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Does PLM have a Future in the Age of Digitalization?

Position Paper: Future PLM

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Abstract

Introducing and operating a PLM system is a cost-intensive undertaking. According to PLM expert John Stark, half of all PLM projects end in failure. The networking of products and services via the Internet of Things (IoT) raises the question of whether PLM is now no longer up to the demands placed on it. Is PLM, as we know it today, on its way out, rendered obsolete by linked data, big data and self-learning systems? Or, to put the question differently, how will PLM have to change in order to provide companies with optimum support during their digital transformation?

PLM experts from user firms, software vendors, consulting companies and universities addressed these questions in a workshop and raised a variety of issues concerning "Future PLM" in order to prompt a discussion of requirements and possible solutions. The authors of this position paper are Sylke Rosenplänter (Opel), Bodo Machner (formerly BMW), Thomas Kamps (CONWEAVER), Karsten Theis (PROSTEP), Martin Eigner (Kaiserslautern Technical University) and trade journalist Michael Wendenburg. All of them agree that we need a new type of PLM.

This Position Paper comprises the 22 work out theses and invites all reader, to provide comments and discuss it in public.

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Position Paper: Future PLM

Does PLM have a Future in the Age of Digitalization?

Digital Transformation

1. *PLM must take on new tasks* - The digitalization of products and production will change the face of PLM. Products will be networked with their environment and with the user via the IoT. After-sales and customer service are playing an ever more important role as part of the product offering. Data from the product use phase must be linked back to the engineering data so that custom products can be manufactured in intelligent factories without additional effort or expense.
2. *There is no definitive digital master* - Any future approach to PLM will revolve around the aggregation and linking of distributed data to form a digital master, i.e. an end-to-end digital product description incorporating data from development, production and operation. This digital master must be constructed collaboratively step-by-step and is subject to a continuous process of change.
3. *Fusing the digital and real worlds*– The development of products that are networked with their environments and the provision of support for service-oriented business models demand that conventional product data (as present in the digital master) be linked to the digital map of the shipped product configuration (*digital twin*), and necessitate the use and linking of production and operating data.
4. *Future PLM is a management matter* - The digital transformation of a company is a matter for management. PLM as the *enabling technology* for digitalization must therefore be firmly rooted in the board or management philosophy.

Processes and Methods

5. *An interdisciplinary mindset is essential* - Current PLM and ERP processes are largely shaped by mechanical engineering requirements and offer only inadequate support for electrical/electronic development, software development and service planning – areas whose own processes cannot always readily be transferred to the mechanical engineering field. What is needed are, on the one hand, suitably adapted PLM concepts and, on the other, agreements, methods and system functions for cross-domain collaboration.
6. *Future PLM needs to adopt new structures* – Smart, networked products and new, service-oriented business models are calling the central role of the traditional *bill of materials* (BOM) in the structuring of product data into question. PLM must support new structures for a range of different tasks, e.g. for requirements management within a model-based systems engineering (MBSE) framework, for cost optimization or for project management. The methods used in MBSE form the basis for the integration of mechatronic and cybertronic systems.
7. *PLM architectures do not stop at company boundaries* - Support for collaborations with joint ventures, development partners, suppliers of systems, software and services, etc. is a key demand placed on future PLM architectures. At the same time, these architectures must ensure that the *intellectual property* of OEMs and partners is protected.

PLM Architectures

8. *Monolithic systems have had their day* - Monolithic solutions are no longer adequate in the face of the increased complexity of products and processes. Moreover, no single system is able to cope with all the processes and stakeholders involved in the product lifecycle. We need federated semantic networks that link the digital models that are distributed across the various subsystems. (e.g. the data from the design phase, from series development and from in-the-field product use).

9. *Future PLM must be able to change* - Future PLM architectures will have to be based on consistent but extensible master and structure data, while providing functional modules that can be adapted autonomously and flexibly to changing processes and organizational structures. They must support dynamic adaptation because the data models will change regularly and, as the processes in the organization change, so too will the owners of the individual data objects

10. *Successful PLM implementation is more than just a change of system* - New PLM architectures cannot be implemented simply by replacing one system with another. Instead, they must be continuously adapted to changing business models and processes. This is only possible in a context of standardized services, cross-system integration layers, semantic networks for linking data and role-specific user functions.

11. *Data linkage not synchronization* - A modular IT architecture with *best of breed* solutions guarantees a flexible working environment that meets users' expectations. Context information from third-party systems can be provided across system, process and enterprise boundaries by means of a persistent *linked data layer*. This *linked data layer* is also a prerequisite for efficient MBSE processes.

PLM Functionality

12. *Seeing the light on the dark side of the moon* - The product use phase, about which manufacturers previously had little information, is becoming part of the product lifecycle. The PLM systems of the future will have to be able to manage complex product configurations, including electronics and software, and be able to map changes to the configuration in live operation (*digital twin*).

13. *Future PLM must involve customers more closely* - New technologies such as the additive manufacturing methods, augmented reality, etc. are making new, service-oriented business models possible. In the future, customers will be able to configure certain aspects of a product or its design themselves so that the product continues to develop even after it has been shipped. These changes must flow back into the PLM system.

14. *Data garbage must be eliminated* - The volume of data managed in PLM systems is constantly growing. We therefore need to think about the question of archiving or disposing of data elements and their links even though, to a certain extent, this contradicts the PLM principle of traceability.

15. *Variance must be easier to manage* - Modular product development and modular products are essential if it is to be possible to reuse existing assemblies and interlink engineering with the *configure-to-order* process. PLM systems must support both variant configuration and indications of use of transverse modules / toolkits across different brands, variants and derivatives.

PLM Implementation

16. *PLM systems must become more open* - Openness as set out in the Code of PLM Openness (CPO) is a necessary precondition for implementing future PLM architectures and all the systems and components they comprise. The closed applications developed by certain IT technology vendors are in total contradiction to this requirement. Successful PLM systems offer flexible configuration capabilities and open interfaces for data exchange and linkage.

17. *Greater transparency in PLM projects* - In the same way as in product development, agile procedural models should be chosen for PLM implementation in order to reduce complexity and respond to the dynamic pace of change. The challenge lies in finding the right balance between agile methods and a stable underpinning. Successful project management must aim for consistent implementation and system introduction in order to ensure that the planned goals are achieved on time and on budget.

18. *PLM introduction is not an IT project* - The future PLM environment can only be implemented successfully through cooperative project organization involving process managers, process users and process IT. During implementation, it is necessary to adopt a global view of all the process changes involved, including the benefits and the effort involved in migration and system introduction.

19. *Future PLM must be more cost-efficient* - Greater attention should be paid to the total cost of ownership during PLM implementation. Model-based technology platforms that permit extensive interactive customizing and, more importantly, support the automatic adaptation of the configured PLM solution on subsequent upgrades from the basic version are reducing operating costs. However, it will also be necessary for vendors to adopt new business models, for example subscription models that do away with the payment of license fees.

People and Organization

20. *Future PLM demands new skills* - Interdisciplinary collaboration between mechanical, electronic and software developers, as well as between product development and service departments, demands all-rounders with excellent people skills. This demands that not only colleges and universities but also enterprises offering further training opportunities develop new course profiles.

21. *Future PLM stands or falls by the added value it offers users* - Developers and design engineers still think of PLM systems as a brake on their creativity. They need a working environment in which they can share their *work in progress* with others without any administrative overhead. This raises the question of how the system can support users better through the linking of information, through the generation of proposals by the system itself and through self-learning mechanisms, and of whether this type of support is actually welcome.

22. *The user data belongs to the user* - The intelligent networking of products via the IoT is opening up previously undreamed of technological capabilities, such as autonomous driving or remote control of home automation solutions via a smartphone app. It is not only extending the reach of PLM to include aspects such as cybersecurity but is also raising ethical and legal questions relating to the handling of information and user behavior.

