Chapter 7 – Business benefits of a PLM system

This chapter examines problems related to companies' product lifecycle management, and the possibility of solving problems by utilizing a PLM system. The chapter also discusses the costs of acquiring and deploying a PLM system.

Factors leading to product lifecycle management

Hardening global competition constantly causes more and more pressure on businesses to change their processes and operate more efficiently. The speed of changes is unparalleled and product life cycles are shortening. The number of variations in product structures will increase as products are made more and more often according to the customer's wishes.

The factors causing pressure for change in processes and increasing the amount of product data are, among other things:

- Growing competition and tighter budgets
- Internationalization of business
- Company mergers
- Shortening delivery times
- Less time available for developing new products
- Tightening quality requirements
- Regulations and common industry standards
- Tightening legislation

All this requires an ability to move quickly and continuously to reform products and their creation processes. During the last few decades, companies have had to change their modes of action in many different ways:

- Manufacturing automation has increased.
- Product portfolios have expanded.
- Customers have been given more and more opportunities to influence products.

- Manufacturing has moved to sub-contracting and contract manufacturing.
- Organizations have changed.

Changes in the business environment have made it more difficult than before to find the right product-related information and to maintain and retain the entirety of this information. The main reasons for these problems are an increase particularly in the variations of products, and the huge amount of product information as well as the complexity of companies' supply networks.

It not easy to find the original sources for information in the wide, decentralized and global organizations of a modern company, especially in those cases when suitable tools for information control are not available. Indeed, many companies have fallen into a vicious circle: the large number of items and the numerous laborious assignments caused by the maintenance of item information and product data are problems that feed each other (figure 30). Information retrieval is slow because the information is scattered over different systems or on the PCs of fellow employees. Updating the information becomes increasingly inaccurate and irregular.

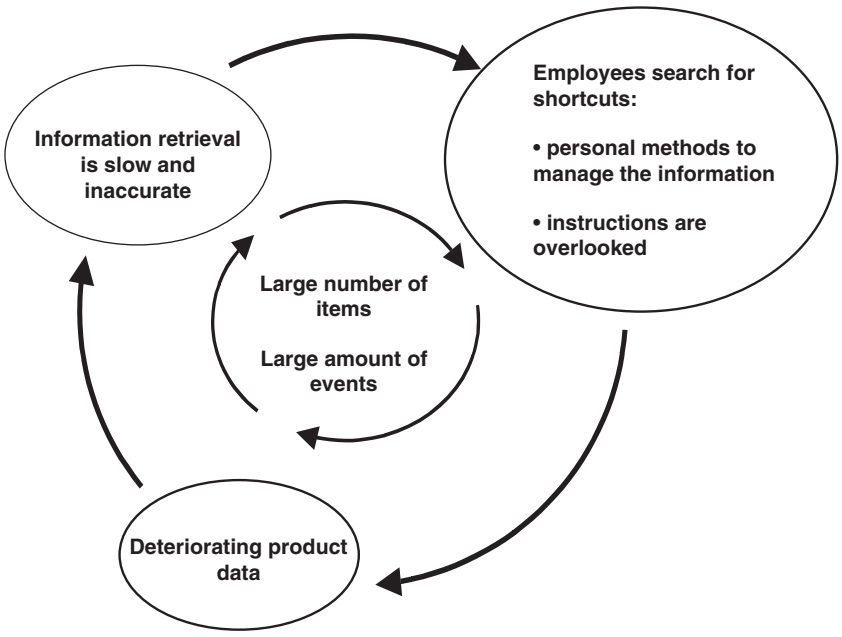

Figure 30. Vicious circle of deteriorating product data.

This leads to a situation in which the designer, fitter or service man cannot trust the product information in the company's information management system. They will then establish their own filing methods and look for personal shortcuts with which to manage the information. The information might be recorded, for instance, in small pocket notebooks. This makes the work of all the other designers, partner employees, service men and other parties working in the same value network more difficult. The search for information becomes ever more difficult as more and more people contribute to the disintegration of the system. This leads to a vicious circle of product management in which the system continues to disintegrate more and more.

To break the circle, or prevent its formation, attention must be concentrated on the improvement and harmonization of modes of action and standardization, and on reducing general hassle. In this, the help of a PLM system is irreplaceable.

Benefits of the PLM system in product lifecycle management

Many industries are quite networked nowadays and the information system environment of different companies is very heterogeneous. There can be several specialized CAD systems, ERP systems, sales systems, and so forth in production use. The heterogeneous information system environment sets great demands upon the integration of systems and the transfer of information. On the other hand, it is possible to obtain the most considerable advantages in this environment. The same also holds true for the operation of the company in a scattered operation field in which there are plenty of interest groups of different types. The great physical distances and the interfaces of organizations of different types will lose their significance when the product management is reasonably adapted. PLM systems are extremely suitable for developing the internal communication of the company and communication between external companies in the same network. Between the separate departments of the organization and other external interest groups, the improvement in communication is perhaps the most important single benefit from a functional product lifecycle management system.

The system can be used to improve direct communication, transfer of files and conversions between different file formats. This is important when different types of software are used for the production and maintenance of product data – for example CAD software. CAD data transfer to the ERP system can be developed through the PLM system when for example the use of common databanks is possible. The improvement of communication brings many indirect advantages. The quality, effectiveness and speed of operational processes can be considerably

improved when mistakes caused by bad communication, faulty information and the resulting incomplete planning decrease. When one decides to invest in a product lifecycle management system, perhaps the most important consideration is that the system allows for a radical reduction in many kinds of unnecessary information processing and transfer work. Quality work that has been done once, using tried and tested solutions, can be better utilized. Information can be searched more effectively. More rational and faultless changes are made in the design work and the value of existing applications increases.

A Coopers & Lybrand study from the year 1994 has shown that quite a small part of the working time of an engineer is actually used in planning and designing (figure 31). About 30% of the time is spent on retrieving, distributing, and maintaining information. Twenty percent of the time is spent redoing things that have already been done once. The reason for this is often that it is quicker to do the work again from the beginning than to look for work that was done earlier. About 14% of the time is spent at different meetings, the purpose of which is often to provide information to others working on different parts of a project and to get information in return.

The product lifecycle management system collects many kinds of information on the daily operations of a manufacturing company. For example, information on the number of different items – documents and components – in the item base, the number of changes that have been made to a certain product or assembly and the components in production use are especially valuable for developing the business in the area of the whole supply chain. When a PLM

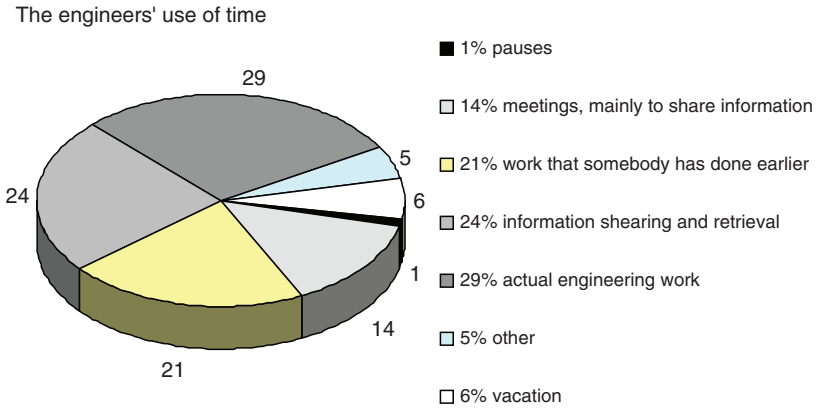

Figure 31. The engineers' use of time.

system has been used for some time, the utilization of the information gathered by the system, using reports based on the information in the database, can begin. These reports provide firm basic information to support the company's decision-making. The systematic cutting and standardizing of the item stock, which is based on the usage records of items, can be considered a good example of this kind of report. This kind of analysis of information is presented in more detail in the last section of this chapter.

However, attention must be paid to the fact that a product lifecycle management system alone will not automatically improve the operational effectiveness of any company. The system is only a tool, used by the organization to remove physical distances, to overcome the difficulties that appear in daily work and to break through separate organizational interfaces. Company employees and organizations can use it to intensify their own work. The use of a PLM system provides opportunities to develop the rationality and cost efficiency of the whole supply network. However, it is very difficult to measure the results of these development operations in money. This can cause problems when the profitability of the implementation project is justified to the management or a repayment period is counted for the investment – even though it seems very clear that the system is worth acquiring. The immediate pecuniary advantages of a PLM system accumulate as cash assets of the company in terms of saved time and increased effectiveness in daily operations. These savings appear in declining quality costs and in the reduction of tied-up capital. The pecuniary advantages can also include a large group of indirect but very significant advantages such as quicker time-to-market of products and quicker time-to-react to changes in the market and a better margin for sold products. All these advantages derive from better quality of operations, and from more efficient and quicker operation in the product and order-delivery processes. The following list represents a concrete example of the immediate advantages obtained by a certain company with the help of a PLM system.

Saving time

- The definition of the product structure takes less time because it is easy to utilize already existing information.
- The amount of overlapping work decreases.
- The part lists are available to everybody involved and are in accordance with all the latest changes.
- Fewer corrections to information are needed.

- Historical information on parts and drawings can be retrieved quickly and with minimum effort.
- The availability of planning information is facilitated: information related to products, parts of the product, assemblies, and such like will be found easily and quickly.
- The drawing up of documents is easier and faster.
- The external and internal grade of service of the company rises.

Improvement in quality

- Changes in documents can be electronically accepted and released.
- The distribution of change information is faster and less faulty.
- Certificates, records and test results can be connected to a product.
- Standards are within reach of everybody; it is easy to update and distribute them.
- Information security improves and it is easy to create and maintain different levels of user privileges.
- The flexibility of operation increases.

Reduction of tied-up capital

- The number of different items is reduced and items are more standardized.
- The component stock can be made smaller when the product structure shows exactly what is needed in the warehouse.
- The management of the total production load is facilitated with the help of the right product structures.

At the end of the chapter, the operative advantages and their measurements will be dealt with in more detail. The advantages gained by the sample company are not due only to the PLM system. The changes accomplished by a company typically

result from a successful change in processes and modes of action. These matters are dealt with in many management doctrines for industrial enterprises. However, the PLM system must be seen as an excellent tool with which effectively to carry out these doctrines. Chapter 10 deals separately with Concurrent Engineering (CE) and Computer Integrated Manufacturing (CIM) management doctrines as well as various forms of cooperation between companies in value networks.

Measuring the business benefits in daily operations

As is well known, it is difficult – thought not impossible – to convert the benefits of a PLM system directly into euros or dollars. The advantages can be roughly divided into two different forms: the savings achieved in operations and the new and increased earnings possibilities of the business. The savings are manifested in the intensification of the operative operation and in the decrease in expenses and working capital, whereas the new business opportunities are perhaps even more matters of strategy. The following summary of advantages, particularly in the operative operation, is considered from a savings viewpoint. The possibilities at the strategic level are dealt with in chapter 12.

Material costs: reducing inventory tied capital

Typical problems

- The item management of the company is not in order. The company's component stock includes a large group of component items (self-manufactured components or components to be bought) with the same contents. This problem typically occurs when it is easier to create new items than to find similar items already in production use from the company's item management systems.

- The company's own component design and manufacturing is inefficient. Design and manufacturing could more effectively utilize standard components or similar components from totally different product families in different parts of the product. A good example of this: one company in the field of heavy transportation vehicles manufactured 120 different kinds of pins in their component manufacturing factories. When they realized this, they looked carefully into the product designs and realized that they could manage with only four different kinds.

- Procurement buys the same type of components from different suppliers for different products. Procured components of the same type are also handled and stored as separate items.

- Procurement also spends the savings brought by bigger volumes. Product development and sourcing each maintain large amounts of overlapping information on items as well as information on their suppliers.

- From the design process and sourcing point of view the company makes overly fast and uncontrolled changes in the design of the product. These uncontrolled changes lead to the wrong component procurements and unusable component stocks. For items made within the company, this can cause problems in the making of the tools and jigs, as well as in the planning of NC software.

Causes of problems

- Information maintenance is difficult. Difficulties in retrieving and controlling product data often lead to unwanted short cuts in operations models. These short cuts mean that new items are always established, when necessary, for each new purpose because it is too difficult to retrieve existing item from the information systems. In many cases, the information can be anything but correct, real-time information.

- The product data concerning component items is not up to date and is unreliable.

- There are difficulties in the internal and external communication of the company regarding product data and the changes that have taken place in it.

Indicators to measure operations

- The number of component items in the item base of the company divided by the products (the generic products) proportioned to the number of components in individual products (i.e. How many components are there in the information system of the company compared with the different kinds of items needed to make the company's products?)

- Length of the cycle from purchase invoice to account sales, in other words the time from the acquisition of components to the delivery of the product
- Value of the component inventory

Development potential brought by PLM in this area

- Ability to easily retrieve and maintain all necessary item information
- Reducing component stock and expanding the convertibility of components
- Better management of component information and better management of component suppliers and related information
- Reducing the items in the component warehouse and dropping their value

Improving the productivity of labor

According to a Coopers & Lybrand study, real value adding engineering work is quite a small part of the total time used in the product development organization. About a quarter of the time is spent in finding, distributing and maintaining information. Twenty percent of the time is used in repeating tasks that have already been done once. About 14% of the time is spent on information-sharing meetings.

Typical problems in companies

- The product knowledge of the product development organization depends very essentially on the individuals in the organization. There is usually a lot of information and special expertise but it is very much bound to particular people. The information cannot be made useful to the whole organization.
- Far too much work is needed to retrieve existing product data and to maintain and transfer it during the maintenance stage or product creation stage of the product process. Likewise, during the after

sales phase of the product life cycle, large amounts of both direct and indirect work are typically expended in sharing and retrieving product data. People within the organization who are believed to know most about the matter are contacted by telephone or e-mail and asked to find and gather together information about the question in hand. The organization always produces new "quick and dirty" patch information for new purposes instead of sharing information that has already been created, maintained, and found once.

- The reuse of existing information or experience from older products and functioning design solutions is difficult, which weakens the quality of new products.

Causes of the problem

- The product data is scattered over several separate information management systems. There are no links or references between these systems to enable the transfer and ensure the continuity of the information. Manual work is needed to transfer information from one system to another.

- All the essential individual pieces of product data are maintained in separate product management systems. In this case overlapping work will be done to maintain information in several separate systems.

- Distribution of the information is typically performed using the push principle, for example to the maintenance organizations. In other words, a certain organization or group of employees is informed by notices of changes that have taken place in the product at some stage of the change process. In this case, the organization is flooded by notices and must maintain a large amount of information just for their own purposes, which complicates the speedy retrieval of the right information when it is needed.

Indicators to measure operations

- Measurability is typically difficult and unpunctual in this area. Possible indicators are the direct costs of labor related to the transfer of information and change management of products, as well as the maintenance and documentation work needed to keep

the information intact – likewise, the time used in finding and retrieving information.

Development potential brought by PLM in this area

- Individual knowledge is converted into intellectual capital available to the whole organization. Individual knowledge is converted into electronic form, in order to control it.
- Controlling, retrieving, maintaining, and distributing product data and product knowledge in electronic form – in bits.
- Reuse of existing information.
- Reducing the resources used in retrieving, maintaining, and transferring product related information.

Costs of quality

Typical problems in companies

- Many product design mistakes are made or the designs are incomplete (e.g. illegal configurations are possible, which result in faulty products being delivered to the customer).
- Faulty product units have to be repaired during production or even at the customer's premises after delivery.
- Manufacturing is problematic, i.e. volume manufacturability is poor.
- Many products come back as returns and for repair under guarantee.
- Many problem situations appear and too much time and work must be spent settling claims.

Causes of problems

- Complexity of the product process and the product creation project model; complexity of the products

- Lack of traceability in change management and design history
- Slowness of change processes
- Shortcomings in the traceability of the order-delivery process and of individual product content (i.e. the actual parts of an assembly)

Indicators to measure operations

- Ability to produce quality, yield of manufacturing processes, waste, and corrections to products in manufacturing
- Guarantee claims

Development potential brought by PLM in this area

- Improvement of the ability to produce quality with the help of efficient and rectilinear, streamlined and straightforward product processes (the traditional thesis that 80% of the cost of the product is determined during the product process)
- Fast, efficient change management
- Traceability of change management and design history

It is quite clear that the biggest development and saving potential in operative operations of the entire supply chain are hiding in cooperation between companies. When operating in a value network of companies the product process achieves an ideal condition in which the suppliers and customers are able quickly and flexibly to utilize each other's existing product information. To reach this ideal future state, companies simply must be able to distribute the information safely and effectively to their partners. However, the precondition for the intensification of operation between companies is sufficient quality of operations within the individual company before it can act over company boundaries with a great level of confidence. Furthermore, one can state that as regards operative business the objectives and indicators are nearly the same both within and between companies.

It is also important to notice that a PLM system alone cannot automatically cure the ineffectiveness operations either internally or between companies. PLM systems just provide new opportunities at both operative and strategic level. They

give a better ability to use, distribute, and refine product data. They make changing modes of action and developing the daily tasks of the organization possible and provide a tool to improve the effectiveness of processes. The task of the PLM system indeed is to provide the organization with a new tool. Company workers and organizations can use it to intensify their own work, to break separate organizational interfaces, and to overcome physical distances and the difficulties appearing in their daily work. Product lifecycle management opens opportunities for many different development operations, to develop the rationality and cost efficiency of the product and order-delivery process overall.

PLM and data warehousing as a tool to support decision-making

PLM systems, like nearly all information processing systems based on the use of databases, collect a large amount of information about system use. This means that a PLM system records information about daily tasks performed on the system, as well as information about users and their activities. This recorded information about daily operations provides an excellent tool for making different statistical analyses and for basing decisions on the collected information. This provides a great opportunity to develop the processes for which the company is utilizing PLM. Traditionally far too little of the information collected by PLM systems about different work processes has been utilized. The chance provided by the system to use valuable information for the improvement of processes related to the development and delivery of products is not always utilized. The metrics that can be used for the measurement and analysis of operative operation and products, as well as the setting of indicators, were dealt with in more detail in the previous section. A coarse basic process, in accordance with figure 32, for example, can be adapted to the collection and analysis of data.

In this context, the main point to remember is that the information that the system does not collect cannot be analyzed either. This must be considered when determining the functionality of the PLM system. In other words one must take into consideration what information one wants to gather, and what kind of information about one's operations should be collected. A good example might be the change processes. First, create reason codes (reasons why the ECO has been made) for the ECO process. In other words different reasons for certain basic categories – such as design error, documentation error, cost cut, manufacturability, etc. – which cause product changes are used in the change process and the number of these reasons per product or product line is analyzed. In this way, it is usually easy to analyze the sources of design problems in the product, based on analyses of hard evidence.

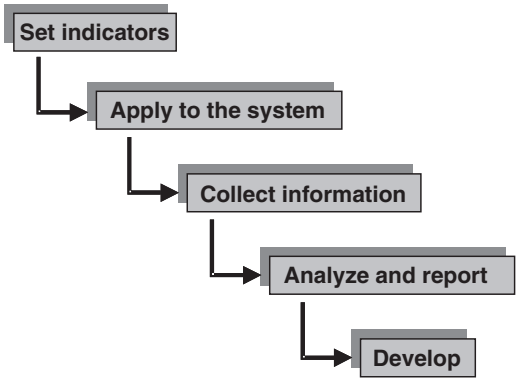

Figure 32. Use of quantitative information for developing processes.

The analysis of the collected information and the use of information technology for this purpose are essentially connected to reporting. In this context, the terms Data Mining, Data Warehousing and Data Mart are commonly used. Data Warehousing has been one of the recently developing application areas of IT technology. The idea of data warehousing is to build a completely separate system totality or database to which information is added from the databases of various operative systems, such as PLM and ERP. The purpose of this is to speed up production of demanding reports and analyses without disturbing the production environment of these operative systems.

There are moderately handy reporting tools in many commercial PLM systems. However, when one wants to make more profound analyses, the ability of ready-made reports to carry out the reporting that users want will often remain incomplete. Because companies continuously create significant amounts of information of different types and characters, changing it into a useful and analyzable totality is a very demanding job. According to the principles of data warehousing the information is gathered into one place, which connects and collects information from different parts of the company or organization so that it will be possible to couple and analyze information from separate sources and from different systems. Collecting the information into a big warehouse is not the only alternative. The information can also be analyzed locally by gathering information for one locality or for the basic system for local analysis. This is called a Data Mart or local warehouse.

When designing the analysis of information, one must also define how the information is utilized. In other words, is it better to use a local warehouse or databank, or one that includes the whole company? Data mining can be considered a relatively new method for analyzing and modeling the information contained in

large databanks. The central idea of data mining is based on using special analysis tools to find mutual interdependences or models in different information elements. The mining of information can be utilized, for example, by using properties and models of existing information and changing parameters to create alternative predictions and scenarios. The focus of data mining is commercial and economic modeling. In other words, it can be utilized, for example, in analyzing the lifespan costs of the product. On the other hand, one must note that all the analyses and modeling based on the collected information require a large amount of quality information in the background in order to operate reliably. The data is needed both to create a functional model and then to measure its functionality and reliability.

The commonest justifications in companies for the use of information technology for data mining are:

- Cutting costs.
- Reducing reporting and calculation work by using system tools suitable for this kind of work.
- Increasing and improving the control of processes in certain business areas.
- Setting clear goals and related indicators. Continuous follow up of metrics based on the "hard evidence" data recorded on various databases. Added together these improve the controllability of the business, based on accurate information.
- Improvement in the planning of economical decisions.
- Basing planning on values that have been clearly measured and continuously followed up in the focus areas.
- Follow-up of the values to be measured allows for more accurate estimates, as well as improvements and greater reliability in plans compared with supposition and the use of feeling based decisions.
- Improvements in quality.
- Setting of metrics and their follow-up makes it possible to react quickly to deviations.
- Improvements in the cost efficiency or margin of the product.

- Analysis of products and streamlining of processes made possible by developing efficient and target-oriented cost structures based on collected, analyzed and reported information.

So a PLM system can be used to support decision-making. In the above-mentioned areas the system can be used in relation to the developing either of products or of processes according to the principles of Data Mart or Data Warehousing, for instance together with the cost and price information maintained in ERP systems. A few examples follow, based on typical process data collected by a PLM system, of the analysis of a manufactured product or product family.

1. Reason for the product changes or ECOs. Collected reasons for the changes that have been made to a certain product or product family in a certain period of time or a certain life cycle phase. The dispersion and amount for each reason. The reason codes can be divided, for example, into the following categories:

    - Reduction of costs
    - Documentation error
    - Design error
    - Product improvement – customer feedback
    - Product improvement – claim
    - Product improvement – development of production
    - New version

2. Number of items in the product – procured items/(components) items made in-house/compared to procured components. – Comparing the procured/made ratio and their cost in order to compare the cost structure and profitability of the assemblies and to make decisions on whether to buy or manufacture.

3. Number of different items delivered by the different component suppliers.

For example, the following list of clear measured indicators can be used for the analysis and development of processes:

Change processes: ECO analysis

1. The throughput time of an individual component change, from ECR to ECO Release and production (e.g. simple change in a certain component supplier)

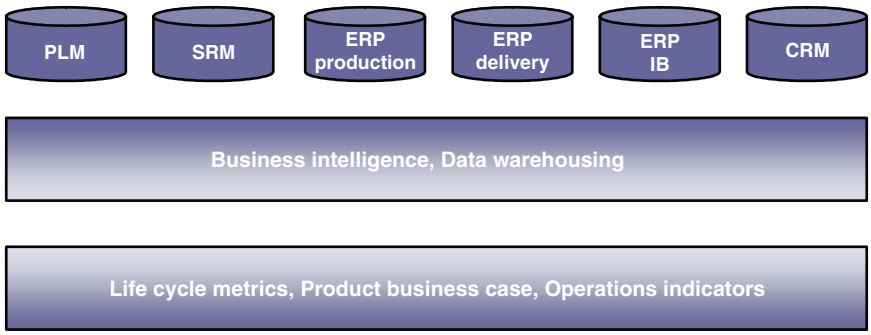

Figure 33. The IT systems that typically support the different functions of a company. Utilizing the information controlled and maintained by these systems together with data warehousing makes possible the development of products and processes as well as making of the so-called informed product lifecycle decisions based on real information.

2. The handling and throughput time of various steps in the change process:

   The duration of changes that have taken place during a certain period at different stages in the change process – for example the time elapsed from the ECR or ECO to the release of the new change (*release*) or for obtaining approvals for the release.

3. Throughput time for changes: the turnaround time of the whole change process in a given organization or part of the organization.

A good example of the integrated use of typical ERP and PLM system data (figure 33) – data warehousing – is a simple cost analysis, where the costs of the individual parts of the products or the margin of the product is analyzed. In most cases, the complete product information is stored in the PLM system and the pricing, cost and labor allocation information is stored in the ERP system. Usually the ERP system contains quite extensive part lists of the components needed to make an assembly or part of a product. However, in most cases it does not cover the whole product, but only a certain part or assembly of the complete product.

Analyzing the cost of acquisition and the deployment of a PLM system

The direct advantages of PLM were introduced at the beginning of this chapter. From these manifold advantages, the following claim can be stated: the better the attempt to adapt PLM efficiently, particularly as a strategic tool offering new and more efficient modes of action, the greater will be the advantages.

Next, we will consider, at a general level, the cost of a PLM implementation project in a company. The PLM implementation project and its stages were considered in chapter 6. All the stages in a PLM implementation project involve either work or acquisition costs. Every project is unique and involves different kinds of emphasis so it is difficult make an unambiguous and generally applicable cost estimate.

PLM system suppliers and PLM consultants have gained a lot of experience from different kinds of projects, with different contents. At the negotiation and planning stage, all the forthcoming implementation stages must be surveyed as carefully as possible with these parties. One can state roughly that most of the costs derive from imported or internal work rather than from the hardware or software licenses. It is easy to develop a wrong idea of costs by counting only the cost of software licenses. The time required for the deployment of the system can range from several months to several years, usually depending on the chosen system and the size of the implementation and company. Thus, the final cost of the system will depend on the duration and scope of the deployment. It is impossible to give a general rule of thumb for costs, because the project's content, internationality, integration, and so on affect the final cost. Very roughly, the deployment of a first PLM system in a company with about 200 users could cost from 200,000 to 1,000,000 euros or US dollars. However, the costs of the customer's own work have not been included in this estimate. The costs are somewhat smaller when upgrading an old system, or implementing a new system on the foundation of an existing system. This is because a lot of internal groundwork has already been done. The core item and document processes are in use and supportable with PLM systems, the item classification schemes are in place, etc. In addition, the company possesses a lot of general knowledge and experience of PLM.

The costs of internal work arise mainly from the following work phases:

- Comparison of competing suppliers and software
- Definition, planning of the system, planning of the introduction project and management
- Possible piloting of the system
- Definition of the system, starting the project
- Planning and management of the project
- Definition and design of the information to be handled by the system
    - Defining the item information

    - Attributes and their content
    - The lifecycle phases of the items
    - Defining item creation processes and workflows,etc.

- Preparing the information for the system

    - Gathering item and document information from legacy systems
    - Refining the information, i.e. deleting obsolete information and verifying the quality of information
    - Gathering files to be loaded into the system
    - Preparing the relations between file attachments and items
    - Preparing product structure information

- Setting up, programming the system, possible tailoring, interfaces to other systems

- Bulk transmissions of information, i.e. loading the prepared mass of information into the system

- Testing the system

- Education and training, creating instructions and support materials

In addition to costs related to the implementation work, many costs arise from the equipment and licenses connected with deployment of the system. When costs are estimated, the factors taken into consideration should include, among other things:

PLM software licenses

Usually the license is either floating or named: the number of floating licenses depends on the number of simultaneous users of the system; the licenses either are in general use for all users or are fixed for a certain group of users. Of floating licenses, one can state as a rule of thumb that a few dozen simultaneous users' licenses will suffice for a hundred users, when all the users of the system are in the same time zone. Named user licenses are allocated for certain tasks or functions or for certain persons, i.e. everyone that uses the system must have a license for the task in question. In some cases, the licenses are divided into two categories: those who use or view the information and those who create new information. Software licenses can also be leased (rented) from some system suppliers. In that case, there will often be

a finance company involved, which buys the licenses and then rents them out to the user. This mode of action can be suitable for companies whose financial strategy or liquid assets do not allow for large investments.

Database licenses

The database applications in the background of the system usually require separate licenses. The database license can also be either floating or a fixed so-called processor-specific license, the price of which is determined by the number or strength of the processors on the server.

Hardware acquisitions

PLM system servers may have to be acquired for the management of the databases and files. Other devices, such as workstations may also have to be acquired or upgraded depending on the initial situation in the company.

Maintenance of equipment, licenses and software

A yearly maintenance fee has to be paid for the licenses, as well as a so-called support payment. The price of this payment varies from one supplier to another but is typically from 15% to 20% of the price of the software licenses.

Summary

- Internal and external modes of action can be considerably changed with the help of a PLM system.
- The advantages, measured in money, include both savings achieved in the operative operation and new earnings opportunities.
- Active analysis of the information in PLM can be used to produce valuable reports to support the company's decision-making. The costs of the acquisition and deployment of PLM arise from imported and internal work as well as from the hardware and software licenses.