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# The product-service bundle design in digital environment

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**Abstract**

**This paper discusses the design of a product-service bundle from the information integration viewpoint. The basic differences between traditional and modern concepts of operations management have been identified. The role of supportability analysis has been highlighted too. The paper deals with a modern concept of CALS (Continuous Acquisition and Life cycle Support) as an environment to share data between business partners involved in development processes.**

**Zusammenfassung**

**Der Artikel behandelt das Projektieren der Produkt-Service-Verbindung vom Standpunkt der Informationsintegration aus. Der Autor erläutert grundlegende Unterschiede zwischen dem traditionellen und dem modernen Operationsmanagementkonzept. Ergänzend wird die Rolle der logistischen Unterstüzungsanalyse betrachtet. Der Artikel stellt das Konzept von CALS (Continuous Acquisition and Life Cycle Support) dar, welches als Umgebung die Datenverteilung zwischen den am Entwicklungsprozess beteiligten Geschäftspartnern ermöglicht.**

# 1. Introduction

Today, enterprises operate in environment full of information. Most of them have a mix of new and old hardware and software. Very often, they use different management and business concepts. Thus, modern enterprises are focused on achieving integration of theirs business applications and networks. Simultaneously, they decentralize their organizational structure. The basic goal of all companies is to meet customer needs. Every company has external and/or internal customers, and every customer has expectations regarding the company's output. The ability to understand and comprehend the customer's requirements in a continually changing environment is very important. The traditional approach of product development called sequential engineering has been followed by very long time to market. Through the use of modern concept of product and process design and logistics and supply chain management, a company develops and delivers its products and services to clients in a manner that is more rapid and at lower cost.

# 2. Concepts of operations management

Operations management is recognized as a business function responsible for the value-adding system in both service and manufacturing companies. Thus, operations add the value that businesses deliver to customers. Value-adding processes are technological processes, transportation, warehousing, distribution, etc. In the past, the value-adding process has been referred to as the manufacturing process in factories, or as a service providing process in service organizations.

Operations management has traditionally been observed as the administration of processes that transform inputs (materials, information, energy, capital,) into output (products and/or services) that are valued by customers. According to [Hann. 2001], service operations were treated as separate from manufacturing operations (see Figure 1). The performance measurement system has provided feedback that may be used to track, monitor, update, and improve the value-adding system.


**Figure 1. The traditional concept of operations management**

Traditionally, operations management was referred to only as managing transformation processes. Today, operations management is about the processes that organizations use to satisfy their customers. As Figure 2 suggests, the modern aspect of operations management integrates service and manufacturing. The basic idea is that most customers expect more than a product or service. In most cases, customers expect a product-service bundle. In other words, they expect a combination or a package of manufactured and service value. Usually, customers don't buy service value and manufactured value from different vendors.

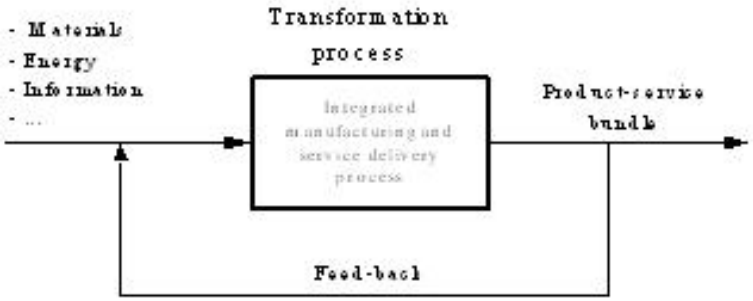


**Figure 2. The modern concept of operations management**

Managing operations requires intensive interaction with the other business function. In the age of e-business, operations management is much more integrated into the other functional areas of business. Today, many businesses are managed from a cross-functional perspective.

# 3. The modern design of product-service bundles

The design of product-service bundles is specifically associated with those items which are ultimately to be sold to customers. Terms like a concurrent engineering, simultaneous engineering, and integrated product development are mostly used synonymously and present an approach towards the design of product-service bundles based on information integration. They involve performing design tasks in parallel that have previously been realized sequentially. Also, the coordinated team work of design engineers and a continuous flow of information between all functional departments that influence the lifecycle of product-service bundle are necessary. This is sustained by information systems and helps to reduce design time and time to market. Also, the data in the product-service bundle database are managed better, as a lot of users access them.

Logistic support design should be accomplished in the scope of a product-service bundle design. In this process, it is necessary to identify different kinds of requirements: functional, economic, ecologic, logistic, etc. As illustrated in Figure 3, each of those requirements is analyzed within specific tasks. For example: the functional concept of the product is formalized by describing the expected main and additional functionalities, economic requirements are treated in the process of value engineering, ecologic requirements are analyzed trough procedure of life cycle assessment, risk analysis should be used for safety requirements, etc. The results of analyses are coordinated in the framework of integrated product development. The term "integrated" refers to coordinating data from different sources so that resulting data collection can be managed with minimum redundancy.

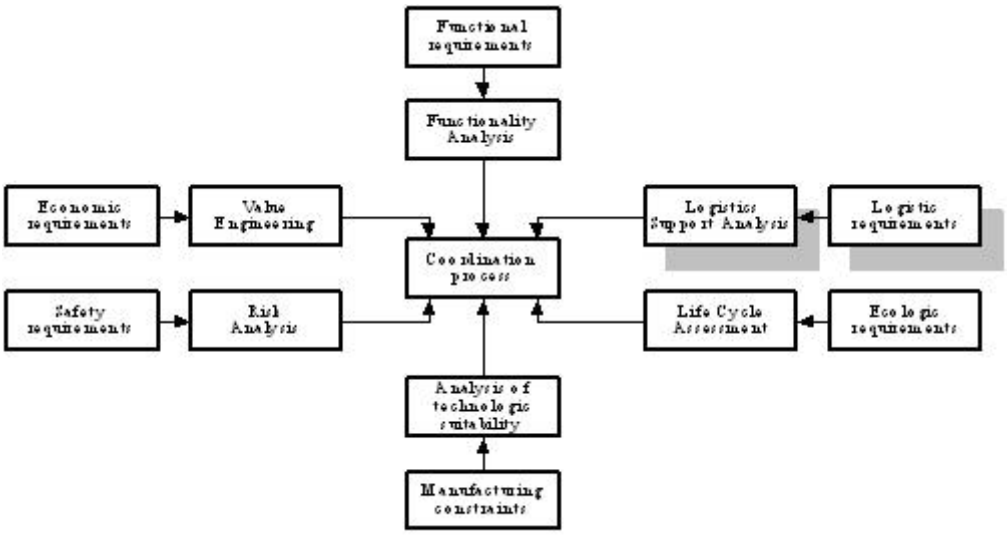


**Figure 3. Requirements analyses in the design of product-service bundles**

SA (Supportability Analysis) is the iterative process of designing, implementing, monitoring, estimating, and adjusting support system for the purpose to achieve just-in-time availability of support elements in integrated mode. The goal of SA is to enable optimum system performance at minimum life cycle cost. SA includes whole life cycle of system and the integration of support elements has been accomplished with the help of modern information and telecommunication technology. In the USA, the field of LSA has regulated by the MIL-STD 1388-1A and MIL-HDBK 502 standards as well as the Department of Defense 5000-39 act ("Acquisition and management of integrated logistic support for systems and equipment"). In the context of SA, it is necessary to perform LSAR complementary procedures. Acronym LSAR has two meanings: Logistic Support Analysis Records and Logistic Support Analysis Reports. Logistic Support Analysis Records is a system in form of common relational database used to recognizing, store and sort SA data in a logical and accessible manner. The second meaning refers to SA report system and statements that content and transfer data.

Engineering computer applications have been created on the basis of very complex and semantically rich information models. In non-integrated operations systems, each data change in primary applications (usually CAD systems) provokes the additional activities for other applications updates. The consequence is that designers and manufacturers do not have control over their product databases. As Figure 4 highlights, the solution to the problem lies in data sharing between computer supported engineering applications (CAD, CAM, CAP, SA,) through a common data base.

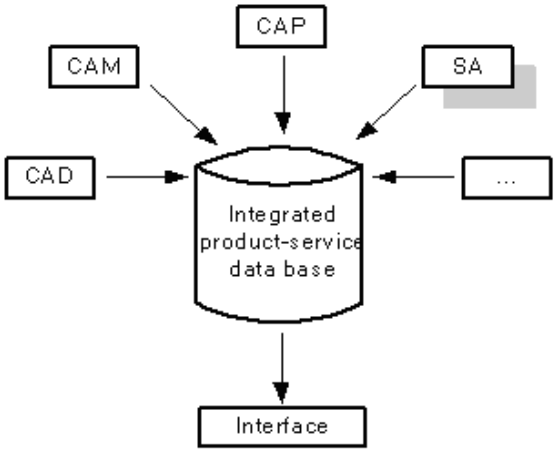


**Figure 4. Integrated product-service data base**

# 4. Integrated product development in CALS environment

The world-class approach to provide logistic data integration and sharing between different software and hardware platforms is concept CALS. CALS (Continuous Acquisition and Life cycle Support) is logistics strategy in the field of business transaction and operations management utilizing computer network. The goal of original version of CALS (Computer Aided Logistics Support), developed in the mid-90's in response to high costs and long lead time of product development, has been a transformation from a non-integrated product-service bundle design, manufacturing and support to an integrated mode of operations. The basic premise of CALS is creating logistic data once and using it many times through the data sharing process. This improves the accuracy of the data and reduces unnecessary duplication and redundancy.

CALS began in the United States as a military strategy. Since 1993, CALS is an international business strategy and covers the public and private sectors. Today, its goal is to enable information the integration of enterprises on a worldwide basis.

Except for earlier described concurrent engineering, according to [Prev. 1994], CALS has three supporting pillars:
- CITIS;
- IETM;
- EDI.

CITIS (Contractor Integrated Technical Information Service) provides authorized electronic access to contractually required information. CITIS may also be considered as a tool to manage the generation, storage, update, reproduction and distribution of technical and business data. Modes of data which may be shared under CITIS are:
- drawings and design data;
- delivery data;
- plans and resource data;
- project management data;
- logistic support data;
- financial data;
- marketing, commercial, and contractual data; etc.

IETM (Interactive Electronic Technical Manual) is sophisticated logistic service for technical diagnostics and maintenance support. IETM allows a user to access required information faster and more easily than is possible with a paper manual, because often several paper manuals are necessary to execute a simple maintenance task. Powerful troubleshooting procedures can be made available using the intelligent features of the IETM. Personal computer with IETM software or access to XML based Web IETM (see Figure 5) can provide successful expert advise in fault isolation procedure.

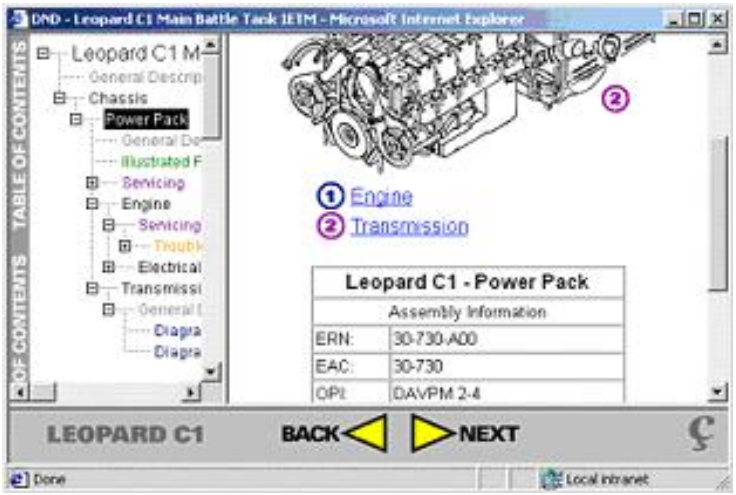


**Figure 5. Windows of Web IETM**

The benefits of IETM over conventional paper manuals are:

- faster access to maintenance data;
- less errors;
- reduced time for training of maintenance technician;
- quicker updates of data;
- lower cost of storage, and distribution of data; etc.

Digital technical manuals have established on the concepts of intra-operability and inter-operability. As the phenomenon intra-operability refers to requirements for the information integration between elements that are within IETM structure (authoring system, presentation system, reports system, etc.) Inter-operability is an ability of systems to integrating into information environments. In the case of IETM, information environments make CALS, or IMIS (Integrated Maintenance Information System), or CMMS (Computerized Maintenance Management Systems), etc. The inter-operability platform of different information systems within NATO (North Atlantic Treaty Organization) presents the NCDM (NATO CALS Data Model). This is a conceptual data model for product, service and support data that provides semantic coherence for all NATO members and their business partners.

EDI (Electronic Data Interchange) has been in use for several years, and is widely understood as B2B service. In short, EDI is an element of electronic commerce based on a set of standardized messages for the transfer of structured data from one computer application to another. EDI brings a number of benefits to the companies that use it: shortened ordering time, quick response, accurate invoicing, reduced stock, etc.

**The main advantages of CALS implementation are:**
- reduced support and life cycle cost;
- reduced time to market;
- reduced storage space needed for the digital data media;
- better relationships between business partners;
- decreased stock level;
- improved information quality;
- increased staff productivity;
- more efficient diagnostics and maintenance, etc.

# 5. Conclusion

Integrated operations management is directly responsible for the design and management of the value-adding system that creates the product-service bundles used to achieve customer's satisfaction. Focusing on improving the logistics and supply chain performances leads to improvements in the customer's satisfaction. Customer service is one of the logistic system outputs and refers to just-in-time delivering to the customer the right goods, in the right condition and packaging and at right cost. In the context of design engineering, the logistic support design is executed at the same time with design of product-service bundle. The advantages of the product-service bundle design in digital environments are a wider integration of operations, shorter time to market and more complete satisfaction of customer's requirements. In short, CALS is a paradigm of integration that improves competition. Finally, future business relationships will exist in a virtual world where cooperation will cross traditional boundaries between departments, companies, industries, and countries. The future research and development of integrated operations systems will lead to more integrated and seamless business practice in a paperless environment.

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