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## PLM AS A FRAMEWORK FOR NEW PRODUCT DEVELOPMENT

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**ABSTRACT:** The need for close and effective collaboration in creating innovative products requires the integration of business and technical information systems. Efficient new product development is hard to imagine out of PLM (Product Lifecycle Management) strategy and contemporary software solutions. The paper will present some results of the implementation of PLM strategy in the new product development process in a chemical company, that has a very wide production programme structure with numerous product variations, sizes, packaging, labels, etc. and exports its products to most of countries in the region. The paper will also propose the possible model and the methodology of the implementation according to the organizational structure of the company and the product development phases using Siemens Teamcenter Software. In the conclusion, authors will discuss about advantages and possible obstacles of the implementation.

**KEYWORDS:** product lifecycle management, new product development, chemical industry, PLM software

### INTRODUCTION

Product lifecycle management (PLM) is an all-encompassing approach for innovation, new product development and introduction (NPDI) and product information management from ideation to end of life. PLM systems, as an enabling technology for PLM, integrate people, data, processes, and business systems and provide a product information backbone for companies and their extended enterprise (PLM Technology Guide, 2008). PLM empowers a business to make unified, information-driven decisions at every stage in the product lifecycle. In today's highly competitive, fast-paced and global business environment, well-designed and implemented PLM practices, processes and technologies that support an organization's strategies for innovation and growth can afford companies a real competitive advantage (PLM Technology Guide, 2008). PLM solutions establish a cohesive platform to: optimize relationships along the lifecycle and across organizations, maximize the lifetime value of a business' product portfolio and set up a single system of record to support diverse data needs (Siemens, 2011).

Innovation and new product development (NPD) are essential for most companies to sustain future revenue growth. Customers demand more new products in shorter time intervals, often customized to their own needs. They want more attractive designs, better performance, better quality, lower prices, and instant availability. To meet these needs companies have to be able to collaborate closely within their own organization and with partners and suppliers located in various parts of the world. At the same time companies have to manage increasing product and manufacturing complexities due to a quickly growing number of environmental and regulatory rules and requirements (PLM Technology Guide, 2008).

PLM software allows companies to manage the entire lifecycle of a product efficiently and cost-effectively, from ideation, design and manufacture, through service and disposal. Computer-aided design (CAD), computer-aided manufacturing (CAM), computer-aided engineering (CAE), product data management (PDM) and digital manufacturing converge through PLM (Siemens, 2011). This helps to manage new product development process more efficiently through its phases:

1. opportunity identification and selection,
2. concept generation,
3. concept evaluation,
4. development and
5. product launching.

The paper will present these phases of new product development process on one of the products of "Beohemija", a chemical company from Serbia. It manufactures laundry powder and softeners and house cleaning detergents and is one of the greatest companies from this industrial segment in Serbia.

### NEW PRODUCT DEVELOPMENT IN CHEMICAL INDUSTRY

Beohemija's production programme structure is very wide and it includes many variations of laundry powder, fabric softeners, dishwashing detergents, glass cleaners, abrasive cleaners, degreasers, surface, carpet and furniture cleaners, toilet cleaners and fresheners, etc. There are approximately 140 different products from five different brands: Duel, Deus, Scalla, Pompa and Spin.

Product development project that is the object of this paper refers to product packaging improvement, that is, the improvement of the polypropylene plastic bottle for Spin Surface Cleaner. Apart from that, this project includes the slight change of labels and their design and the adaptation of transport packaging. The name of this project is Relaunching the product Spin Surface Cleaner 1000 ml in new packaging.

The project is very important for the company, considering that the plastic bottle production technology is implemented in the production system of Beohemija for the first time. This is just another fact that makes this project unique and very different from those that have been done so far in this company. There are many elements to be thought of – new technology to be successfully implemented, new bottle to be designed that fits to production tools, new label to be designed that fits to new bottle, and, of course, new product to be made that satisfies market needs and demands.

Market needs and demands are starting basis for the new product development process. These needs and demands sometimes are not explicitly specified, so they need to be shaped. In some cases, companies have to hear the voice of the customers and shape their products by following it. In this specific case, company Beohemija had to focus on the problems that the old bottle of Spin Surface Cleaner 1000 ml made to supermarkets and the company itself. The old bottle had greater dimensions than recommended. The problem appeared in supermarkets, because it could not fit to shelves, it was too high. Its height caused a problem to the company, a financial one. Inadequate bottle dimensions made the company to increase the detergent level in the bottle, so it would not seem “not full enough”. This led to higher production costs, because each bottle was filled with additional 20ml of detergent.

Those bottles (Figure 1) were produced by a specialized manufacturer and had the following characteristics: the average mass was approximately 70g (recommended mass is 74g) and the total volume was approximately 1120ml. New bottles (Figure 2) are going to be produced by Beohemija (“in-house technology”) with the following characteristics: the mass of  $72g \pm 1g$  and the total volume of  $1070ml \pm 5ml$ . In the production is going to be used polypropylene MOPLEN RP 340H neutral and UV stabilizer KRITILEN UV-stabilizator 17H in the concentration of 2%.

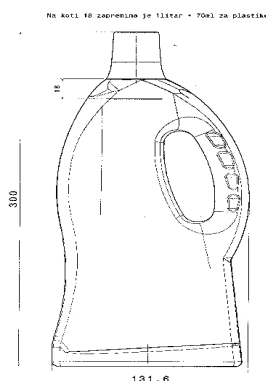


Figure 1 - The old bottle (70g, 1120ml)

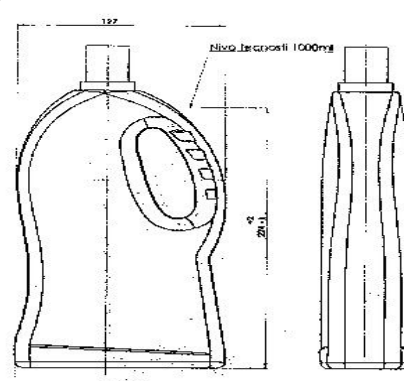


Figure 2 - The new bottle ( $72g \pm 1g$ ,  $1070ml \pm 5ml$ )

Leading consumer products companies agree that the key to driving top-line growth is innovation. Creative product packaging must be designed to meet the diverse requirements of many channels while preserving adequate product standardization and cost controls. A.G. Lafley (CEO, Procter & Gamble Company) once said: “Innovation is our lifeblood - new ideas and new products that make consumers' lives better, build customers' sales and profits, and build P&G's market share, sales, profits, and Total Shareholder Return” (Siemens, 2011). To address the innovation challenges of consumers in increasingly diverse and competitive markets, Beohemija needs to have effectively extended its value chains so it can tap into a world-wide web of inventors, technologists, suppliers, and partners who can help it anticipate customer demand and create the next generation of breakthrough products. This is why the globalization is one of the most important business aspects nowadays.

Product line complexity is expanding to meet more diverse consumer needs, but the next generation of new product must still be delivered faster, with fewer errors, and at a lower cost. Beohemija works hard to develop deep consumer insight, innovative technology, and winning product concepts. It cannot afford to fail to capitalize on this investment by failing to execute the all of the required steps in the many regulatory and retailer compliance 'doctrines' that act as gates in its product lifecycle (Siemens, 2011).

As it can be seen, a company has to meet the following business requirements in the overall new product development process: more innovation, faster to market, compliance, resource optimization and globalization. The PLM software solutions can enable a company to meet these requirements, configuring them to its own business. By combining the data management, process management, and alignment capabilities with the secure and scalable collaboration capabilities, Beohemija will be able to

create an innovation environment that is robust and efficient, and that is tuned to the way of its own innovation. The company can create a step change improvement across the board by implementing a stage and gate methodology for new product development. The company can improve its packaging artwork process speed performance and convert its most time consuming new product development sub-processes for speed to market.

As it was mentioned earlier, each company must find solutions that support its unique strategies, goals and business culture. That is why the PLM solutions are designed as a highly configurable innovation platform for the enterprise. By building upon this foundation to create functional applications that support the way this company innovates, it will be able to eliminate most of the rework and waste that drags on its innovation process and its top and bottom line results. Some PLM system users have generated 50% productivity improvements by configuring these systems to improve their package artwork development process (Siemens, 2011), is one of the biggest sources of profit leakage in most consumer products companies.

#### THE PLM IMPLEMENTATION IN NPD PROCESS

PLM systems are groupware technologies used for the storage, organization and sharing of product-related data and for the coordination of the activities of a distributed team in the deployment of all products' lifecycle processes like project and portfolio management, product design, manufacturing planning and process design, supply production, client service, recycling and all related activities (Siller, Estruch, Vila, Abellan, & Romero, 2008). PLM system represents the central part of an industrial enterprise IT infrastructure and increases additional value by its characteristics that enable converting manually managed processes into automated processes.

The system is specialized for product data management and includes numerous functions designed for item and document management. Company Beohemija is relatively mature for the implementation of the PLM system into its processes. They are standardized, defined and documented. However, human factor is still very important, because work is done partly manually and IT systems support only some parts of the processes. To integrate PLM system into the system of the company, it necessary to define which types of information are going to be updated in the specific system through different phases of the product lifecycle. The object is to update the information at the same place. Other systems (CAD, ERP, CRM, SCM, etc.) can use these information directly from the PLM database. If it is necessary, these information can be imported into the other systems' databases (Testic, 2011).

Table 1 - New product development project tasks and responsible organizational units through phases

Tasks	Responsible organizational units
<b>I Opportunity identification and selection</b>	
Opportunity identification	Marketing, Sales, Development
Opportunity selection	Marketing
<b>II Concept generation</b>	
Project definition	Project management, Sales, Development, Marketing, Production
<b>III Concept evaluation</b>	
Project analysis	Technical development, Project-development management, Marketing, Brand management
Project approval	Top management
<b>IV Development</b>	
Project schedule	Project management
Project schedule analysis	Project management, Sales, Marketing, Supply management, Development, Production, Quality control, Technical preparation
Project schedule approval	Project-development management
Realization of defined tasks of the approved project schedule	Project management
Industrial testing	Project management, Development, Supply management, Production, Quality control
Project verification	Project management, Development, Institutes, Accredited laboratories
Project validation	Marketing, Project-development management, Technical development
Validation approval	Top management
Project realization	Project-development management, Production, Quality control
<b>V Product launching</b>	
Presenting the product to the market	Marketing
Distribution	Sales

The realization of any project is possible only if its tasks are well defined and if responsible subjects are identified. The following table (Table 1) presents these crucial elements for the realization of the project Relaunching the product Spin Surface Cleaner 1000 ml in new packaging according to the company's own methodology and process workflow.

Problems that can be identified in this specific project are tightly related to the low automation level of document flow among responsible organizational units, the low-functional approval system between stages, the difficult data change tracking and limited access to all data in real time.

Since the project Relaunching the product Spin Surface Cleaner 1000 ml in new packaging has the improved packaging as the result, the focus should be on the packaging and artwork as an innovative element in building brand equity.

A packaging has dual purpose: it must effectively and consistently communicate the brand message to the consumer, while containing the product in a space-efficient, sustainable, and compliant way. As a result, manufacturers are under increasing pressure to design more innovative packages that satisfy consumers' desire for environmentally friendly packaging, as well as fulfil retailers' demand for effective in-store displays.

The PLM platform offers out-of-the-box integration with the computer-aided design (CAD) tools for creating and validating the best possible package design aligned to brand requirements. Packaging and artwork development are brought together with the rest of the idea-to-shelf development process, for increased speed to market and confidence in design and label accuracy. On-demand visualization throughout the package and artwork development process aids in collaboration, rapid revision and approvals. Requirements, design intent and feasibility come together as all stakeholders in the process intend. A single source of packaging and artwork knowledge, including drawings, ingredient lists, claims, regulatory marks and brand assets, increases accuracy (Siemens, 2011). PLM system optimizes design process with rapid iterations and the ability to balance conflicting regulatory and retailer requirements, with traceability of all changes along the way.

Considering all the organizational units that are included in this product development process, the implementation of the PLM system in Beohemija should integrate 12 users. This means that 12 installations of the software are needed, so the main roles in this process can take their part in the improvement of a product of this company and its relaunching to the market. These users are from the following organizational units – sectors, shown in Table 2.

Table 2 – PLM system users in the NPD process

Organizational unit - sector	Number of users	User's position
Project-development sector	3 users	Manager of the Project-development sector
		Project manager
Technical development sector	1 user	Tool development associate
		Manager of the Technical development sector
Marketing sector	2 users	Marketing manager
		Brand manager
Sales sector	1 user	Sales manager
Supply management sector	1 user	Supply manager
Production sector	2 users	Production manager
		Technical preparation manager
Quality control sector	1 user	Quality control manager
Top management	1 user	CEO of the company Beohemija

PLM systems let the company link its portfolio decisions to programs and projects, which can then be linked to detailed development, engineering, simulation and manufacturing processes.

Having a single source of projects makes global program execution possible. The PLM solution connects all the participants which should cooperate in the product and process information sharing. It enables the company to digitally manage the product and process data through the product lifecycle, enables the participants to access the data in the real time, to manage the product configuration, to manage and approve changes on products. Users named in Table 2 can be integrated as a project team (Figure 3) and be assigned to each project activity with defined working hours.

Project schedules (Figure 4) are linked to requirements and project tasks can be driven by PLM workflows or change process events. It should be mentioned that the project schedule shown in Figure 4 is created based on activity dates set by the company Beohemija at the beginning of the project, that is not realized according to this schedule because of the changes in the business plan for this year. The resources have not been well optimized and allocated in this project plan, so they had to be transferred

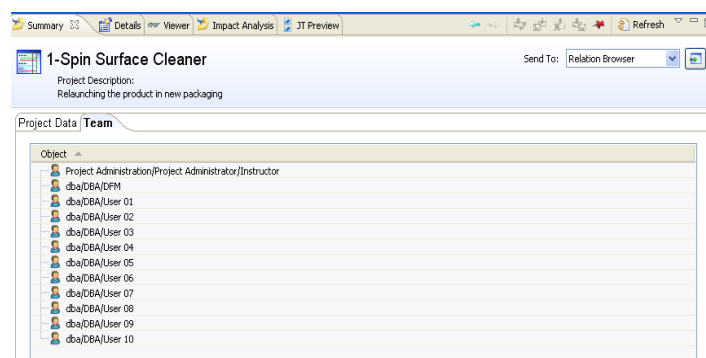


Figure 3 – Project team

to another project with the higher priority. PLM IT solution could help with this problem by enabling the company Beohemija to optimally allocate resources among projects, manage all active ones and plan future ones.

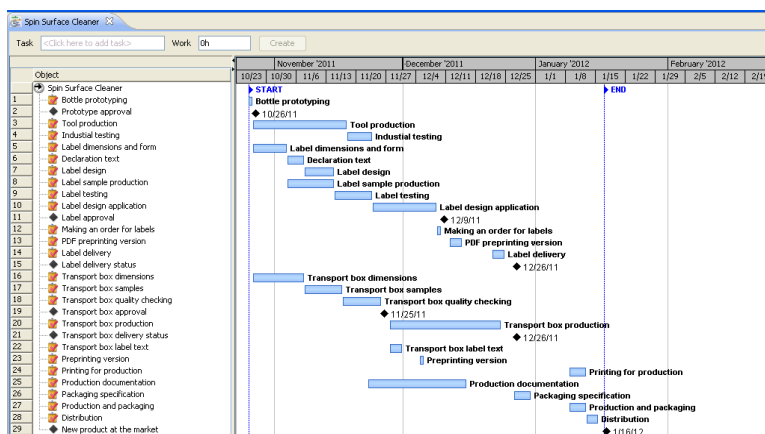


Figure 4 – NPD project schedule

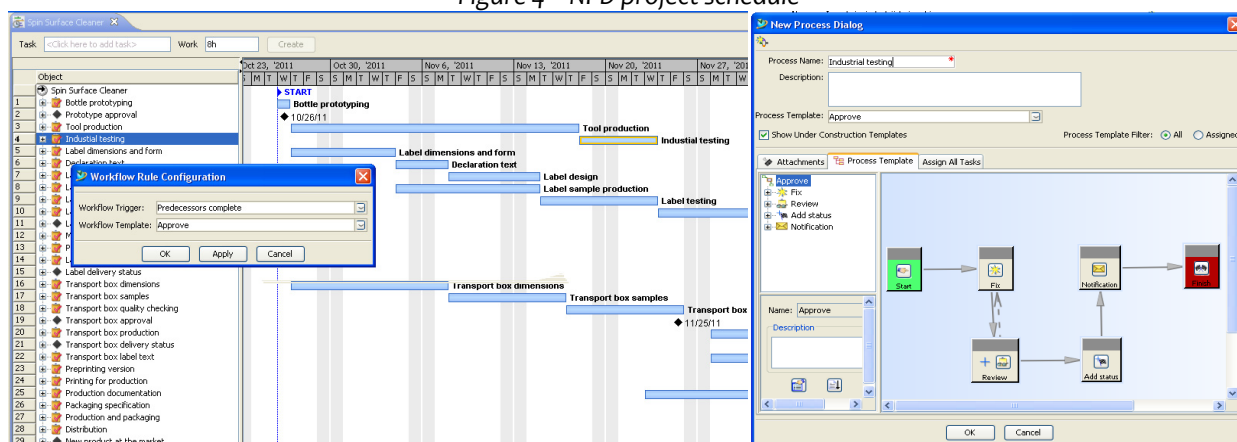


Figure 5 - Process review

Each task from a project schedule can be configured as a workflow and as such can be submitted for review (Figure 5). This enables the company to see each task as a stage-and-gate process and makes the approval and report system more efficient.

**CONCLUSIONS**

The PLM is a strategic business concept that is used for achieving business integration with the key goal: product development. The product development has to gather all the information from the overall product lifecycle (Anisic, 2011). The object of the PLM is to reduce inefficiencies through the product lifecycle. Productivity improvements of over 60% in NPDI-related activities have been achieved through PLM-enabled, enterprise-wide data and process optimization and integration. This has allowed companies to drive innovation, accelerate revenues, increase productivity, reduce costs, improve quality, ensure compliance and shorten time-to-market (PLM Technology Guide, 2008).

The project Relaunching the product Spin Surface Cleaner 1000 ml in new packaging can be managed from its beginning to its end by using a PLM software solution. All the organizational units shown in the Table 1 can be integrated in this new product development process. The process workflow can be created including its stages and gates, when decisions have to be made and outputs of the phases approved.

The implementation of an PLM software solution can be expensive and time-consuming, but it is a reasonable investment. Difficulties that can appear during the implementation in Beohemija can be related to the complicated process of new product development, that first has to be adapted to the stage-and-gate model, so the approval system could function properly, and with well defined NPD phases, so the projects could be efficiently managed and each phase adequately reported.

Twelve installations of the PLM software, which are planned for the PLM system implementation, would enable the company of Beohemija to integrate the organizational units that have very important roles in NPD process. So far, project documentation has been sent via e-mail among responsible organizational units. The PLM implementation makes this practically manually managed documentation flow completely automated and makes the approval system between project stages more efficient. Setting clear goals for development process makes the definition of the scope and PLM system demands easier (Saaksvuori & Immonen, 2010).

Other crucial problems, as the difficult data change tracking and limited access to all data in real time, are also solved by the implementation of the PLM system. Sending notifications about made data changes via e-mail to other participants is very time-consuming and it is difficult to track. All the software users, which are involved in the NPD process or the particular process stage, are automatically informed about all data changes that are made in the area of their interest and they can access them in real time.

Problems that can appear during the PLM implementation can also be related to not precisely defined roles in the stage of the NPD process. Defining the users of the PLM software is one of the most important steps before the creation of the implementation concept. The process workflow has to be standardized and it has to fit to all future projects.

The most important thing to remember is that the PLM advantages are divided into two groups – savings, through process improvements, and new possibilities for making the profit, by creating new innovative products and improving existing ones.

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