everyday activities and showing the system's contribution for some key-process as configuration, change and documentation.

1. Introduction

The Product Lifecycle Management (PLM) [1,2] strategy is a solution addressing many components for managing product data. It in fact involves products, organizational structure, working methods, processes, people and information system, integrating them altogether to obtain the best results. Starting from the product and its components the PLM strategy implementation focuses its attention on the analysis of the actors involved in the "extended enterprise" that will develop and support the product throughout its lifecycle. They could include contractors, suppliers, partners and especially customers. All of them have probably different business architecture and organization structures and need to be integrated creating one well-organized structure around the product, especially because of the strong integration that exists with the customer. In this scenario, PLM could provide a great benefit to the enterprise, managing in a structured and organized way, all types of knowledge through the identification and integration of different information systems, enabling the support of all the product concerning activities [3]. There are many types of systems doing this job as CAD (computer aided design), CAM (computer aided manufacturing), NC (numerical control), PDM (product data management), virtual reality, customer complaint management systems, part library, change management system and the PLM allows the integration between all of them guaranteeing a correct access to all the information in the format that every actor involved in the product lifecycle needs [4,5].

The implementation of the PLM strategy is a very long-period investment and the benefits are not measurable in the short period because of the long activities of introduction of improving working condition, the optimization of the workflow, the changing of the labour habits of the employees, their resistances to these changes, and the implementation of the PDM tool.

Another aspect that increases the complexity in the evaluation of the benefits given by the PLM introduction process, is its progressive implementation. In fact in the first phases of its adoption the PLM is only focused on a specific project, while later it will be spread on some other one, up to the point of being involved in all the company's projects.

Anyway the benefits that can occur by the introduction of the PLM can be divided into two categories:

1. *Long-term benefits*, that have got an influence directly on the business area and that can be expressed in terms of the increased gross margin, improved competitive position, reduction of time to market. These benefits that can derive from the

* Corresponding author.
E-mail address: enrico.vezzetti@polito.it (E. Vezzetti).

0166-3615/$ – see front matter © 2008 Elsevier B.V. All rights reserved.
doi:10.1016/j.compind.2008.06.003

increased of: customers numbers, product's quality, purchase frequency can be due by the product structure management improving, by getting product to market faster and more frequently, by developing and delivering product faster, by removing burden overhead and adding more time available for value-adding task. These are visible and measurable only after several years after the introduction of the PLM strategy.

2. *Short-term benefits* that can reduce the amount of time spent for everyday activities, the way of working improving, the rationalization of the processes due to the improvement of the product structure management and the reduction of the overhead activities. These can be visible and measurable looking at the less range periods. As the long-term benefits could be visible only after several years, in the benefits evaluation it is important also to consider other parameters that can show the money time value and the cost reduction in the short term, as the decrease of the product materials numbers, the process energy consumption, the cost for storing information, the cost for document printing, the rework cost, time (as cost) for searching and identifying information, penalty cost for the product delivery delay.

In order to measure and to better understand if a new strategic asset could give significant advantages, it is necessary to implement an evaluation method able to analyse the benefits given by the PLM adoption to the company asset.

Looking at the technical literature, actually, not so many works have been developed on this topic. Some papers have analysed the return of investment given by the adoption of generic IT tools, oriented to data exchange and sharing, discussing about what relation could exist between the IT investment and the firm performances [6,7].

Some others have developed more particular analysis on specific solutions, close to the PLM strategy, as CRM, SCM and ERP, focusing the attention on financial returns [8,9]. Surely many documents have also discussed, with different point of views, about the benefits given by the ERP implementation in different types of companies [10,11]. But few papers have measured the impact or benefits given by the adoption of a PLM strategy. Some documents have been produced by specialized consultants talking about the effect of specific solutions [12] for particular sectors or more specifically in well-defined case studies [13]. But considering the necessity to have a more wide evaluation model disjoined by a specific PLM solution and by a specific industrial sector this paper, focusing the attention on one-of-a-kind company asset, wants to implement an evaluation method able to analyse the enterprise performances trying to synthesize also the implicit operating objectives, such as the minimization of data management costs into a set of measurable variables, in order to give to enterprise management a structured performance feedback. Starting from the first works [14,15] discussing and proposing methodologies for the conceptual design and implementation of measurements to be employed for identifying the short-term production efficiency, that include financial and technological indicators, it is possible to consider these indicators as good parameters for efficiency estimation.

The terms of Balanced Scorecard, that is a metric reporting system and the usage of key performance indicator (KPI) are famous in the literature as the main way to capture and measure the ROI especially for the business and marketing area, but recently it has been used also for the evaluation of IT investment.

The importance of indicators seems to be evident considering the necessity of the enterprise managers to identify relevant information about the company behaviour in order to face with fast and correct decisions starting from a huge amount of data that could be involved in the entire company process.

The choice of the metrics method usage is due to the typology of reduction cost the papers intend to analyse. For instance underlining the costs associated to the project, as the initial cost of the PLM and the on going cost, it is possible to use some financial methods, as the Accounting Rate of Return, the Payback time, the Net Present Value and so on, but if it is necessary to evaluate the reduction cost and the revenue of the business in relation with the usage of PLM, it is necessary to employ metrics.

A performance indicator can be defined as "a variable that quantitatively expresses the effectiveness or efficiency, or both, of a part of or a whole process, or system, against a given norm or target" [16]. Key performance indicator, is a number or value which can be compared against an internal target, or an external target "benchmarking" to give an indication of performance. That value can relate to data collected or calculated from any process or activity [17]. Whether a company could move in an industrial context or in another, in choosing an appropriate range of performance measures, it will be necessary however to balance them, to make sure that one dimension or set of dimensions of performance is not stressed to the detriment of others.

The mix chosen will be different in almost every instance. As first assumption, considering that PLM adoption is a recent phenomenon and that it is continuously on the upgrade, only the induced benefit in the short period will be evaluated instead of the long-period improvements, as reducing of time to market, increasing revenue and clients, increasing product quality, reducing change and cost, etc. that actually cannot be evaluated but that are anyway induced by the short period benefits.

So focusing the attention on the short period benefits, there are short-term measures which have to be continually calculated and reviewed. These measures can represent: business/financial performances, productivity measurement and efficiency indicator about human contribution [18,19]. Performance areas must be measurable, in the form of performance indicators in order for the company to be able to monitor performance and goal realization.

2. Key performance indicators model design for one of a kind company

In order to implement a general KPI model for the PLM impact evaluation, first of all it is necessary to identify a set of significant indicators that could synthesize the company behaviour.

2.1. Key performance indicators selection strategy

Despite PLM is implemented into all product lifecycle management components and covers a lot of functionalities (requirement management, product management, data management, configuration management, change management, asset management, supplier relationship management) this first study has been focused only on two processes: *data and configuration management* [20].

This choice is due to the fact that these processes have been the first involved, in order of time, by the adoption of the PLM because they represent the most critical ones inside the company. For this reason, in order to stress better the complexity of the PLM implementation, it has been decided to start from here the implementation of the strategy in order obtain a more significant information on the return of investment evaluation of the project.

Focusing the attention on a one-of-a-kind company asset the most important expected results given by an innovative strategy adoption, should be found in the data management functions (code assignments, release, distribution and data base registration) which are very expensive in terms of time and complexity, especially for some standards, as AASI, which requires a lot of