

Next generation plm  
– an integrated  
approach for the  
product lifecycle



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Proceedings of ICCPR2007: International Conference on Comprehensive Product Realization 2007 June 18-20, 2007, Beijing, China Next Generation PLM – an integrated approach for the Product Lifecycle Management Julius D. Golovatchev 1 Oliver Budde 2 1) Detecon International GmbH, Managing Consultant for Enterprise Effectiveness & PLM, Bonn, Germany 2) Research Institute for Operations Management at RWTH Aachen University, Germany Abstract: Consistent definition, categorization and operation of products (e. g. extended products, bundles, etc) delivered to global markets and customized for different buyer segments is one of the major challenges for the Lifecycle Management. Each lifecycle encompasses the processes, information, support systems and people involved in delivering the related business functions.

It can be argued that process supporting technologies/solutions like WFMS, PDM-System etc exist today for the creation of a seamless environment for accessing, manipulating and reasoning about product information that is being produced in fragmented and distributed environment. A holistic approach that is suitable for aligning the Product Lifecycle Management (PLM) business requirements (like process flexibility, shorter time to market etc) to the potentials of new technology driven concepts in the information management like SOA is nevertheless still missing. The authors give reasons why the holistic view on the product lifecycle management as well as the link between an inter-company wide information management is critical for an efficient PLM and present an integrated approach taking these aspects into account. In this paper four building blocks of Next Generation PLM are introduced. The PLM Meta Model makes up the first building block. It defines

the constraints and rules for decomposing the product functionality into meaningful modules.

The PLM IT-Architecture represents the second part and describes the IT-components and their interrelation utilized for the purpose of PLM. A PLM-Process methodology as a basis for describing the relevant activities is attached in the third building block. The final building block is constituted by the Lifecycle Value Management concept for steering the PLM- process on a strategic level like, among other things, by considering portfolio effects. The paper closes with the presentation of a short case study validating the proposed concept for a company in the service industry.

Keywords: PLM, product lifecycle management, extended product, integrative approach, lifecycle value management

1. Motivation As Shark (2004) postulates, Product Lifecycle Management (PLM) is the activity of managing a company's products across the complete lifecycle, from the early stages of conception to the final disposal or recycling of a product. From this definition, a strong interrelation between the value creation process and the PLM of the company can be deduced. Taking the current globally changing business environment into account the PLM can be considered as a strategic weapon for enabling the company to provide an additional value to customers and thereby gain a competitive advantage over their competitors. Especially in the telecommunication industry, which experienced a significant change in its environment during the last five years, PLM is considered to be essential for facing ever shorter innovation cycles (Wohler-Moorhoff et al.

, 2004). In the following two sections, we introduce the main business drivers, which currently have the most impact on a company's business model and are expected to do so in future. For each business driver specific PLM-relevant challenges can be derived. These challenges will be pointed out in detail in the last section of this chapter and will serve as motivation for our integrated PLM- approach in chapter 2. The validation of this approach is the goal of chapter 3 by introducing a case study. (1) Business Drivers Business Driver One: Management of the Extended Product The dichotomy between tangible goods and immaterial services is subject to change according to Saaksvuori (2004).

In the service industry as well as in the traditional industries like manufacturing this development towards a hybrid or extended product can be observed. (Figure 1) Fig 1: Extended Product according to Thoben et al. , 2001 Following the argumentation of Mateika (2005) a critical success factor in the manufacturing industry is the ability to provide more profitable services in addition to the tangible good. But this combination of tangible and intangible attributes in terms of the extended product increases the complexity in managing the Product Lifecycle. (Saaksvuori, 2004) Another concomitant phenomenon of the so-defined extended product is the focus-shift to a horizontal integration along the value chain (Teresko, 2004), which can be achieved by considering product modularization concepts.

Business Driver Two: Globalization Global markets result in global competition that every company is confronted with. This barely new business driver forces companies to follow either a cost-leadership strategy by standardising their products or a differentiation strategy on a global scale by <https://assignbuster.com/next-generation-plm-an-integrated-approach-for-the-product-lifecycle/>

individualizing their products. In order to perform in the cost-leadership role, companies have to implement efficient processes regarding the development of complex products and to handle the order management process. Simultaneously companies have to cooperate with numerous business partners, which results in a high effort or coordination.

A product differentiation strategy implies processes that ensure short time-to-market on one hand and an effective degree of freedom in the process definition for staying innovative on the other hand. Business Driver Three: Legal Frameworks Increasing regulations such as safety, environmental and product reliability will influence company's PLM- process. Especially the resulting effort for ensuring traceability will have an impact. Traceability has two dimensions in the PLM-context. First of all it is related to the PLM process itself.

Effective measures have to be in place in order to ensure the flow of transactions to identify where material misstatements due to error or fraud could occur (Sarbanes Oxley Act). Further, traceability in the order-delivery process is about tracking of an individual product units or even components. Legal frameworks like TREAD Act for the automotive industry in the USA or REACH for the chemical industry in EU can be subsumed under this dimension. Companies that need to respond to this kind of regulation must ensure that the implementation and the integration in the existing processes happen to be simple and at the least possible lifecycle costs. 2) Challenges

Based on the outlined business drivers, challenges for companies can be derived for the strategy, the processes & organization and the IT. An

overview of these challenges is given in the following table.

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Tab. 1 PLM-relevant challenges Strategy Impact Impact on Processes Impact on IT Business Driver 1 Less vertical integration, more horizontal integration of the value chain Focusing on product modularization and utilisation of product platforms to enable the re-use of components Collaborative PLM-process with defined interfaces Process readiness for the management of complex products Data exchange standards IT-representation of complex products Integration of business applications Business Driver 2 Commitment to either a product individualisation or product standardisation strategy Improvement in the process automatisisation Inter-company wide process standards Enterprise Application Integration with external business partner Workflow Management System Business Driver 3 Comply to regulations e. g. (Sarbanes Oxley Act, TREAD Act Support for traceability of products by standardised and well documented processes Support for traceability of processes Safeguarding data consistency Storage concepts for long-time archiving PLM is an essential component to support the value chain process in the company. In Aerospace industry, for instance, taking six month out of the development cycle can increase market share as much as 8% (Teresko, 2004).

Due to the complex and multilayered challenges, that companies have to face, an isolated, non-integrative PLM-approach is not promising. Instead we recommend a more integrative approach that addresses the relevant dimensions of the PLM and thereby ensures an effective implementation. 2 Integrated PLM- Approach The integrated PLM- Approach consists of four components, depicted in figure 2. PLM-IT- Lifecycle-Value Management 4 Meta Model PLM Architecture PLM- Process Building Blocks Fig. 2: Four

components constituting the integrated PLM-approach In the following paragraphs the different components are described further.

(1) PLM Meta-Model Many present quality deficiencies in the product development (esp. in the service industry) originate from a diffuse definition of products as well as from the inconsistent view on the object “ product“. The product (or service) should be clearly and precisely defined to be developed, commercialized and to be understood from the customer. There should be a constant product definition with the overall product lifecycle and for all business processes.

The product as the main subject of the process needs to be defined and this definition should be taken from the customer's perspective. A product is an entity the customer perceives in its entirety and is characterized by being offered to a market place. It includes physical products, services and information (compare figure 1). The precise definition of the complete product range and their categorization still remain a problem especially in the service industry (eg. telecommunication, energy, finance industry etc.

). For example, in the telecommunication industry essentially four categories of products can be differentiated: market product (service), standard solution, customized (individual solution) and bundle. All offered products and services can be assigned to one of the mentioned categories. Product definition is not simply a reflection of the engineering design.

It also includes the entire set of information that defines how the product is designed, manufactured, operated and managed on the market and finally withdrawn from the market. Product definition should be furthermore <https://assignbuster.com/next-generation-plm-an-integrated-approach-for-the-product-lifecycle/>

detailed by the company-wide specific PLM Meta-Model to decrease complexity costs. Such Meta-Model defines the product on an even more detailed level for the optimization of time to market and decreasing of resembling components PLM Meta-Model is the basis for standardization and modularization of products. Modular product data structure as core element of PLM Meta-Model ensures linking the sales perspective to the internal (production) perspective in relation to the offered products and services. The main aim of introducing a modular product structure is the optimization of the product development.

and market Internal Portfolio branch Modules Components cat I Module cat ... in well management systems Realization systems and management Sales view production view Product Modules Module II ... ... Realization PLM as as stock in production order IT architecture: Product realization: PLM-Process Transfer payments Controlling: cost / revenue, product success – accounting Production service: demand assessment, Marketing Portfolio invoicing target and regional resource planning and advance performance mgmt: structure Billing: Processes: input/ output, process quantities Fig. 3: Definition and requirements on product data structure The unique PLM Meta-Model and the corresponding processes should be implemented by considering the existing processes, company structures, and cultures. Requirements from the affected functional areas flow into the definition of the product data structure. One master product data management fits all needs of the main processes and its interfaces.

Using PLM Meta-Model leads to simplification and cost optimisation of “product engineering” through the re-use of the production modules, shorten <https://assignbuster.com/next-generation-plm-an-integrated-approach-for-the-product-lifecycle/>

“ time-to-market”, avoiding overlaps in development and reduce technical variance, availability of the product modules range of all service lines (factories) for all division of the company etc. . (2) PLM IT-Architecture The foundation for moving a product through its complete lifecycle beginning with the product idea and ending with the product removal from the market is a solid PLM IT-Architecture, that is customized for the company-specific PLM- requirements. In our perspective, such a PLM IT- Architecture must support the PLM- process in the dimensions: (1) Decision support, (2) Operational support and (3) integration of supplemental business applications. A standardized off-the-shelf PLM-System is therefore not the tool of choice as Ausura and Deck (2007) point out.

Instead we suggest to rely on a PLM IT- Architecture that re-uses, respectively ustomizes existing IT- components as far as possible. In the next paragraphs a description of the essential IT-components is given that build up the PLM IT- Architecture. Decision Support System (DSS): The main purpose of a DSS is to gather and consolidate data from operative systems in order to provide the senior management with aggregated information regarding the product lifecycle. The Computer Aided Selling (CAS) module provides functionality for the product configuration 1 and product pricing.

The component Strategic Resource Management focuses on the long-term resource capacity planning on a strategic level. Product ortfolio management aspects are covered with the last Value Management component.

Operational Support System (OSS) On the operational level the PLM- process execution is supported by the OSS. The Workflow Management Systems

(WFMS) enables a higher degree of process automation. Especially in the <https://assignbuster.com/next-generation-plm-an-integrated-approach-for-the-product-lifecycle/>

context of distributing and releasing unstructured content like a product specification in cross-functional teams, the WFMS plays an essential role through a strong link to the Product Data Management System (PDM).

The Product Modelling System and the PDM are closely coupled. The former defines the product structure, in which types of modules the product is decomposed into. In the database context this functionality is similar to the schema definition. The PDM-systems stores all product relevant data according to this definition and provides different views for each stakeholder e. g.

marketing and engineering. The Multi-Project Management System as well as the Collaboration Tools are instruments for managing the product in different phases in a collaborative environment. Integration of supplemental business applications: A PLM IT- Architecture is supposed to hold the promise of seamlessly integrating and presenting all information reduced throughout all phases of a product's life cycle to everyone in an organization, along with external business partners. For ensuring this functionality, an EAI-approach has to be implemented. According to recent research activities a Service Oriented Architecture (SOA) is most suitable to integrate the business applications from external partner e.

g. suppliers as well as integrating the own business applications like ERP, CRM etc. in order to fulfil the promise of seamless integration for becoming a real-time enterprise (Abramovici, 2002). Product-Marketing Management Exit Management CAS Strategic ResourceManagement Value Management Applications Supplier) Multi-Project- Tools Workflow- Product System

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Applications CRM CAD Decision System PLM- Process Business Customer) layer (Development Product Operational Support System Business (Management System Product-Data-Management System Collaboration Management Modeling System Business SCM ERP Support Applications (Integration-SOA) 1 The CAS module is also essential in the operative context for the order management.

In our understanding CAS goes beyond the operative support and helps to steer the variant management in order to cope with the increasing product complexity nowadays. . For example hierarchies of assembly groups can be defined. Additionally constraints and rules can be modeled constricting the combination of specific modules. Fig. 4: PLM IT- Architecture building the IT- foundation of the PLM- approach (3) PLM-Process and Structure In this section the PLM-Process description will be introduced.

The main design goals of this approach is to facilitate the execution of this collaborative process (efficiency goal) and equally important to align the activities with the strategic goals of the company (effectiveness goal). Our PLM-Process approach is based on three principles: Stage Gate Approach, Multi-Perspective, Metrics based Management. These principles are subject for further explanation in the following paragraphs. Principle One: Stage-Gate Approach The Stage-Gate Approach is both a conceptual and an operational model for the development, marketing and removal of a product during its life cycle. The PLM- Process consists of seven stages.

This structure is oriented on the life cycle of the product and has been validated in several projects by Detecon Inc. primarily in the Telco-Industry.

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Every stage consists of a distinct number of activities (organized in perspectives, refer to the next section), which have to be accomplished by specific process stakeholders at the given phase. The entrance to each stage is a gate; these gates control the process much like quality control checkpoints. Each gate is characterized by a set of deliverables as input, a set of exit criteria and an output.

Gates are manned by senior managers that form the so-called Product Board. The Product Board acts as a gate-keeper that evaluates the results from one stage by a given set of criteria. Based on this evaluation, the product board can either decide whether the product idea proceeds to the next stage, re-starts at the previous stage or is archived. Principle Two: Multi-Perspective Product Lifecycle Management has always to cope with the conflict of objectives between the product marketing and the technical side.

Several case studies have documented that this conflict often results in product failure in the market. Either because the product specification is too much technical driven and therefore far from the market demand or the product marketing has defined product specifications without collaborating with the technical department about technical feasibility beforehand. For solving that conflict of objectives three perspectives on the process have to be taken into account in order to ensure an efficient coordination and collaboration of the relevant departments or business partners. In the market perspective all activities are assigned to that relate to the product marketing. Referring to the service industry, typical tasks like the definition of product specifications and the management of the product on the market-place belong into this category.

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By contrast the technical perspective subsumes all technical or production-oriented activities. Additionally the financial implications of moving the product through the life cycle re grouped in the financial perspective.

Principle Three: Metrics based Management In addition to the process definition the organisational component must not be neglected. Since products, and consequently the PLM-process, become more complex and involves internal as well as external partners along the value chain, there is a greater need to balance top- management control with the empowerment of self-managed, cross functional teams. As a prerequisite for achieving this balance, the company has to implement a metrics-based management approach in which teams are measured on strategic performance indicators such as development cost, time to market and customer satisfaction. The definition and selection of the indicators is critical for the successful implementation of the PLM-concept.

By setting the weights properly the teams will self-steer to the greatest short- and long-term profit, which results in less coordination effort and efficiency gains especially in the context of for cross- departmental teams.

Evaluation Implementation Marketing Management Perspective Perspective  
Business Plan Implement Plan Technical Implementation Launch Product Go-  
Live technically Business Case Monitor& Manage KPIs Monitor&

EnsureProduct& Process Controll Business Case Delivery Finalize 1 3 4 5 6 7

Gate 1 Gate 4 Idea Paper Description Report by Board Innovation-

Management Planning Launch Exit Market Technical Financial Perspective

Market& Capabilities Analysis Technical Evaluation Financial Rating Market

Roll-out Planning Develop technical concept Detailing Business Case Market

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Adjust Business Case Monitor Innovation-Market Exit Technical Exit Business Case 2 Gate 2 3 Gate Gate 5 6 Gate Detailed Design Product Launch Report Mgmt. Approved the Product Fig. 5: PLM-Process based on three principles (4) Lifecycle Value Management Life cycle oriented product planning is a necessity for companies on the competitive market and requires a robust and systematic process combined with the right organizational environment. Enterprises use Lifecycle Value Management to support the management of the product after launch through the growth, maturity, and decline stages of the product life cycle. In the overall value chain, Lifecycle Value Management ensures that the products and services which are developed and implemented fulfill the market requirements and reflect the market demand.

Lifecycle Value Management requires permanent attendance for analysing and planning or ensuring the customer benefits and the alignment to all company functions. There are three different but supplementary building blocks of Lifecycle Value Management. PLM and Lifecycle Management Value Reporting Controlling Customer Needs Management Value Oriented Portfolio Management Fig. 6: Three building blocks of Lifecycle Value Management Value oriented portfolio management (incl.

IT-supported portfolio database) Increasing complexity of the product marketing without an appropriate and efficient data foundation will result in a lack of business transparency and low synergies in the value network. The modular structure of the portfolio promotes the use of common parts in the production processes, increasing the ratio mass production to overall production. Strategic alignment and value based product portfolio

management enable an effective product lifecycle management. Focusing on <https://assignbuster.com/next-generation-plm-an-integrated-approach-for-the-product-lifecycle/>

clearly defined products makes a significant contribution to effective portfolio management. The products can be positioned without overlaps and in accordance with market demand.

Value oriented portfolio management helps to prioritize product investments. Sales and marketing departments benefit from the increased transparency of the product range and the improved comprehensibility for the customers.

Reporting and controlling process regarding the product lifecycle management process The referencing of different divisions (sales, resources and production planning; cost/profit accounting, etc. ) to a standard product definition lays the foundation for the application of important controlling instruments (e.

g. product success accounting). The unambiguous correlation of the basic data to business management indicators along the lines of a standard product structure provides staff and management with precise and timely information about all of the critical success factors that help staff and management to make the right decisions at the right time. Customer Needs Management Customer Needs Management incl. Requirement Management builds interface between PLM and Customer Relationship Management (CRM) and gives input for the collaborative product design.

The effective Customer Need Management ensures that product content matches customer requirements and allows delivering more personalized products by facilitating mass customization Implementation of these three building blocks combined with a modular product data structure ensures the “ state-of-the art” Lifecycle Value Management: Individual product

performance information available at real-time. Product Manager retains product accountability throughout life cycle. Strategy for product growth, maturity, and withdrawal stages is defined up front. Product replacement strategy also considered. Systematic (e.

g. annual) review and clean-up/optimization of product portfolio. Supplier and customer are involves in the high collaborative integrated PLM 3 Case Study A renowned company in the telecommunications industry carried out an extensive restructuring program which would enable it to maintain its position in a deregulated market environment. The objective was on the one hand to convert the previously technical driven approach for the product design (i.

e. , their orientation towards technical performance features) to an approach focusing on the customers' needs and requirements. On the other hand, the aim was to develop and implement the integrated management approach, Next Generation PLM. In the initial situation the PLM and the platform was not "state-of-the-art" (e.g. no withdrawal phase, missing of decision gates, long "time-to-market" etc).

A portfolio management process was not designed and implemented. The current portfolio structure was oriented on the rganizational or technical structure and not organized from the customer's point of view. The product portfolio was characterized by a large number of product variants and features. All these products needed to be handled individually from an IT management perspective. This broad variety of products needed to be realized and implemented within all operative processes, IT-applications and

-systems as well as sales information tools. This led to an enormous complexity that impedes the maintenance of IT-landscape and the management and optimisation of the processes.

No integrated IT-solutions were available at company and at its affiliates.

During the project the integrated PLM approach valid for the company and its affiliates was developed. Implementation of Next Generation PLM at this company showed the valuable benefits for solid product development, marketing and strategy: PLM Meta-Model: Easier know how exchange and using of the “ same language” during product development as well as fast and efficient communication between international partner Introduction of the harmonized product definition and product portfolio for all national and international affiliate companies The product portfolios across all of the company were to be reduced by 50% and integrated into a modular structure. Adoption of the product data platform at all international subsidiaries PLM Process and Structures Acceleration time-to-market up to 25% by several product groups Efficient cost savings along the PLM process by using standard support system and re-using of modules and components (process costs saving up to 170 m USD/year in the product realization phase) Effective and similar procedure of innovation and market management projects execution PLM IT-Architecture An implemented shared platform for document and project management.

One physical server is used to support separate product lifecycle

management processes in all divisions and subsidiaries Lifecycle Value

Management Sound marketing strategy due to the early recognition of

market needs and standardized information More detailed input for

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controlling for exactly allocation of revenue and costs to products Simpler allocation at cost centres and cost unit Introduction of the harmonized product portfolio for all national and international affiliate companies

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