A Case Analysis of a Product Lifecycle Information Management Framework for SMEs

Daniel Perez-Gonzalez, Pedro Soto Acosta, & Emilio Placer-Mauri

Abstract

Information management during the product lifecycle has received a great deal of attention over the last few years, mainly because firms work in a complex business environment characterized by information overload, high levels of competitiveness and the acceleration of technological change. In this context, Product Lifecycle Management (PLM) software has been evolving rapidly and, today, powerful tools in the market enable high levels of information to be managed. However, commercial PLM software is mostly oriented towards large-sized firms, which poses a big challenge for small and mid-sized enterprises (SMEs). To address this issue, SMEs can develop their own Product Lifecycle Information Management (PLIM) Frameworks for managing data and information throughout the product lifecycle processes. This article presents a successful example of a PLIM Framework: the case of Pladomin's PLIM Framework.

Keywords: Product Lifecycle Management, information management, internal processes, SMEs

1. Introduction

Changes in the current global economic scenario are inevitable. As a consequence, managing all the information during lifecycle of the product represents a major challenge for small and mid-sized enterprises (SMEs), which must nowadays compete in a global market (Soto-Acosta et al., 2015). The process of managing the whole lifecycle of a product from the inception, through design and manufacturing, until it is disposed of, is referred to as Product Lifecycle Management (PLM). PLM is a new approach for managing information along the product lifecycle that enables firms to reduce products' time-to-market as well as to respond to a growing demand of quality and customization of products. From the point of view of knowledge management, companies may benefit from PLM through fast and easy exchange of documents and expertise, simultaneous dissemination, real-time control, improved communication and accessibility of product-related information. At the same time, PLM is a collaborative platform that can improve information access and sharing inside the company and between the company and its stakeholders.

Although there is a wide offer of PLM software available on the market, the lack of interconnectivity with other enterprise information systems is still a common issue that firms must deal with. Another important challenge has to do with the limited financial resources of SMEs, which limits their access to this costly software (Vezzetti, Violante, & Marcolin, 2014). In addition, adopting commercial PLM software may introduce significant changes in companies'

routines and processes. In this sense, a self-developed PLIM Framework might be a good alternative. Nevertheless, planning and managing the process of change is fundamental for the success of the PLM system. The main objective of this case study is to present an example of a successful implementation of a self-developed PLIM Framework in a SME from the manufacturing industry.

2. Company Background .

Pladomin is a Spanish SME with over 80 employees and an annual turnover of approximately 10.6 million Euros. Initially, the company specialized in manufacturing household products, but in 1980 some of its activities were reoriented to attend to the demands of industrial customers in the telecommunications sector. In 1990, after obtaining the ISO 9002 norm, Pladomin started to collaborate with some of the most important domestic appliance manufacturers, such as Fagor, Bosch, Siemens or Teka, among others. Over the last decade Pladomin has obtained the ISO 9001-200 and the ISO TS16949:200 certifications and made an important push to enter the automotive sector. As a result, Pladomin became one of the main providers of plastic components for well-known automotive brands like Ford, Mercedes, Volkswagen or Volvo.

Pladomin's installations are located in Santander (North of Spain), where it manufactures components in all kind of thermoplastics, using diverse automated injection machines and the most advanced manufacturing techniques (gas assisted injection, biomaterial injection, multi-component injection, etc.). Nowadays, the company manufactures more than 640 tonnes of plastic components per year for a large portfolio of national and international clients, receiving orders from customers located in countries like France, USA, UK, Italy, Germany and China.

3. The Project .

Due to its continuous endeavor and dedication Pladomin has grown over the last 40 years from a small company to a medium-sized company, extending its customer portfolio from small national clients to international customers, including strong multinational groups from the automotive industry. However, in the current business environment there is a growing demand to develop more complex products and, at the same time, to shorten their time to market. In this scenario, excellence in quality, knowledge management and collaboration in product design have become a common demand from Pladomin's customers. As a result, PLM has emerged as a new paradigm for managing information along the product lifecycle that may improve the efficiency of internal processes and collaboration with clients and other stakeholders.

3.1 The Preceding Scenario: Before using PLM

Project management at Pladomin was the responsibility of only one person, who was the project leader. Each project had its own structure and a folder with all the drawings (2-D and 3-D) and related information. Due to this, creating new versions of drawings with alternative solutions was sometimes a problematic task. Pladomin used to work with more than ten

clients at the same time. In these circumstances, managing existing projects is difficult if clients assign the same drawing number or specification to totally different components. As a consequence, the risk of errors is such that it can even lead to a collapse in daily operations. Even though the risk is amplified in the case of large companies, this kind of problem is quite common in the product development process, and it occurred in Pladomin. Accordingly, top management at Pladomin concluded that access to and exchange of product-related information between the different stages of the product lifecycle and between the company and its stakeholders was a serious challenge which could be addressed through PLM.

3.2 Second Step: Analysis of PLM as Commercial Software vs. Internal Procedure

Pladomin had the possibility of choosing between two alternatives: a) to purchase a commercial PLM; or b) to develop a PLIM framework by themselves. Since the adoption of new routines and the cultural change may occur faster in SMEs, implementing PLM should be easier at Pladomin than at larger firms. However, planning and managing the process of change is a key pre-requisite for the success of the PLM. Before deciding whether to purchase a commercial PLM or to develop a PLIM Framework, a detailed analysis of the business model should be conducted (Hachani, Gzara, &Verjus, 2013). To support the decision making process, Pladomin analyzed their previous way of working from the point of view of managing product-related data and information. The analysis was divided into three blocks:

1. - *The use of information and formats.* Pladomin manages a lot of information from different sources and for different purposes. For example, it gathers information automatically from at least eight different software systems of its customers. Sometimes the data format is not compatible and, in this situation, the company must convert data by using an intermediate software or get back to the customer if it does not work. Thus, as a main feature, the new PLM must be able to work with different formats and improve the conversion processes.

2. - *Information consistency.* Pladomin creates and stores information in different data storage formats and paper support. When clients share confidential information, storage becomes a critical issue. In this situation, it is difficult to find an equilibrium between satisfying customers' requests for confidentiality and, at the same time, guarantee the accessibility to information for both the firm and the customers. In fact, one of the main problems that Pladomin must overcome is that sometimes information is unavailable when needed. Based on these identified issues, implementing PLM at Pladomin should be directed towards simplifying the integration among data management systems, which means robust data importation and exportation between systems.

3. - *Information redundancy.* It is very common to find duplicated information, since every new version of a project is independently managed. Information redundancy can create confusion. Accordingly, adopting PLM may enable all the duplicated information to be removed

Having seen the need to implement PLM, Pladomin analyzed the characteristics of the commercial PLM software being offered by Siemens, Oracle, SAP, Autodesk and ZUKEN, among

others. After comparing the different options, the company identified some of the most commonly mentioned advantages of commercial PLM software: enhanced quality of the product; less time to launch the necessary documentation; environmental responsibility (less paper); centralized databases; better internal processes; reduced time-to-market.

In addition, most commercial PLM softwares are advertised as easy to use, install and maintain, but little is known about the connectivity, information sharing with clients or connectivity with Computer Assisted Design (CAD) software. In this case, Pladomin has some relevant constraints: they use CATIA and/or SOLIDWORKS software for 3-D drawings and AUTOCAD for 2-D drawings and, as a consequence, information systems integration is a must. However, they noticed that the integration of PLM with the company's CAD system was an important issue that could not be addressed by using commercial PLM software. Another inconvenience of adopting commercial PLM software was that the minimum implementation cost of the commercial PLM software is around €120,000, with annual costs of around €30,000 approximately. In addition to the cost of the software, the company estimated that it would be necessary to incur around €40,000 in costs for the lack of data integration of commercial PLM software. Developing an internal procedure for PLIM framework may address the data integration problem efficiently without committing too many financial resources.

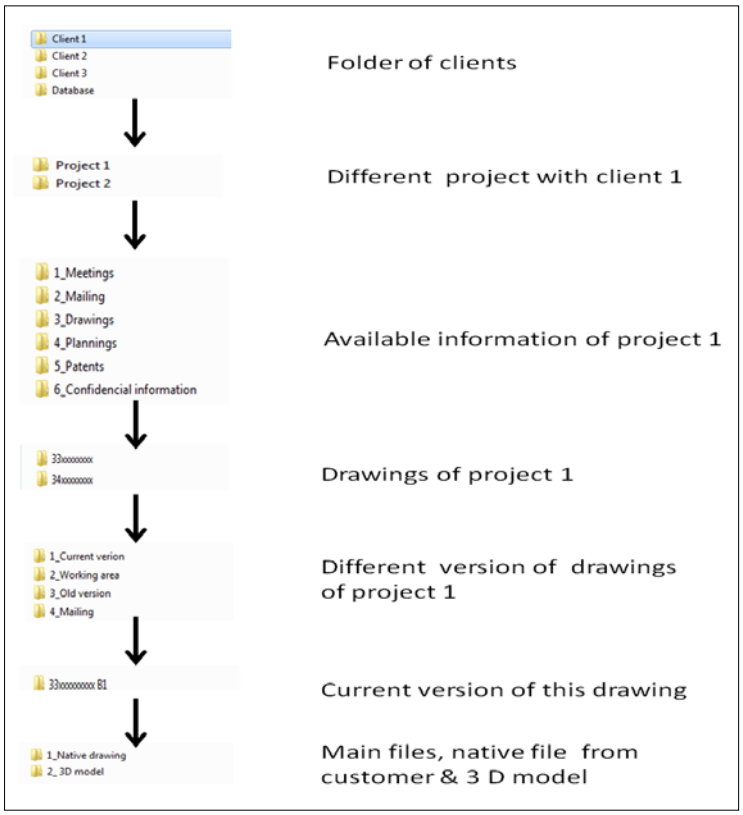
3.3 Current status

Taking into account all the limitations of commercial PLM software, Pladomin decided to define a PLIM framework using their own database. They preferred a self-developed PLIM framework over commercial PLM software for two main reasons: 1) adopting a totally different way of working with new procedures, processes, systems and servers may cause a collapse of the business processes; 2) making an important investment in standard PLM software does not guarantee that the expected benefits will be achieved.

Pladomin's PLIM framework was developed as an intuitive and user friendly tool, following the methodology of the 5 S's which stand for Sort, Set in Order, Shine, Standardize and Sustain. The PLIM framework was established on the basis of a folder structure in order to avoid wasting time and resources during data creation, searching and launching of processes. Each project has a folder and one associated subfolder for the old version (project 1), the current version (project 2) and the version in progress (project 3).

The hierarchy structure of Pladomin's documents is one of the pillars of their PLM approach (see Figure 1). However, the efficiency of the PLIM Framework derives essentially from the precise definition of the procedures, the profound involvement of the managers, employee training and self-discipline. They have been working with this PLIM framework for more than 5 years and during this time, the company has experienced continuous growth, which proves that the PLIM framework is an efficient tool.

Figure 1. Pladomin's PLIM Framework



4. Lessons learned

The lessons learned from the Pladomin case are related to the implementation process of the PLIM Framework and can be divided into two categories: a) the technology of PLM, its main benefits and challenges; and b) the lessons derived from the different steps of the PLIM Framework development.

PLM Technology

In the manufacturing industry, product-related knowledge is one of the most strategic resources of a firm and, therefore, has potential to generate superior firm performance. Aware of how important it is to reduce the time-to-market of products without compromising quality, Pladomin considered the possibility of adopting a PLM. In order to document the adoption decision, they formed a team of Information Technology (IT) experts which was responsible for: a) analyzing the different commercial PLM software available on the market; and b) identifying the main benefits and challenges derived from adopting PLM in SMEs.

Regarding the analysis of commercial PLM software, the first conclusion is that all the commercial PLM software available on the market has more or less the same functionalities. The benefits of PLM are mainly intangible and generally translate into a reduced time-to-market of products. From the knowledge management point of view, companies may benefit from PLM through fast and easy exchange of documents and expertise, simultaneous dissemination, real-time control, improved communication and accessibility of product-related

information. Around 40% of engineer's use of time is linked to information management processes such as information search or information sharing. In this sense, the correct usage of PLM can save at least 50% of this time, which could be used to develop more value-adding tasks.

The second lesson learned is about the limitations of commercial PLM software. Adopting commercial PLM software implies assuming certain limitations from the beginning. For instance, the integration of the PLM with other systems, such as CAD systems, is considered one important challenge. Regarding Pladomin, the company estimated that, in addition to the costs for acquiring the software, it would be necessary to incur around €40,000 in costs for the lack of data integration of commercial PLM software. In this sense, the team of IT experts concluded that, although adopting commercial PLM software may be the easiest way to benefit from PLM advantages, it may not work properly unless additional investments in PLM are made.

Implementation of PLIM Framework

PLM implementation constitutes a complex, multi-level project that must start with a detailed definition of the different business processes that take place during the lifecycle of a product, such as manufacturing, maintenance, service and support (Erdogmus, 2008; Williams & Carver, 2010). Pladomin devoted a large amount of time to defining internal processes and procedures, using a Value Stream Mapping (VSM) methodology to decide which one can remain the same and which needed to be updated. At the same time, they established the requirements that a PLM must accomplish in order to be suitable for their activity. Based on market surveillance, they identified the limitations that commercial PLM software may have and decided to develop a PLIM Framework based on their own database. Along with financial considerations, Pladomin justified this decision based on internal requirements, customer requirements and company strategy: new potential customers, new markets, new processes and new technological requirements.

Furthermore, even when the PLIM Framework is a self-developed tool, some of the business processes must be changed or renewed. In addition, if a commercial PLM software package is implemented in a company for the first time, changing business processes may involve a large amount of effort in terms of resources and time (Vezzetti, Violante, &Marcolin, 2014). In the case of Pladomin, the PLIM Framework was the first system to manage all information related to the product lifecycle. In this sense, the third lesson learned is that when a company adopts PLM for the first time, the implementation process itself becomes a process of change. This is because these changes should occur not only at the IT level but also at a strategic level, a process level, and, more specifically, at the level of the individual skills and capabilities of employees.

The fourth lesson learned from the Pladomin case refers to the role of human resources in PLIM Framework adoption. PLM is an information-driven approach that integrates technology, business processes and people (Grieves, 2010). In this sense, Pladomin acknowledges that employees' involvement was a critical factor for the success of PLIM Framework. In conclusion, PLIM Framework is a multi-level project, which requires personnel commitment.

The adoption of the PLIM Framework at Pladomin improved the information flow within the company and between the company and other external stakeholders participating in product design and development. At the same time, Pladomin managed to improve customer service and maintenance based on accumulated product-related knowledge. Drawing on the Pladomin case, the fifth conclusion is that a PLIM Framework could be seen as a collaborative platform that may respond to a growing demand to access and interchange high levels of information, so enhancing organizational learning.

5. Conclusion

The Pladomin case illustrates the implementation of a self-developed PLIM framework as a new information-driven approach that enables companies to control the whole lifecycle of a product. Based on the findings from this case study, we can draw several conclusions.

Firstly, the case of Pladomin highlights the importance of documenting the election of the PLM. There are many types of PLM software available on the market and they seem to be easy to adopt and use. Resistance to change may be an important challenge that may compromise the effectiveness of the software. PLM implementation failures are due to incompatibly between the selected software and the philosophy of the company. In order to avoid this type of issue, the choice of the PLM solution must be preceded by an extensive analysis of business processes and procedures. Secondly, this practical case shows the crucial role of employees in PLM implementation success. PLIM Framework is a multi-level project that requires employee commitment at all hierarchical levels. In this sense, a high involvement of top management creates an optimal atmosphere for PLIM framework acceptation and usage. Finally, the main conclusion could be that a self-developed PLIM framework may generate the same benefits as a commercial PLM. Even though the standard software may be a good choice for most companies, specific issues such as integration with other systems can question the effectiveness of the PLM system. These findings shed light on the critical factors that affect the success of a self-developed PLIM Framework for SMEs. The authors hope that this case may offer guidelines for SMEs that have implemented PLM or are planning to do so.

References

Erdogmus, H. (2008). Essentials of software process. IEEE Software, 25(4), 4–7.

Grieves, M.W. (2010). Product lifecycle quality (PLQ): a framework within product lifecycle management (PLM) for achieving product quality. *International Journal of Manufacturing Technology and Management, 19*(3/4), 180-190.

Hachani, S., Gzara, L., & Verjus, H. (2013). A service-oriented approach for flexible process support within enterprises: application on PLM systems. *Enterprise Information Systems, 7*(1), 79-99.

Soto-Acosta, P., Popa, S. & Palacios-Marques, D. (2015). E-business, organizational innovation and firm performance in manufacturing SMEs: An empirical study in Spain. *Technological and Economic Development of Economy*. DOI:10.3846/20294913.2015.1074126

Vezzetti, E., Violante, M. G., & Marcolin, F. (2014).A benchmarking framework for product lifecycle management (PLM) maturity models. *The International Journal of Advanced Manufacturing Technology*, *71*(5-8), 899-918

Williams, B. J., & Carver, J. C. (2010). Characterizing software architecture changes: A systematic review. *Information and Software Technology, 52*(1), 31–51.