Phases of Product Lifecycle and Corresponding Technologies

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Abstract

Product Lifecycle Management makes it possible to command the whole lifespan of a product and the information connected with it. Efficient product lifecycle management enables companies to compete successfully in international and global market. The core of product life cycle management is the creation, preservation and storage of information relating to the company's product and activities in order to ensure not only the fast but also fast and trouble free finding, refining, distribution and reutilization of data required for daily operations. This paper describes phases of product lifecycle and corresponding technologies of Product Lifecycle Management. The paper also describes with a further discussion of the business concept of product lifecycle management, marketing strategies, approaches and benefits of Product Lifecycle Management.

Keywords: Product Lifecycle Management, Global Market Management, Marketing Strategies

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Introduction

Product Lifecycle Management (PLM) is a systematic business management approach that can be utilized by all types of businesses in order to improve their products, for their growth and thus the sustainability performance of the companies. This technique can be used equally by both large and small organizations and its purpose is to ensure more sustainable value chain management. Product Lifecycle Management (PLM) is an integrated concept to assist in businesses managing the total life cycle of products and services towards more sustainable consumption and production patterns. It can be used to target, organize, analyze and manage product-related information and activities towards continuous improvement throughout the duration or the life cycle of the product.

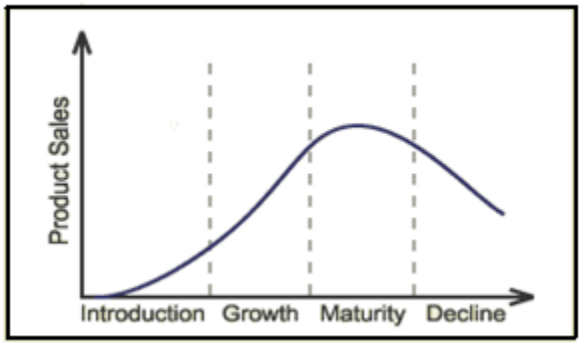
Definitions:

- **Product Lifecycle management (PLM):** A strategic business approach that applies a consistent set of business solutions in support of the collaborative creation, management, dissemination, and use of product definition information across the extended enterprise from concept to end of life—integrating people, processes, business systems, and information.
- **Product Life Cycle (PLC):** A product passes through certain distinct stages during its life, and this is called the **product life cycle.**

Product Life Cycle Concept:

The sale potential and profitability of a product never keeps the same rather changes as the time changes. The product life cycle (PLC) is the course of a product's sales and profits over its life-time. A product passes through various distinct stages during its whole life span, and this is termed as product life cycle (PLC). Product Life Cycle is the progressive of a product through four stages. They are

- Introduction
- Growth
- Maturity
- Obsolesce and Death.



Typical Product Life Cycle

Product Lifecycle Management (PLM) is the process of managing the entire lifecycle of a product from its conception, through design and manufacture, to service and disposal. PLM

integrates people, data, processes and business systems and provides a product information backbone for companies and their extended enterprise.

'Product lifecycle management' (PLM) should be distinguished from 'Product life cycle management (marketing)' (PLCM). PLM describes the engineering aspect of a product, from managing descriptions and properties of a product through its development and useful life; whereas, PLCM refers to the commercial management of life of a product in the business market with respect to costs and sales measures.

Product lifecycle management is one of the four cornerstones of a corporation's information technology structure. All companies need to manage communications and information with their customers (CRM-Customer Relationship Management), their suppliers (SCM-Supply Chain Management), their resources within the enterprise (ERP-Enterprise Resource Planning) and their planning (SDLC-Systems Development Life Cycle). In addition, manufacturing engineering companies must also develop, describe, manage and communicate information about their products.

One form of PLM is called people-centric PLM. While traditional PLM tools have been deployed only on release or during the release phase, people-centric PLM targets the design phase.

Recent (as of 2009) ICT development (EU funded PROMISE project 2004-2008) has allowed PLM to extend beyond traditional PLM and integrate sensor data and real time 'lifecycle event data' into PLM, as well as allowing this information to be made available to different players in the total lifecycle of an individual product (closing the information loop). This has resulted in the extension of PLM into Closed Loop Lifecycle Management (CL_2M).

Marketing Strategies related to PLC.

Marketing Mix Element	Introduction	Growth	Maturity	Decline
Product	Basic Product.	Improvement.	Diversity of models, brands.	Withdrawal of weak products in a phased manner.
Price	Skimming or Penetrating policy.	Penetrating policy. Lower price.	Competitive parity.	Prices are cut.
Distribution (Place)	Build selective distribution.	Built intensive distribution.	Built more intensive distribution.	Go selective phase out unprofitable outlets.
Promotion (Sales)	Use heavy sales promotion to entice trail.	Reduce to take advantage of heavy consumer demand.	Increase to encourage brand switching.	Reduce to minimal level.
Advertising	Build product awareness among early adapters and dealers.	Built awareness and interest in the mass market.	Stress brand difference and benefits.	Reduce to level needed to retain hard core loyals.

Marketing Objectives:

Objectives	Introduction	Growth	Maturity	Decline
	Create product awareness and Trail.	Maximize market share.	Maximize profit while defending market share.	Reduce expenditure and milk the brand.

Phases of Product Lifecycle and Corresponding Technologies

Many software solutions have developed to organize and integrate the different phases of a product's lifecycle. PLM should not be seen as a single software product but a collection of software tools and working methods integrated together to address either single stages of the lifecycle or connect different tasks or manage the whole process. Some software providers cover the whole PLM range while others a single niche application. Some applications can span many fields of PLM with different modules within the same data model. An overview of the fields within PLM is covered here. It should be noted however that the simple classifications do not always fit exactly, many areas overlap and many software products cover more than one area or do not fit easily into one category. It should also not be forgotten that one of the main goals of PLM is to collect knowledge that can be reused for other projects and to coordinate simultaneous concurrent development of many products. It is about business processes, people and methods as much as software application solutions. Although PLM is mainly associated with engineering tasks it also involves marketing activities such as Product Portfolio Management (PPM), particularly with regards to new product development (NPD). There are several life-cycle models in industry to consider, but most are rather similar. What follows below is one possible life-cycle model; while it emphasizes hardware-oriented products, similar phases would describe any form of product or service, including non-technical or software-based products:

Phase 1: Conceive

Imagine, specify, plan, and innovate

The first stage in idea is the definition of its requirements based on customer, company, market and regulatory bodies' viewpoints. From this specification of the products major technical parameters can be defined. Parallel to the requirements specification the initial concept design work is carried out defining the aesthetics of the product together with its main functional aspects. For the Industrial Design, Styling, work many different media are used from pencil and paper, clay models to 3D CAID Computer-aided industrial design software.

In some concepts, the investment of resources into research or analysis-of-options may be included in the conception phase - e.g. bringing the technology to a level of maturity sufficient to move to the next phase.

However, life-cycle engineering is iterative. It is always possible that something doesn't work well in any phase enough to back up into a prior phase - perhaps all the way back to conception or research. There are many examples to draw from.

Phase 2: Design

Describe, define, develop, test, analyze and validate

This is where the detailed design and development of the product's form starts, progressing to prototype testing, through pilot release to full product launch. It can also involve redesign and ramp for improvement to existing products as well as planned obsolescence. The main tool used for design and development is CAD Computer-aided design. This can be simple 2D Drawing / Drafting or 3D Parametric Feature Based Solid/Surface Modeling. Such software includes technology such as Hybrid Modeling, Reverse Engineering, KBE (Knowledge-Based Engineering), NDT (Nondestructive testing), and Assembly construction.

This step covers many engineering disciplines including: Mechanical, Electrical, Electronic, Software (embedded), and domain-specific, such as Architectural, Aerospace and Automotive. Along with the actual creation of geometry there is the analysis of the components and product assemblies. Simulation, validation and optimization tasks are carried out using CAE (Computer-aided engineering) software either integrated in the CAD package or stand-alone. These are used to perform tasks such as:- Stress analysis, FEA (Finite Element Analysis); Kinematics; Computational fluid dynamics (CFD); and mechanical event simulation (MES). CAQ (Computer-aided quality) is used for tasks such as Dimensional Tolerance (engineering) Analysis. Another task performed at this stage is the sourcing of bought out components, possibly with the aid of Procurement systems.

Phase 3: Realize

Manufacture, make, build, procure, produce, sell and deliver

Once the design of the product's components is complete the method of manufacturing is defined. This includes CAD tasks such as tool design; creation of CNC Machining instructions for the product's parts as well as tools to manufacture those parts, using integrated or separate

CAM Computer-aided manufacturing software. This will also involve analysis tools for process simulation for operations such as casting, molding, and die press forming. Once the manufacturing method has been identified CPM comes into play. This involves CAPE (Computer-aided Production Engineering) or CAP/CAPP – (Production Planning) tools for carrying out Factory, Plant and Facility Layout and Production Simulation. For example: Press-Line Simulation; and Industrial Ergonomics; as well as tool selection management. Once components are manufactured their geometrical form and size can be checked against the original CAD data with the use of Computer Aided Inspection equipment and software. Parallel to the engineering tasks, sales product configuration and marketing documentation work will be taking place. This could include transferring engineering data (geometry and part list data) to a web based sales configuration and other Desktop Publishing systems.

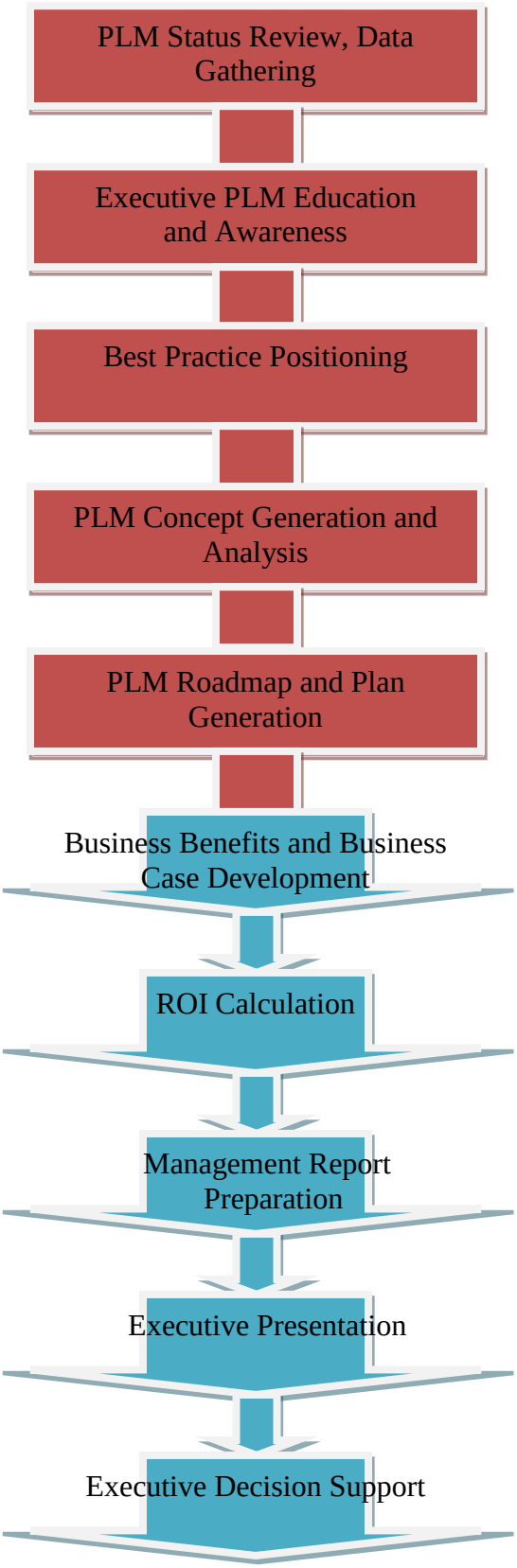
Phase 4: Service

Use, operate, maintain, support, sustain, phase-out, retire, recycle and disposal

The final phase of the lifecycle involves managing of in service information like providing customers and service engineers with support information for repair and maintenance, as well as waste management/recycling information. This involves using such tools as Maintenance, Repair and Operations Management (MRO) software.

It is easy to forget that there is an end-of-life to every product. Whether it be disposal or destruction of material objects or information, this needs to be considered since it may not be free from ramifications.

The Ten Step Approach to PLM includes the following ten activities:



The Ten Step Approach to PLM is applicable in companies of all sizes in almost any industry and can be beneficial at all stages of PLM investigation and use. It is as applicable during the initial introduction of PLM as when extending an existing PDM implementation. It can be used to review current PLM performance, to clarify PLM concepts, to choose between different options, or to gain a deep understanding of an individual option. Experience shows that these ten steps help in understanding where PLM can be applied to a business most effectively. They help to get that all-important executive approval for the PLM initiative to proceed. The Ten Step Approach is a tried-and-tested methodology that has been used in many companies, at different stages of PLM progress, in many industries. The ten steps make it clear to everyone involved what has to be done, with clear deliverables at each step to show what has been achieved.

Importance of PLM

PLM - is an essential tool for coping with the challenges of more demanding global competition and ever shortening product and component lifecycles. New and better products must be introduced to markets more quickly, with more profit and less labor, and the lifecycle of each product must be better controlled, for example from financial and environmental perspectives. Fierce competition in global markets drives companies to perform better. In order to perform well financially, companies must be able to make informed decisions concerning the lifecycle of each product in their portfolio. Winner products must be introduced to market quickly and poorly performing products must be removed from the market. To do this well, companies must have a very good command of the lifecycle of each product. A good command of product and process definitions over a large product portfolio requires that ways of operation and IT systems must support each other flawlessly. Today's complex products require the collaboration of large specialist networks. In this kind of supplier and partner network, product information must be transferred between companies in electronic form, with a high level of information security. Overall, PLM can also be considered as a tool for collaboration in the supply network and for managing product creation and lifecycle processes in today's networked world, bringing new products to market with less expenditure of time and effort. However, the benefits of operational PLM go far beyond incremental savings, yielding greater bottom line savings and top-line revenue growth not only by implementing tools and technologies, but also by making necessary, and often tough, changes in processes, practices and methods and gaining control over product

lifecycles and lifecycle processes. The return on investment for PLM is based on a broader corporate business value, specifically the greater market share and increased profitability achieved by streamlining the business processes that help deliver innovative, winning products with high brand image quickly to market, while being able to make informed lifecycle decisions over the complete product portfolio during the lifecycle of each individual product. Operational efficiencies are improved with PLM because groups all across the value chain can work faster through advanced information retrieval, electronic information sharing, data reuse, and numerous automated capabilities, with greater information traceability and data security. This allows companies to process engineering change orders and respond to product support calls more quickly and with less labor. They can also work more effectively with suppliers in handling bids and quotes, exchange critical product information more smoothly with manufacturing facilities, and allow service technicians and spare part sales reps to quickly access required engineering data in the field. In this way, PLM can result in impressive cost savings, with many companies reporting pay-off periods of one to two years or less based solely on reduced development costs. PLM also enables better control over the product lifecycle. This gives opportunities for companies to boost revenue streams by accelerating the pace at which innovative products are brought to market. Excellent lifecycle control over products also gives new opportunities to control product margins more carefully and remove poorly performing products from the markets. This set of benefits, driving top line revenue growth and bottom line profitability, makes ROI extremely compelling, with some industry analysts characterizing PLM as a competitive necessity for manufacturers.

Conclusion:

PLM is a strategic business approach to empower the business, to enable product and process innovation, and enhance both top and bottom line business performance. It includes technology, processes, best practices, and other elements that provide a complete solution to business problems. PLM helps to understand the product's life cycle and can help a company to understand and realize when it is time to introduce and withdraw a product from a market, its position in the market compared to competitors, and the product's success or failure.

Product Lifecycle Management is a complete product solution from initial phases of product development to product marketing. PLM integrates and automates business processes which

generally results in efficiency and consequently enables companies to develop more new products, in less time than their competition, reduced costs, increased productivity and improved the quality of products and procedures. These efficiency improvements can generally be leveraged in two ways: Increased output with the same resources (labor, time, material) or constant output with fewer resources. The result in the first case is a higher revenue at the same costs, in the latter case it is constant revenue at lower costs. In both instances the gross margin will increase as a result of using PLM.

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