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## PRODUCT LIFECYCLE MANAGEMENT TOOLS

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**ABSTRACT:** Product Lifecycle Management (PLM) gathered and made accessible all the data and information of all stages of this process. PLM is recognized as one of the key leading technologies to facilitate companies to overcome a lot of challenges, which will offer companies a new way to rapidly plan, organize, manage, measure, and deliver new products or services much faster, better, and cheaper in an integrated way. It is hoped that the PLM technology solutions will form the frontier basis for further research, development, and application of PLM systems. The need is to quickly adapt to the dynamic changes of the market for industry companies in order to pursue the most advanced competitiveness. This article presents one of the most widely-used PLM solution suites in the market, Siemens PLM software-Teamcenter. Teamcenter is built on the latest IT technology and all modules share a common data model and database. It is designed to enable Siemens PLM and its customers to configure and more easily expand Teamcenter's functionality today and in the coming years. In addition, a useful way for managing product structures by using Teamcenter Structure Manager is presented. In Structure Manager, you can create, view, and modify a product structure.  
**KEYWORDS:** Product Lifecycle Management, Product Structure, Technology

### INTRODUCTION

The need to improve product innovation, product development, and engineering performance is leading many companies to adopt or extend Product Lifecycle Management (PLM) solutions. These solutions have proven value in helping manufacturers improve their product innovation, product development, and engineering performance - and ultimately the profitability of their products. To be competitive in the current world economy, companies need a PLM strategy centred on an integrated product model that incorporates manufacturing data. To enable such a system, the company needs a software infrastructure - a layer that interfaces with the operating system.

However, many companies struggle with the best way to transform their business and take advantage of these enabling PLM technologies. For any technology to provide a business benefit, it has to allow companies to change the way they do business so that they are more competitive, reduce business risk, increase revenue, decrease cost, or in some other way recognize tangible business advantage. Companies need to closely collaborate with customers, manufacturers, and suppliers in a real time manner in order to quickly respond to dynamic market changes.

Key technologies to support these business models have changed as well from mass production, to a flexible manufacturing system, to manufacturing knowledge management, to product customization, to product knowledge management, and to product lifecycle management (PLM) [1,2,3,4,5]. As such, PLM is recognized by world's leading universities, institutes, and solution vendors as the next big wave in enterprise application software.

### WHAT IS PLM?

People often describe Product Lifecycle Management (PLM) as a technology. It is more appropriately described as a strategy for making companies more innovative and productive by applying a number of technologies [8,9]. These tools enable manufacturing companies to capture, use, and build upon the intellectual property created by design and manufacturing engineers, and to do so all the way from the concept of a product to the end of its life.

PLM is more than product design. To be competitive in the current world economy, companies need a PLM strategy centered on an integrated product model that incorporates manufacturing data. To enable such a system, the company needs a software infrastructure - a layer that interfaces with the operating system.

PLM provides customers, developers, manufacturers, and suppliers with the most effective means of collaboratively managing business activities throughout product development. PLM supports the capability of innovation, creation, management, share, and use of product data, information and knowledge in virtual enterprise networks by integrating people, processes, and technology.

PLM systems manage a portfolio of products, processes, and services from its initial conception, through design, manufacture and supply, to service and disposal. Throughout the entire product lifecycle there exist three major objectives, which are:

- customer benefit such as product quality and serviceability,
- company benefit such as product cost and profit, and
- society benefit such as clean and green environment.

To reach customer benefits, mass customization, time-to-innovation, product quality, and reliability are recognized as the key approaches enabled with technologies e.g., product family design, platform based design, modular product design, design process modeling and management, design knowledge management, collaborative design engineering, function/ behavior/ structure design, etc.

To achieve company benefits, time-to-market, time-to-volume, and time-to-profit are known as the key approaches enabled with technologies, e.g., collaborative product service, product lifecycle process management, product lifecycle information and knowledge management, etc.

To obtain society benefits, design for service, design for reuse and design for recycle are justified as the key approaches enabled with technologies, e.g. product/ service co-design, collaborative early design for lifecycle efficiency, environmentally conscious design, etc. To effectively manage these product lifecycle processes for competitive advantages via efficient collaboration, technology solutions for PLM are proposed as the future trend. Accordingly, the impacts of PLM technology solutions to industry are analyzed.

### PLM APPLICATION

There are companies that supply software to support the PLM process. That software itself is just a tool and cannot make many contributions if the PLM process is not defined first and understood by its users whom it should contribute to at the end. Setting up PLM within the company is a process and project itself.

Selected operations that should be managed as a part of the PLM across the company business would be:

- Customer relationship management (CRM) system for managing customer record,
- Enterprise resource planning (ERP) system for managing financial records,
- Supply chain management (SCM) system for managing supplier support,
- Human resource management (HRM) system to manage the employee record,
- Requirement management (RM) system for managing of requirements,
- Project management (PM) system for managing capabilities provide project scheduling, tracking, and resource management while the Change management (CM) is driving the execution of these projects via the process workflows and part/document management capabilities.
- Product data management (PDM) system for managing product data and workflows.

The first step in establishing PLM would be understanding and analyzing the company way of work, organizational structure, roles and responsibilities within the organization. Each of the PLM operational systems should be defined to specify who is contributing to the system, how the information is shared and who is the responsible person appointed for each of the systems.

It is not necessary that all those operation systems are integrated within one software tool, and usually for small and medium companies they won't be, while on the other side big companies might need to adopt available software and tools to their specific needs.

### PLM SOFTWARE-SIEMENS TEAMCENTER

Siemens PLM, with headquarters in Plano, Texas, is a business unit of the Siemens Industry Automation Division. The Siemens Industry Automation Division (Nuremberg, Germany), a division of the Siemens Industry Sector, is a worldwide leader in the fields of automation systems, low-voltage switchgear, and industrial software. Its portfolio ranges from standard products for the manufacturing and process industries, to solutions for whole industries and systems that encompass the automation of entire automobile production facilities and chemical plants. Siemens AG finalized its acquisition of UGS PLM Solutions (UGS) in May 2007.

Siemens PLM has a long history in the PLM market and is a global supplier of PLM solutions with offices and customers around the world. Siemens PLM provides one of the



Figure 1 - Teamcenter Functional Structure [7]

broadest and deepest suites of PLM offerings in the industry today, and has continued an aggressive program of acquisition and partnership to broaden their offerings even further [6].

Additionally, they have continued to expand their business into new areas and have established a set of key systems integrator relationships to increase their focus on various geographies and industries. Siemens PLM reports that they have 63,000 customers in 62 countries and they have 6.7 million licensed seats of PLM software of which 5 million are Teamcenter [6].

### TEAMCENTER APPLICATION

In this article the application of Siemens PLM Software-Teamcenter is presented. Bill of Material (BOM) Management provides the ability to create and manage product structures and their multiple logical constructs. These product structures include part-to-part, part-to-document, and document-to-document relationships so that a complete bill of information (BOI) can be defined and managed throughout a product's and its associated information's lifecycles.

In My Teamcenter, you can attach CAD files, specification documents or other information to the top-level assembly, or to any of the assemblies or piece parts. You can build, view, and manipulate the product structure in Structure Manager or you can import it from an MCAD system such as NX. Using Structure Manager you can visualize assemblies, make visual comparison, and analyze clearances and tolerances. The main goal of the article is to introduce the Teamcenter Structure Manager using a product (locomotive).

Firstly, we create a folder with all parts of the assembly in My Teamcenter home menu. In this case we talk about the folder 'Lokomotiva'. When an item is an assembly, you see a BOM view object icon that exists for the item and a BOM view revision object that exists for the item revision. Teamcenter automatically creates a BOM view revision when you initially create the product structure in Structure Manager. This is shown in Figure 2.

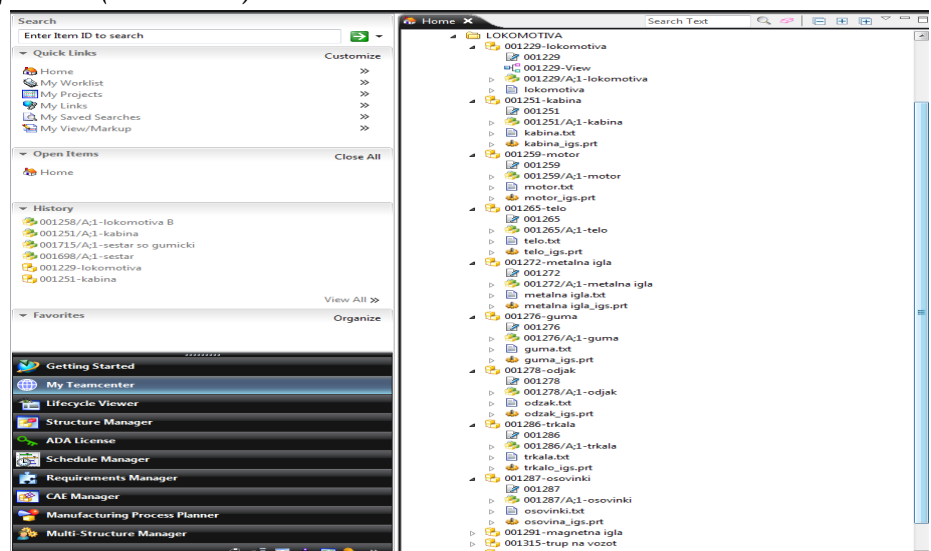


Figure 2- Items and item revision

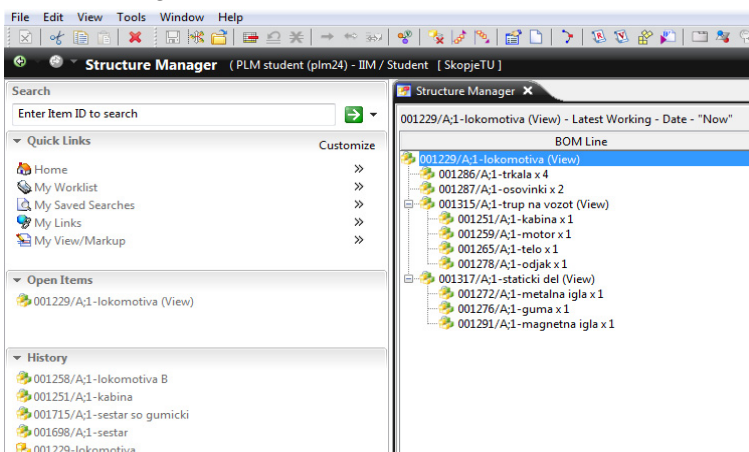


Figure 3 - Product structure display

Teamcenter Structure Manager allows you to use precise part of the product structure, not the latest revision. The precise parts are always the green lines in Structure Manager like 'trup na vozot' in Figure 4. This means that any further changes and new revisions to the parts of the 'trup na vozot' will not impact this subassembly. But, if one or more of these parts are component of another assembly (that is not precise), it will use the latest version.

You can compare two structures to identify changes or differences between the two product structures. You compare the displayed state of the product structures of everything that is visible in the two compared Structure Manager windows. You must set the appropriate revision rule to configure the structure in each window.

Product structure appears in an indented BOM format similar to those used in many CAD systems. By viewing the product structure, you can see which components are parts and which are assemblies. Figure 4 shows the product structure of the locomotive with all parts of the product. Also Structure Manager allows you to add or remove components of the assembly, but if another user is editing a single-level assembly within the product structure, Teamcenter prevents you making changes until the other user has saved the changes.



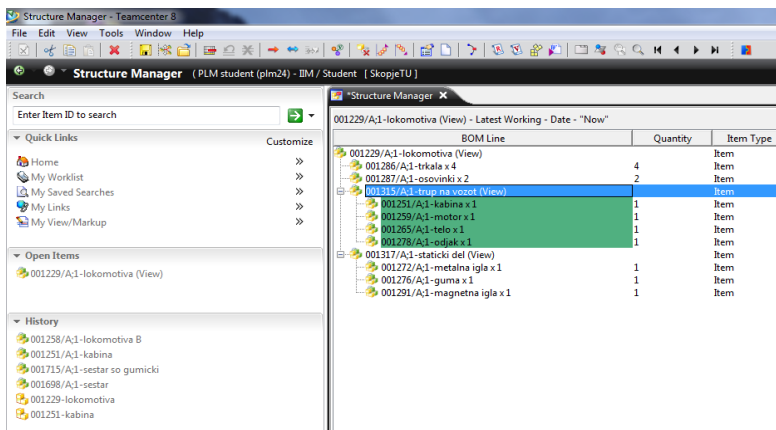


Figure 4 - Precise part

- Lowest level mode that compares only the lowest level items of the product structures, ignoring all intermediate assemblies.

For example we added one more component to our product, and than we compared both product structures in multi level mode. The difference (the new part) is in the red line on Figure 5. You compare two configured structures displayed in separate Structure Manager windows. Figure 6 presents the report of the compare command.

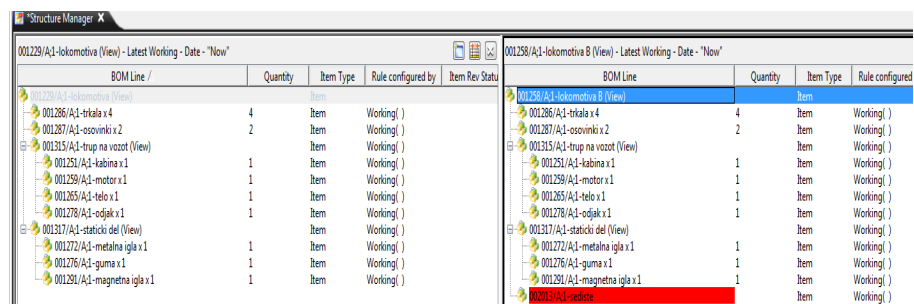


Figure 5 - Comparing two product structures (visual comparison)

BOM Compare Report - 001229/A;1-lokomotiva (View) -> 001258/A;1-lokomotiva B (View) Multi Level				
Item Id	Item Name	Rev	Qty	
001229/001258				
002013	sediste	() ->A	0 ->1	

Figure 6 - Comparing two product structures (table comparison) - Report

## CONCLUSIONS

PLM has proven itself to be useful for all management levels in the companies. PLM is used both from those who are doing execution and from the decision makers within the organization answering to the rapid changes in the business environment. As an information technology strategy, PLM establishes a coherent data structure that enables real-time collaboration and data sharing among geographically distributed teams. PLM lets companies consolidate multiple application systems while leveraging existing legacy investments during their useful lives.

Teamcenter enables customers to maximize the power of their product knowledge and leverage it to increase the profitability and productivity of every stage in their product lifecycle. The companies which are using this software notice personal and team productivity, shorter time to market, increased product quality and minimized product and lifecycle costs.

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