DATA MANAGEMENT IN THE PRODUCTION PROCESS IN THE SYSTEM PRODUCT LIFECYCLE

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Abstract

Data management system in the long term evolved into a form in which we know them today. Many companies that helped the development trend. Whether that these systems be developed, involved in their programming, or just long-term use and have formed their own modules and modifications. When creating systems there was a merging of multiple systems into new systems. In this way, developed also PLM systems. This paper deals with a short overview of their development and description of the systems, which are united in it. Digitization is currently a major trend in area enterprise manufacturing changes, whether in product innovation, or the creation of new production processes. In the field of digital factory is just like in ordinary enterprise necessary manage factors such as performance and the cost

Key words:
PLM, PDM, ERP, CRM, SMC, product lifecycles

Introduction

The first engineering database to support information technology to manage information and data created in 80 the 20th century. Later, these databases expanded, and used other technologies to manage data, gradually several systems were assigned to standardize and after an first PDM and later PLM systems. PDM systems accounted integration platform containing all necessary information about the product development process. This included CAx systems, office programs and NC tools. Included and processed primarily data on the development and design of the products.
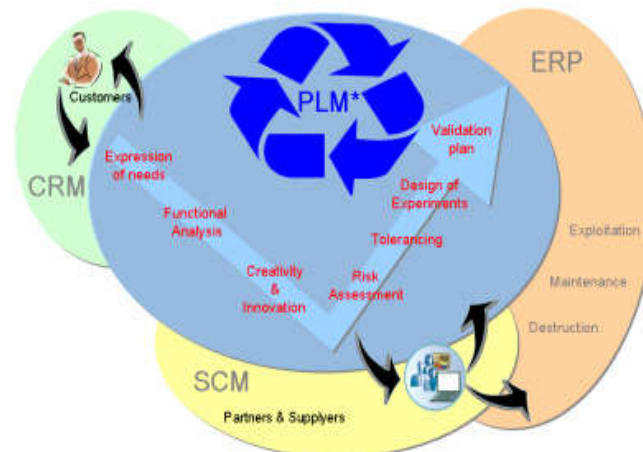

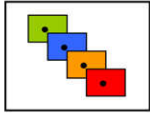Fig. *PLM systems and subsystems, affiliated during their development*

Subsystems included in PLM systems and their properties

As set out above PLM encompasses a number of systems which are used in the management, planning, controlling production and other business process and facilitate the decision making process.

1 ERP systémy

Enterprise Resource Planning (ERP) is a in-house software information   system used to manage and coordinate all the resources, departments and functions of the business community through shared data stores. ERP system consists of modular hardware and software units that communicate on a local corporate network. The modular principle allows the company to add or reconfigure modules while preserving data integrity in one shared database that is centralized. Improving information processes and gain competitive advantage. Expectations from the ERP system:

- Detailed and current reports on business performance.

- Sufficient information on partners and customers, new impetus to trade.
- Simplified planning and management.
- The conditions for the development of special solutions.
- Height and Return on Investment - given the change process and management.

Fig. *Diagram of ERP systems*

2 SCM systems

Supply Chain Management (SCM) is the designation for the activities as supply chain management, both for software supporting this activity. Usually, this whole package of software tools that allows connection the individual articles of the supply chain (supplier - manufacturer - distributor - retailer - customer), thereby substantially improving its ability to respond to customer requirements, eg. shortening delivery times. SCM is nowadays often only one of the modules of a comprehensive ERP system. SCM solves the following problems:

- Distribution in the network: the number, location and role in the network of suppliers, production facilities, distribution centers, warehouses, cross-dock and customers.
- Distribution strategies: questions solutions of establishments, supply system
- Compromises in logistics operations: the abovementioned activities must be well coordinated in order to achieve the lowest total logistics costs.
- Information: Integration of processes within the supply chain to share value information,
- The management of inventory : quantity and location of stocks including raw materials, work-in-progress (WIP) and finished products.
- Cash-Flow: Arrangement the payment conditions and methodologies for exchanging financial resources between entities in the supply chain.
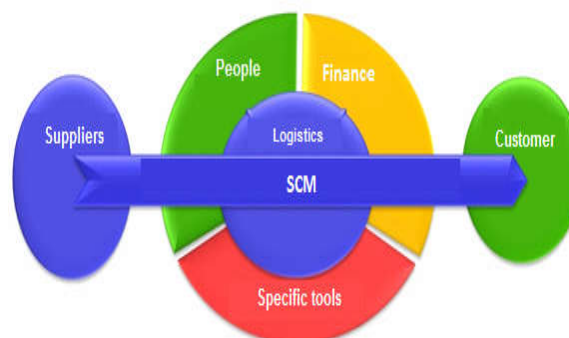

Fig. *Diagram of SCM systems*

3 CRM systems

Customer Relationship Management (CPM) is a customer relationship management is a File tools supporting marketing, sales and customer service. Prerequisite for the proper functioning these functions is a direct customer knowledge. This enables the company to retain of existing customers and the better if gaining new marketing methods. In a market economy true that will survive only those companies that can correctly adapt to changing market demands, and legal systems CRM allows companies create and have a precise map customer needs.
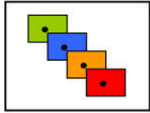
Fig. *Components of the CRM system*

4 PDM systems

Product Data Management (PDM) we can understand as a system for creating construction technological documentation for the administration and management of complex product data. Within the PDM emphasis is on the management and monitoring of this writing, documentary implement changes, and then archive all information related to the product. PDM system can be seen as a tool to manage large amounts of diverse information about the product from which the outputs are used to implement production. It is a tool which supports teamwork, improves productivity when creating documentation, ensures clarity of documents, topicality and their safe storing. These include CAx systems, office programs and NC tools. Include a particular data processing on the development and design of the products.
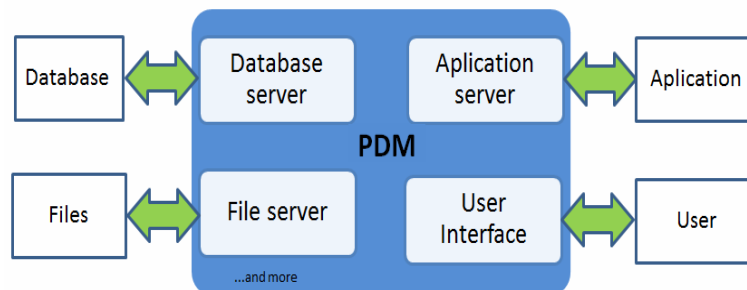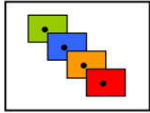

Fig. *Architecture of PDM system*

5. PLM sytems

Product Lifecycle Management (PLM) is a product lifecycle management since the creation the idea through the selection of variants for its implementation, execution primary models, testing them in the area of virtual reality, optimizing of any errors in them, to construct prototypes. Continues the solution methods of production and her actual design, distribution finished products to customers, possible claims, selling products on the market, report all data about them from the beginning to the end of their life cycle and possibly also its innovation, or recycling. Question of dismantling and recycling have been engaged in the design part of the product. Where the designers intend also possible dismantling and recycling beyond the lifetime of individual products. Filling their activities includes any hitherto mentioned systems and covers the part of the and many other systems. Use of PLM systems several times exceeds the benefits of its application as compared with the incurred costs.

Based on what PLM manages, we can to categorize these benefits:
- Increase in revenue,
- Reduction in the draft,
- Accelerate change cycles,
- Implement a more a complex, less disruptive cooperation,
- Spend Make less components in larger volumes,
- Increased business experience,
- Reduced production scrap and waste,
- Reduced overhead costs.

As seen in PLM systems includes all previously referred components and systems and their features and functions. They are therefore the most complex and deepest, but more efficient and more profitable for its users. The following Table. 1 are briefly summarized the benefits of the deployment of PLM systems.
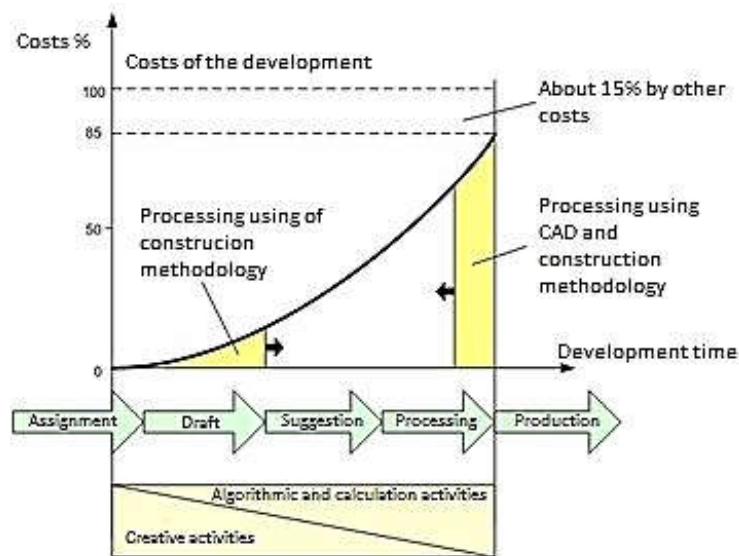
Tab. Benefits of implementing PLM systems

Benefits	Improvement
The time to market	~ 30 % reduction
Quality costs	~ 20 % reduction
Product development costs	~ 24 % reduction
Product costs	even 20 % reduction
Change management costs	even 40 % reduction

Cost Management Product Lifecycle

Cost management throughout the product lifecycle are currently takes center stage managers. The main reason is the shortening of product life cycle. Also includes parts life cycle phases, such as disposal and recycling induce costs, which was once not considered. The resulting product costs are influenced not only product features that serve to meet customer requirements, but also their own way of producing the product. As product features are chosen mode of production as a result of pre-production stages of the product life cycle.

Fig. *Development costs product*

Already alone product development raises the need for more available funds. Progresses phases within the pre-production stage, the costs increase because of the design concept, where the majority of creative work of the development team, the specific design solution will, design and verification technologies increases the number of stakeholders and the use of aids such as CAD, CAM, simulation software and etc.. Although the use of such funds reduces the pre-production stage, but increases the cost associated with it. Progress of product development costs shown in the following fig. 7.

The benefits of when planning and of production processes in the manufacture of

For efficient production planning process is essential. Rather, plan production of processes carried out manually based on experience and knowledge of individual employees planning. First have evolved product plans, and then plans the production processes. Shortcomings of this approach contributed to concurrent engineering, where planning processes and products conducted jointly. Software tools, such as DELMIA, Process Designer, Process Simulate, Plant Simulation support planning processes in environments concurrent engineering .
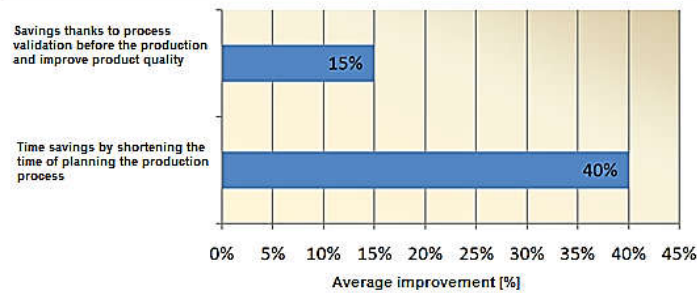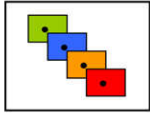
Fig. *Benefits of DP when planning production processes*

Using the Digital factory to support the creation of products and design of processes significantly shortens the time needed for production planning. This requires technology and improvement of of business processes, which includes the use of a systematic approach in the form of the introduction of process automation, improved visualization and collaboration. Time information retrieval can be reduced by up to 80% with access to shared data. Products and processes planning gain much more feedback, reducing the time needed for troubleshooting.

Tecnomatix and other products from Siemens PLM software

NX improves productivity through product development, delivering faster, more flexible modeling of individual components and assemblies, higher performance of several CAD applications used at the same time, more efficient digital simulation and more efficient manufacturing PLM Software Teamcenter connects people throughout the lifecycle with a single source of knowledge about products and processes Velocity Series is a comprehensive family of modular , yet integrated solutions across the product lifecycle management (PLM) in the midmarket . Medium allows manufacturers to compete effectively with larger companies with more funds available. Add to portfolio Velocity Series, Siemens falls Solid Edge with synchronous technology - is a complete 2D/3D CAD software based on the properties with excellent modeling of parts and assemblies, drafting, transparent data management , and inclusion of finite element analysis (FEA). 3DSync - is a tool designed to edit 3D CAD data, which, thanks to the synchronous technology facilitates designers to work with imported data engineering components and assemblies. It is intended for use in conjunction with existing CAD system helps engineers to reuse the data , thus reducing the cost and time needed for processing Tecnomatix ™ is a broad portfolio of digital manufacturing solutions that offer an innovative approach by linking various manufacturing engineering disciplines with the product , from the layout and design , process simulation and validation after implementation registration Siemens PLM Software includes several software tools for different areas of production , which can be interconnected. Tecnomatix suite of tools allow industrial companies to use in practice, the concept of the digital enterprise, thus producing plans and projects, design, verify and optimize manufacturing processes and resources in the digital environment. Precise digital modeling, simulation and spatial (3D) visualization allow professionals working in development visualize, analyze future production process, thus limiting the possibility of errors that could occur during the start-up of production. Tecnomatix product portfolio is very extensive. It is composed of interconnected, but also separately usable software products.
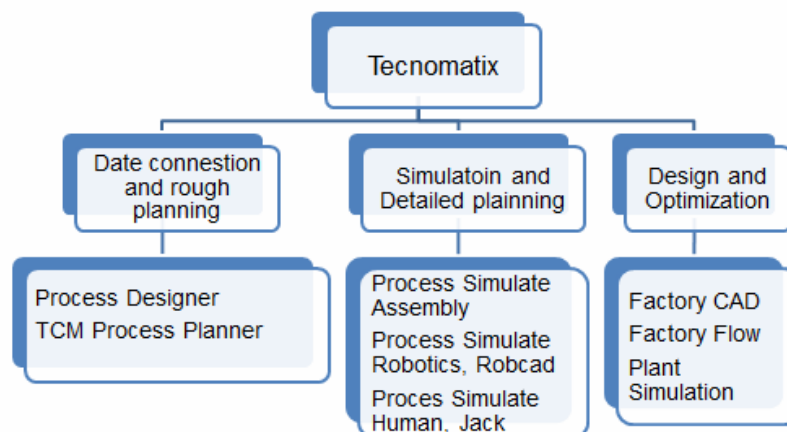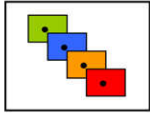

Fig. *Tecnomatix distribution of modules according to the type of use*

Conclusion

Each company has a choosing from a range information systems that facilitate its operation and help improve activities. Use systems also depends on the size and revenue of the company. In some companies are sufficient for smaller

systems like ERP or CRM. Larger companies, however, need more complex and more compact systems, the field is an unpayable PLM help in the management of all business processes. Help companies save time and financial resources. Tecnomatix is very compact portfolio systems for support in area PLM especially in areas planning and simulation manufacturing system. Is a suitable tool for creating digital factories and their support.

Acknowledgement

Refernces

STRAKA, M., ROSOVÁ, A., FEDORKO, G.: Simulačný systém EXTEND, 1. vyd - Košice : TU - 2013. - 72 s. [CD ROM]. - ISBN 978-80-553-1520-1

SANIUK S.: Modelling of virtual production networks, LogForum : Electronic Scientific Journal of Logistics .- 2011, Vol. 7, no 1, s. 23—33

RUDY, V.: Techniky pre projektovanie výrobných systémov. In: Metodiky pre inovácie high-tech strojárskych produktov a výrobných systémov : vedecký zborník. - Košice : TU, 2012 S. 107-112. - ISBN 978-80-553-1249-1

KLOS, S., PTALAS-MALISZEWSKA, J.: The impact of ERP on maintenance management, Management and Production Engineering Review, 2013, Vol. 4, no. 3, s. 15—25

FIĽO, M. - LUMNITZER, E.: Matematické metódy hodnotenia kvality pracovného prostredia, 2013. In: Fyzikálne faktory prostredia. Roč. 3, č. 2 (2013), s. 179-184. - ISSN 1338-3922

EDL, M.: Systémové pojetí životního cyklu technického projektu v prostředí DP. 1. vyd. Plzeň : Smart Motion, s.r.o., 2013, ISBN: 978-80-87539-20-0

EDL, M. - KUDRNA, J.: Metody průmyslového inženýrství. 1. vyd. Plzeň : Smart Motion, s.r.o., 2013, ISBN: 978-80-87539-40-8

BOŽEK, P., HUSÁROVÁ, B., PIVARČIOVÁ, E.: Riadenie prostriedkov automatizovanej výroby. - 1. - Trnava : Tripsoft, 2000. - 195 s. - ISBN 80-968294-3-2

LENORT, R., KLEPEK, R., SAMOLEJOVÁ, A.: Heuristic algorithm for planning and scheduling of forged pieces heat treatment | Heuristički algoritam za planiranje i terminiranje toplinske obrade otkivaka, (2012) Metalurgija 51 (2) PP. 225 - 228

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