ORIGINAL PAPER

PRODUCT LIFECYCLE MANAGEMENT FRAMEWORK FOR BUSINESS TRANSFORMATION

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ABSTRACT. **Background:** The role of Product Lifecycle Management (PLM) in business change varies in scope and impact. PLM initiatives range from Information System (IS) change to strategic business transformation, and capabilities to implement PLM successfully are unclear. The paper identifies a PLM framework for transition and related variables. Understanding these variables influence successful PLM transformation.
Methods: The methods used in this paper include a literature review on existing frameworks available for PLM initiatives. This paper is based on a PLM case study done between 2011 – 2015, when the company's strategy transformed it from an engineering company to a product and service company.
Results: The results show that strategy-driven PLM transformation impacting a company on many levels, and PLM focusing on IS-driven process harmonisation fails due to limited knowledge of the business models, products and services.
Conclusions: The conclusions are that PLM is at the core of business transformation and cross-functional impacting products, services and customers.

Key words: product lifecycle management, product management, enterprise architecture, business model, business strategy.

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INTRODUCTION

PLM is a key initiative for many companies, but the methods used and results obtained from PLM initiatives are conflicting. The promised value of PLM initiatives is not always realized or even evident after PLM implementation. Due to the rapid pace of digitalization and the emerging service economy, PLM is under pressure to deliver on its promise and go even further in the future [Sääksvuori 2016].

This paper focuses on research and models that can be applied to the manufacturing industry, where the character of the business is complex solution deliveries that require deep technology and engineering capabilities. This low-volume, high-mix solution is typical for many European manufacturing companies. The challenges that these engineering technology companies face when implementing PLM are dependent on the product, service and PLM maturity level. The business characteristics are often project-driven Engineering, Procurement and Construct (EPC) solution deliveries. This paper looks at how the case company applied and implemented PLM to transform to a product-service company.

For a PLM transformation to succeed, it is important to understand the different areas that must be taken into consideration before and during the PLM initiative. Existing PLM

research is reviewed in the context of the case company's industry logic and PLM implementation requirements. The approaches that are of interest are those that can be used or applied to an engineering technology company that is transforming to a product-service driven company. The literature review answers the following questions:

– what PLM maturity models exist that can be used to understand the current state and set the degree of transformation?
– what PLM models or guidelines exist that can be used in an engineering technology company to implement the transformation?

Therefore, the current state, the company's objectives and readiness need to be mapped from the following viewpoints:

1. What are the objectives for the PLM change?
2. What is the definition level of products and services?
3. What is the current state of the company's operating model (enterprise architecture)?
4. What product and services definition change is needed to achieve the objectives?
5. What changes are needed in the operating model (enterprise architecture) to achieve the business capabilities?
6. How to implement change in an organization (program and change management)?

This paper is divided into three parts. The first part is a literature review (Section 2) of exiting models based on research findings. The second part is a case study based on the PLM business transformation that was carried out between 2011 – 2015 (Section 3). The third part (Section 4) concludes what was learned from the case study and the literature review, and how well the research supported the transformation carried out in the case company. In addition, there is a list of new additional questions that require further investigation.

LITERATURE REVIEW

PLM Maturity Models and Framework

Vezzetti et al. published a maturity review of the different available PLM Models [Vezzetti, Violante, Marcolin, 2013]. The PLM models reviewed include areas that are considered important for PLM implantations. The high-level areas that are covered in the different PLM models are:

1. Business dimension influencing PLM
2. Maturity Model
3. Guidelines for PLM implementation

The literature review presents six alternative PLM approaches that can be used to understand PLM maturity and plan how to proceed. Out of the six models presented, the origin of five is academic and one originates from consultancy [Stark, 2006]. The characteristics of the different models vary and their focus varies from information system-centric to business strategy-centric.

Out of the six models presented in the study by Vezzetti et al. , the models that can be utilised in a low-volume high-mix products and services are of interest [Vezzetti, Violante, Marcolin, 2013]. Table 1 summarises the main characteristics of the PLM models selected.

Vezzetti et al. conclude that the main objective of using a PLM Maturity Assessment is to make the implementations of PLM more approachable and a plannable process [Vezzetti, Violante, Marcolin, 2013]. The PLM models offer a starting point for a company to structure PLM. It also offers management a way to phase the PLM development in more manageable parts that have a logical sequence [Silventoinen, Papinniemi, Lampela, 2009].

Saaksvuori and Immonen [Sääksvuori, Immonen, 2005] present how a company can implement a corporate-wide PLM concept impacting the related processes, and information systems [Silventoinen, Papinniemi, Lampela, 2009]. The principle of this maturity model is a phased approach that a company goes through when implementing PLM. It covers possible changes to the enterprise architecture and organisational

culture. However, the focus here is more on the Information Management PLM system and related data models. Processes are presented, but they are high level core business process reviews [Silventoinen, Papinniemi, Lampela, 2009]. Sääksvuori and Immonen's maturity model has 5 maturity levels [Sääksvuori, Immonen, 2005]. Silventoinen et al. [Silventoinen, Papinniemi, Lampela, 2009] proposed a modified version of this model that is presented in Table 1. This model is divided into five maturity levels: (1) Unstructured, (2) Repeatable but intuitive, (3) Defined, (4) Managed and measurable, and (5) Optimal process and concepts that are continuously refined.

Stark's [2006] PLM model is similar to the model of Sääksvuori & Immonen [2005]. However, the business dimension is divided into 3 areas, as presented in Table 1. The important addition is the company focus and the introduction of the lifecycle concept from the customer's and company's point of view. This introduces the concept of an inside-out versus outside-in view of the product and service lifecycle. This can also be seen as a logical step towards creating a customer-driven operating model in an enterprise. Moreover, this can lay the foundations for integrating customer experience and service design elements to a PLM Model. The maturity model presented is similar to Sääksvuori's [Sääksvuori, Immonen, 2005].

Kärkkäinen et al.'s [Kärkkäinen, Pels, Silventoinen, 2012] model is the newest PLM model is built on earlier models. A significant addition is the introduction of the customer dimension. This model introduces the need to consider customer needs and the customer knowledge in a PLM implementation. According to Karkkäinen et al. [Kärkkäinen, Pels, Silventoinen, 2012], PLM includes customer information from three different aspects: (1) information that has value for the customer, (2) traditional customer information about the customer, and (3) information from the customer how the products and services are used in operational life [Kärkkäinen, Pels, Silventoinen, 2012]. This enables a company to create insight into how the customer operates based on operational product-service information. This opens up an interesting possibility to align Customer Relationship Management (CRM) and PLM. Kärkkäinen et al. present a maturity model that is similar to Sääksvuori's [Sääksvuori, Immonen, 2005] and Stark's [2006]. However, the significant addition to their maturity model is the addition of customer information and customer insight that can be gained from it as a company advances from level to level. One missing element from this model is the guidelines how to implement PLM. This can be applied from either Sääksvuori or Stark's [Sääksvuori 2016].

All the models presented in the references do not cover the products and services that are impacted by the PLM implementations. The models are also missing the product definitions presented by Haines [2009].

The challenge for any company is to identify the most relevant model that can be adapted to the contexts of the business. These models offer a starting point to create a systematic approach and understand the PLM transformation (Current state vs. To-be state).

CASE COMPANY

The case company provides leading technologies and solutions to different industry areas and the solutions provided to the customer range from spare parts to operate and maintain, and equipment for production plants. The business transformation started in 2010 and the first steps to organise PLM development started in 2011. The transformation was the responsibility of a dedicated internal development organisation for the business lines and areas.

The first operating model development phase focused on core and supporting business process development and IS. This led to siloed process development and IT system development, which did not work together. In addition, the supporting IT development was independent of the core processes they were supposed to support. These first attempts to deploy failed due to the uncoupling of process and IT application. Only limited capabilities from the operating model could be brought

into use. A major challenge was the business lines' concerns that the new operating model did to support their business requirements

In 2011, a move towards PLM-driven development was initiated resulting from a productisation audit that covered products and services. The audit highlighted risks in: (1) product management maturity variation, (2) revenue generation insight into and between products, (3) product and service definition of unstructured and missing areas, (4) product management tasks being done in delivery projects, (5) limited cross-product/service knowledge between products in the organisation.

A separate audit was carried out to determine the PLM maturity level. This led to the first objective to create an initial PLM Concept. The focus of the PLM Concept was a simplified process and PDM-centric adaptation of the business dimensions

presented by Sääksvuori [Sääksvuori, Immonen, 2005] and Stark [2006]. This concept work led to improved system and process alignment, but the limiting factor was still applicability to the product and service lines.

The case company's product, service and technology portfolio is heterogeneous and was managed independently by the product and technology managers. Most customer deliveries, especially plants and process lines were based on past project deliveries. Some product lines were using systems engineering and Configure-to-Order (CTO) principles and were found at equipment level. Service products were managed as part of the product lines, but typically this was unstructured. Figure 1 illustrates the case company's different industry areas and the technology, products and services that are to be managed over the entire lifecycle.

Table 1. Simplified version of the PLM Maturity Models and the relevant attributes

Attribute category	Model		
	Sääksvuori (2004) [4]	Stark (2011) [5]	Kärkkäinen (2012) [6]
Name	Product Lifecycle Management	Product Lifecycle Management	Defining the Customer dimension of PLM Maturity
Origin	Academic	Consultant	Academic
Business dimensions	• Process • Structures • IT Systems • PLM Strategy • People in change management	• Company • Product development • PDM	• Strategy & Policy • Management & Control • Organisation & Processes • People & Culture • IT • Customer focus
Number of business dimensions	5 Primary	3 Primary	6 Primary
Maturity levels	1. Unstructured 2. Repeatable but intuitive 3. Defined 4. Managed & measurable 5. Optimal	1. Traditional 2. Archipelago of PLM Islands 3. Frontier-crossing PLM 4. Enterprise wide 5. Patchwork 6. Enterprise wide enterprise deep	1. Chaotic 2. Conscientious 3. Managed 4. Advance 5. Integration [1]
Number of maturity levels	5 Primary	6 Primary	5 Primary 4 Secondary
Guidelines the PLM implementation	1. Define PLM goals for implementation 2. Analyse existing PLM foundation 3. Rank Processes 4. Identify company maturity level 5. Select appropriate reference model 6. Customize reference model 7. Define requirements for system selection 8. Select software solution 9. Define roadmap & implement SW solution	1. Understand as-is situation 2. Understand the desired future state 3. Develop an implementation strategy from current to future situation 4. Develop detailed implementation plans corresponding to the strategy 5. Implement the plans	-

New beginning – Strategy Driven PLM

The decision to create a corporate-wide PLM Concept and nominate a PLM Concept owner was made in spring 2011. This paved the way to create a strategy-driven PLM concept and implementation project. This approach applied ideas presented in Sääskvuori's [Sääksvuori, Immonen, 2005] and Stark's [2006] PLM's Models. The work also integrated the product and service definition work carried out with product lines applying the modified method from Haines [2009].

The first task was to define the maturity levels and business logic of the different product lines in the case company. The maturity levels varied across the company, as did the business logic.

Based on the mapping in Figure 1, the case company's PLM Maturity Levels can be categorised, for example, with Kärkkäinen's model [6] as follows:

Level 1: Chaotic stage – Level of coordination is low
 − Corporation-wide
 − Industry Areas with all technologies, products and services
 − Chemical – Plants & Process Islands
 − Next Generation Services

Level 2: Conscientious stage – Level of coordination is mainly at functional level
 − Metals Refining – Plants & Process Islands
 − Water Treatment – Plants & Process Islands
 − Energy – Plants & Process Islands
 − Mineral Processing – Plants & Process Islands

Level 3: Managed stage Level of coordination is reaching cross-functional and company level
 − Mineral Processing – Equipment & Services
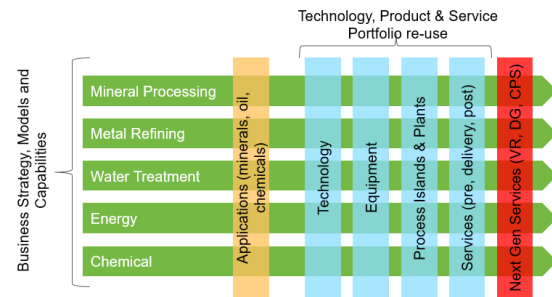 − Metals Refining – Equipment & Services

Fig. 1. Case Company industry areas, technology, product, and service footprint

Level 4: Advanced stage Level of coordination is dyadic in inter-organizational relationships.
 − None

Level 5: Integration stage Level of coordination is extensive, reaching inter-organisational networks
 − None

The result highlighted that corporation-wide PLM maturity was at a chaotic and unstructured stage. Moreover, it was evident that equipment and service were at a higher maturity level than the plants and process island. This meant that the strategy would be difficult to achieve if investment in PLM were not made.

The case company strategy was both the driver and justification for the PLM initiative. The alignment to the strategy and the strategic PLM objectives. The strategic drivers were as follows:
 − 3-fold increase in revenue by the year 2020.
 − Improve return on investment for customers with efficient operating costs and technology.
 − 4-fold increase in service business from current level.
 − Reduce engineering hours in delivery projects
 − Increase the reuse of products, services and modules in delivery projects.
 − Increase the level of strategic sourcing to improve cost competitiveness.

The PLM initiative also supported several strategic initiatives, for example, (1) customer centricity, (2) customer and companies earning logic, (3) leading technologies, and (4) product-service competitiveness.

Product Definition

The productisation state revealed the need to create a common product and service definition within the company. This led to the Product Definition concept, which defined the information needed to unify the products and services across the company. The definition was divided into two dimensions. The first entailed equipment product definition, service product definition and plant product definition. The second dimension related to the productisation levels (A, B, C, D) that were defined for each product and service.Level A was productised more than 80% and fully managed by product management, while level D was less than 20% and was not managed actively by product management. In addition, the product and service management defined which products and services were productised first based on business prioritisation.

The Product Definition was a modified version of the concepts presented in Haines [11]. The productisation categories that each product had to fulfil were:
 − Product and Business Management
 − Sales & Marketing
 − Engineering
 − Delivery
 − Services
 − Quality, Environment, Health and Safety

Each of the above areas contains a set of deliverables that have to be available for the products and services. Based on this available content, the product was assigned a productisation level in the current-state-analysis and a productisation target based on the product strategy (to-be). The productisation work also prioritized which product definition areas were required for each product and service, for example, new product introduction products had different focus areas to mature products. As an example, the productisation target levels for the products and services to support the product strategies according to the

Productisation Maturity Level [Haines, 2009] were:

Level A: Productisation level more than 80%
 − Mineral Processing – Equipment & Services
 − Metal Refining – Equipment & Services
 − Energy – Equipment & Services
 − Mineral Processing – Next Generation Services

Level B: Productisation level between 60% - 80%
 − Water Treatment – Equipment & Services
 − Mineral Processing – Plant & Process Island
 − Metals Refining – Plant & Process Island
 − Energy – Plant & Process Island

Level C: Productisation level between 20% - 60%
 − Water Treatment – Plant & Process Island
 − Chemical – Equipment & Services

Level D: Productisation level less than 20%
 − Chemical – Plant & Process Island

The decision to set different target levels also reflected the current and anticipated reuse level of the products and services in their own industry area, but also in other applications across other industries. This is typical, for example, for automation systems. This also highlighted the need to define the product management roles and responsibilities of the different products and the interfaces between the products. This also requires a product architecture that supports both Engineering-to-Order (ETO) and Configuration-to-Order (CTO) principles as presented in Forza & Salvador [10]. Due to the nature of the solution business that the company is in, the product definition and PLM concept created two addition definitions that were the (1) product-in-product concept, and the product-and-service time-dimension. The first concept identified the relationships between (1) equipment and services, (2) equipment and production processes, (3) processes and plants. Additionally, software system relationships were defined for the above products and services. The product-and-service time-

dimension defined three things: (1) the product platform relationship to scalable products, for example, size, and continuous improvement to extend the product lifecycle. The second (2) defined the integration possibilities of the products to create larger system. Finally (3), the relationship between the physical product and the pre-delivery, delivery and post-delivery services.

Strategy driven PLM framework in case company

The first challenge was the role of PLM in the company's organisation and operating model. Initially, it was a functional part of the Research and Development (R&D) Core Business Process. PLM was seen as only having a role in the R&D Process function and it was located between the Process and supporting IT systems. Based on (1) the productisation audit, (2) the PLM Maturity analysis and (3) the interviews carried out with the product and business line heads, it was clear that there was a business need for a corporate Product Lifecycle Management concept.

The first objective was to position PLM in the correct place in the organisation and operating model. An overall framework was created to support the PLM initiative based on Osterwalder [Osterwalder, Pineur, 2010] and TOGAF principles (Figure 2). This was used to argue the importance and organisational location of PLM, but it also gave clarity to the whole enterprise architecture development.
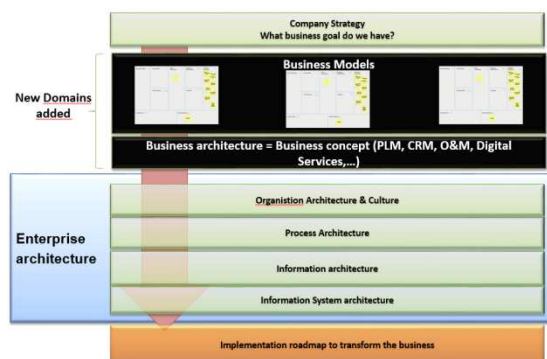

Fig. 2. PLM impact on the Enterprise Architecture

The business model is used to identify the existing and missing business capabilities. For the PLM framework, these capabilities are categorised into three capability domains: (1) PLM, (2) products and services, and (3) customer. The products and services are central to defining the value proposition in the business model. Similarly, customer knowledge is the basis for defining the Customer Segments [Osterwalder, Pineur, 2010]. According to Osterwalder [Osterwalder, Pineur, 2010], the company uses customer segments to understand what value is created and who its key customers are [Osterwalder, Pineur, 2010]. Both the existing and missing capabilities originate from the strategy and business model. The business model capability defines what PLM must do in the operating model (Enterprise Architecture), and these PLM capabilities can be further broken down into PLM features and requirements.
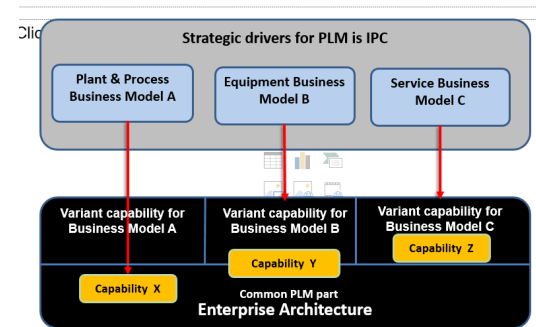

Fig. 3. Capabilities that define the PLM section of the Enterprise Architecture

The capabilities are the parts of the enterprise architecture that are divided further into convenient sized changes or revisions to the organization, processes, information and IT Architectures (Figure 2). The capabilities that drove the PLM model in the case company were: (1) product, service and module reuse, (2) increase service business, and (3) reduce engineering hours in delivers. One of the problems that arose was the need to develop capabilities that were applicable to all or some business areas. The most challenging were those capabilities that were totally unique to a certain business line (Figure 3). The capabilities defined a PLM framework for the case company that had 3 lifecycles phases and interaction between the different product layers that needed to be managed. The framework is

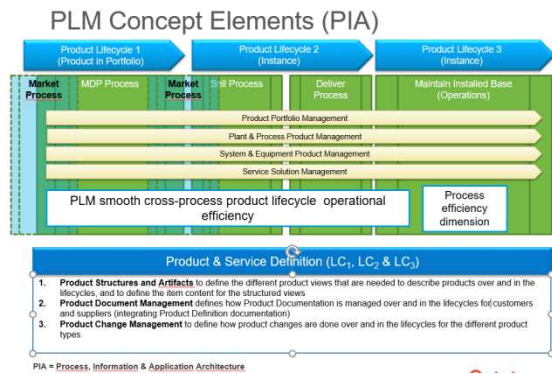an adaptation of the lifecycle phase presented by Stark [2006].

Fig. 4. Product-in-product model

Once this work was carried out, the development project could be as scoped with understandable business capability sets to support prioritised business needs in the one of the three PLM lifecycle phases, and product and service areas. The subsequent stages from here involved typical process, information and IT system development that also included deployment and change in management to on-board the organisations.

DISCUSSIONS AND CONCLUSIONS

How can PLM development succeed with the emerging new technologies e.g., IoT, real-time simulation, or artificial intelligence? We think it cannot do so without understanding the relationship between strategy, business models, products, technologies and how the enterprise architecture is built. PLM can drive product excellence and innovation, but we still do not have a clear structure and execution framework that also includes the customer dimension aligned with strategy and business models. However, we see that the addition of these dimensions is essential for PLM to support future needs. As a theoretical contribution to the study, we propose the rough framework shown in Table 2, which could be developed to include these areas. This model also introduces the relationship with strategy and business models.

Table 2. The extended global PLM Model for Manufacturing

	Operating Model (PLM)	Product - Service	Customer	Dependency
Strategy	Strategy alignment and PLM strategic goals	Strategy alignment & Product & Service strategic goals	Strategy alignment & strategic Customer goals	All
Business Model and business capabilities	Business Model PLM capability identification	Business Model Product/service capability identification	Business Model Customer capability identification	All
Operating Model Dimension	− Management & Control − Organisation Architecture & Culture − Process Architecture − Information Architecture − IS Architecture Sääksvuori [4]	− Product & Service Definition [12]	− Customer Definition − Segmentation − Channels − Customer Relationship Management	All
Maturity Model	Sääksvuori [4]	A, B, C, D Model [12]	Kärkkäinen [6]	
Implementation	Stark [5]	Stark [5]	Stark [5]	

As practical contributions, we see that PLM can have two different approaches in companies. The first is the approach where PLM is information system-centric, and very often only PDM-centric. The second is business-driven, where PLM is a strategic initiative that covers the operating model, products and services. In the case company, PLM was started solely as an Information Management PDM initiative to improve the operating model that mainly supported the R&D business process digitalisation. Following the limited benefits gained with this approach, the decision to move to a PLM business transformation initiative that implemented the strategic drivers through product and service definition and corporate wide PLM strategy, created value by means of

the realisation of corporate and business unit strategies.

However, the case company's PLM drivers were efficiency-orientated and drove PLM from an inside-out viewpoint. This approach does not focus on the customer's voice or insight to understand the customer's business need and selection of the correct solution to achieve their business objectives over a sustainable lifecycle. The inside-out approach creates an environment where PLM is seen to implement short-term benefits rather than long term benefits through sustainable and evolving customer relationships. By nature, PLM is strategic and the improvements are realised in the long run. This work is measured in years and must be a constant form of systematic and manageable evolution from one maturity level to the next. It is important for companies to understand what their maturity level is and what type of change they are trying to achieve with their products, services and PLM management system, but also customers. These areas must be developed together. Therefore, products and services are the core of PLM. This leads to the question whether PLM should be driven from an outside-in approach that starts from customer insight and strategy. If the approach is changed to outside-in, then the needs and insight of the customers would drive PLM over their lifecycle. This would lead to a situation where the products and services would better fulfil the customers' evolving requirements and improve customer experience. This could also lead to a better understanding of how services and digitalization could be implemented in companies, and support ways of integrating service design and customer experience with PLM.

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ZARZĄDZANIE CYKLEM ŻYCIA PRODUKTU W OKRESIE TRANSFORMACJI GOSPODARCZEJ

STRESZCZENIE. **Wstęp:** Znaczenie i wielkość roli zarządzania cyklem życia produktu (PLM) zależy od obszaru działalności gospodarczej. Zarządzanie cyklem życia produktu inicjuje różne zmiany zarówno w systemie informacyjnym przedsiębiorstwa jak z transformacji na poziomie strategicznym. Trudno też określić jednoznacznie warunki pomyślnego wdrożenia zarządzania życiem produktu. W pracy zidentyfikowano ramy dla zarządzania cyklem życia produktu jak i zmienne zależne procesu. Prawidłowe zrozumienie wpływu tych czynników ma istotne znaczenie dla pomyślnej transformacji zarządzania cyklem życia produktu.

Metody: Główną metodą pozyskiwania danych był przegląd istniejącej literatury naukowej dotyczącej różnych inicjatyw związanych z zarządzaniem cyklem życia produktu. Praca obejmuje analizę przypadku zarządzania cyklem życia produktu w oparciu o dane konkretnego przedsiębiorstwa z lat 2010-2015, w okresie którym uległa transformacji strategia tego przedsiębiorstwa z profilu inżynierskiego na produktowy i usługowy.

Wyniki: Otrzymane wyniki pokazują, że przeprowadzona transformacja miała wpływ na działalność przedsiębiorstwa na wielu poziomach. Zarządzanie cyklem życia produktu skupione tylko na harmonizacji procesu w oparciu o system informacyjne nie odniósł pożądanego skutku ze względu na ograniczoną wiedzę na temat modeli przedsiębiorstwa, produktów i usług.

Wnioski: Zarządzenie cyklem życia produktu jest kluczowym elementem transformacji biznesowej i ma wpływ na wzajemne zależności pomiędzy produktami, usługami i klientami.

Słowa kluczowe: zarządzanie cyklem życia produktu, zarządzanie produktem, struktura przedsiębiorstwa, model biznesowy, strategia biznesowa

Część tej pracy została zaprezentowana w formie referatu podczas konferencji "24th International Conference on Production Research (ICPR 2017)", która odbywała się w Poznaniu między 30 lipca, a 3 sierpnia 2017 roku.

MANAGEMENT VON PRODUKT-LEBENSZYKLUS WÄHREND EINES WIRTSCHAFTLICHEN UMBRUCHS IM UNTERNEHMEN

ZUSAMMENFASSUNG. Einleitung: Die Bedeutung und Relevanz der Rolle des Managements von Produkt-Lebenszyklus (PLM) hängt von der Art der wirtschaftlichen Betätigung eines Unternehmens ab. Das Management des Lebenszyklus eines Produktes generiert Veränderungen sowohl im Informationssystems eines Unternehmens als auch beim wirtschaftlichen Umbruch auf dem strategischen Niveau. Es ist auch schwierig, eindeutig die Voraussetzungen für eine effektive Einführung des Managements für den Produkt-Lebenszyklus zu bestimmen. In der vorliegenden Arbeit wurden die Rahmen für das Management des Produkt-Lebenszyklus sowie abhängige Variablen des Prozesses ermittelt. Die richtige Verständnis dieser Einflussfaktoren hat eine wesentliche Bedeutung im Prozess einer effektiven Transformation des Produkt-Managements.

Methoden: Die Hauptmethode der Gewinnung von Daten war eine Übersicht der bestehenden wissenschaftlichen Literatur, die verschiedenartige, mit dem Management des Produkt-Lebenszyklus verbundene Vorgehensweisen umfasst. Die Forschungsstudie stellt Analyse eines Studienfalls in Bezug auf das Management des Produkt-Lebenszyklus anhand von Daten eines konkreten Unternehmens aus den Jahren 2010-2015, in denen die Strategie dieses Unternehmens einer Transformation vom Ingenieur-Profil zum Produkt- und Dienstleistungsprofil unterlag, dar.

Ergebnisse: Die ermittelten Resultate weisen darauf hin, dass der durchgeführte wirtschaftliche Umbruch die Tätigkeit dieses Unternehmens auf vielen Ebenen beeinflusst hat. Das nur auf die Harmonisierung des Prozesses anhand von Informationssystemen fokussierte Management des Produkt-Lebenszyklus brachte keine positiven Nachfolgen mit sich. Das geschah wegen des beschränkten Wissens über die gegenseitigen Abhängigkeiten zwischen Produkten, Dienstleistungen und Kunden.

Fazit: Das Management des Produkt-Lebenszyklus stellt ein Schlüsselelement der Business-Transformation dar und übt einen bedeutenden Einfluss auf die gegenseitigen Abhängigkeiten zwischen den Produkten, Dienstleistungen und Kunden aus.

Codewörter: Management von Produkt-Lebenszyklus, Produkt-Management, Unternehmensstruktur, Business-Modell, Business-Strategie

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