

Product Knowledge and Lifecycle Management in Project-Based Manufacturing

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Abstract. Changes taking place in project-based manufacturing emphasize the importance of agile manufacturing, product knowledge and product lifecycle management. The paper describes dependencies between product and production strategy, and covers also other topics that are identified to be potential research areas in the future. Perspectives of industrial service business as well as manufacturing and supply networks are briefly discussed. As an outcome it can be argued that more research is needed to encompass product lifecycle perspective, and to cover the information needs of internal and external stakeholders. Due to constant increase of industrial services, also services should be included product definition, i.e. extended product description. This introduces a new set of requirements that need to be taken into account as a part of product and production strategy definition.

Introduction

Background. Finnish manufacturing industry is mainly focused on the low-volume project-based production. Due to the changes taking place in the contemporary business environment many project-based manufacturing companies are looking for new ways to compete; heightening global competition, decreasing margins and business growth shifting on developing economies, manufacturing companies looking for new position in a value chain downstream closer to the customers, and delivery projects becoming smaller in their size put pressures to develop new, more flexible and more agile operating concepts. Product knowledge management has been identified as an important factor for the future competition among manufacturing companies, since it provides basis to create modular and partly-configurable product definition as well as supports utilization of lifecycle information.

Problem statement. In order to improve future competitiveness manufacturing companies need to have a shared understanding of the key concepts on the product knowledge management, especially in the area of the product definition and production strategy.

Target of the research. The paper aims to clarify the key terms and concepts relating product knowledge management from product definition and production perspectives.

Research methodology. The paper is based on the literature review of the following areas: product and production strategy, industrial services, and manufacturing networks. Empirical part is based on qualitative, in-depth and semi-structured interviews that took place in four Finnish project-based manufacturing companies and follow-up discussions with the companies

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Business environment change – Industrial services and manufacturing networks

Manufacturing industry undergoes significant changes. Heightening competition, reducing margins and business growth shifting on emerging economies put pressures to develop new skills and capabilities for future production; the importance of agile production methods, need for collaboration and co-development, as well as more efficient management tools grow. [1,2]

Business focus shifts on services; service business constitutes significant part of annual revenue in a large number of manufacturing companies [3-5]. Service concepts evolve from being technology-based to customer-oriented; solution providers take a new position in a value chain and integrate deeper in customer business and production processes [6,7].

Products and services integrate into complex solutions [6] and manufacturing itself can be considered as a service: As Yang et al. [8] put it “new service-oriented networked manufacturing mode [--] can realize agile services and green intelligent targets, solve more complex manufacturing problems and perform larger scale collaborative manufacturing”

Networked operating model expands product definition into the network. Due to the increasing role and importance of manufacturing and supply network [1-2,9] suppliers need to be taken into account as external stakeholders; the information needs of actors in manufacturing and supply network need to be considered as a part of product knowledge definition [10]. Equipment and services integrate into complex solutions, and there is therefore a growing need for common product definition and management structures. Lifecycle information gathered from installed base constitutes a basis for future services. [6, 11]

Product and production strategy

The term production is actually more than just manufacturing: manufacturing is perceived just in operations inside the company’s manufacturing plant, but the production includes also the materials and parts purchasing and the final product delivery to the customer. The strategy itself defines the visions and aims, which are needed to success in marketing environment. [12,13]

Product and part definition. The definition of product is depending on the author, the point of view or the standard: basically no universal definition is available. The product is often called as a part or component: the three different terms normally means the same thing. But according to McKay et al. [14] the part is object which is already manufactured (or will soon be) and the product is object which is already sold (or will soon be). The component is non-decomposable object, which includes parts; normally component is purchased object. Assembly cannot be called as product, because the assembly has to include at least two parts. Other issue which separates the assembly and component from each other is the data: these two objects may include different information. [14] And also with the help of data the product can be described: the data will include features, parameters, relationships to other part and even some constraints [15].

When exanimate the international standard [16] it gives the definition for the part as “a product with operational functionality that is expected to be used as a component of one or more assembled products”. So, according to this standard it can be said that the product and part can be handled as individual terms. On the other hand, Stark [17] wrote that the product is defined as an object which consist number of assemblies or parts. Stark’s [17] and McKay’s [14] the definitions of term product are similar, the stage in product lifecycle is interact to the definition: is the product already manufactured, or is it still in production. [14,17]

Earlier it was pointed out that the definition is depending also from the point of view. In the Fig. 1 is shown the different point of view of one kind of product. So, when talking about the product, it has to be clear which point of view the product is seen. Not only is the viewer’s position in the company affecting to definition, but also the use of the product has a meaning to definition. [18]

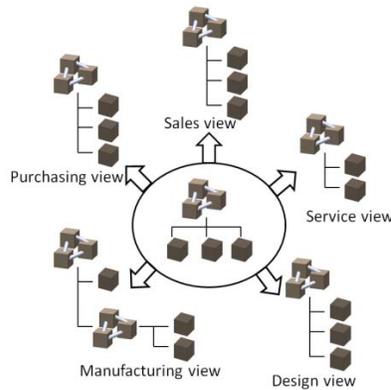


Fig. 1. Product and its different points of views inside of the company [18]

When thinking about the product definition it is crucial first to identify what is the actual product and/or part. The term product is covering all the parts, assemblies, products and sub-assemblies. These are the things that the company needs to produce a finished or semi-finished article for the market/customers. And the product itself is the key element in the product and manufacturing strategy. But without correct manufacturing (and design) information the products/parts cannot be manufactured: the product data is defining the manufacturing method and the manufacturing costs.

Production Strategy. After defining the term product the production strategy is easier to plan. When changing the production strategy is not affecting only to production: its affects can also be seen in the company's management, business, marketing, purchase et cetera. It should be aware of that before actually changing the productions strategy the own production should be analyzed. In this analyze the purpose is to recognize unused production's developmental potential(s). After this analyze the company will know can the production be intensified and can some mode of operations be developed. [12,13]

Production strategy is related to manufacturing strategy. In some cases some product are going to be manufactured somewhere else than in own manufacturing plant: for cost, marketing and/or delivery reasons (just to mention few). The strategy itself can be analyzed from different point of views: the product, level of industry or company. [19]

The reason why the production strategy may change is depending on different manufacturing reasons, as Miltenburg [19] wrote: "cost, quality, delivery, performance, flexibility, and innovativeness." In production engineering point of view most likely the reason is the total costs. Some products may need special know-how and the workers may be hard to find (for example some welders) so the only possibility is to use subcontractors. Also in some cases the work load is not regular all the time so to avoid idle time among the workers, some task may be bought from subcontractors.

Product Strategy. When making the changes to production strategy it will automatically affect to product strategy: these two have interdependences. The main challenges are to recognize the interdependences and make the correct decision: what is worthwhile to do and what can be done. The product interdependences to production are (just to mentioned few): materials, number of parts, time of delivery, stocking, manufacturing, assembly, complexity of the product and manufacturability of products. [12]

Changes in product strategy are not affecting only to already existing products. The changes are also implemented to the stage of product development: in some cases the change in product strategy means that some changes have to be done to the product. And from this point of view the product strategy is linked to product lifecycle management. [20]

In production engineering point of view the changes in product strategy do not always mean that changes has been made in business strategy. The manufacturing technology (for example machine tools) may change and the need for new product strategy is set: it may be that old machines are no longer suitable for manufacturing such product that customer' needs. [20]

Conclusions

The paper shows important dependencies between product and production strategy as well as product and part definition together with business model and business strategy. The way how key terms and concepts are defined have significant importance on the applicability of the terms and concepts as well as from the perspective of information reuse. Therefore it is recommended to pay close attention on determining the key concepts and terms, especially relating to product and production strategy.

It can be argued that as a part of product and production strategy determination it is essential to carefully define the key terms: especially the terms “product” and “part”. The reasoning is that these terms have several stakeholders and perspectives. For example, designers and purchasing unit often see parts and product differently, and the challenge of different perspectives is going to cumulate in network. It is recommended to define terms “product” and “part” in a way that no misunderstanding is possible. Common understanding on the key concepts supports product and production strategy definition.

Taking into account recent development of manufacturing industry; growing amount of industrial services and networked business and operating models it becomes evident that product and production strategy need to be expanded to cover industrial services and supply network in addition to manufacturing. Comprehending use case and operating environment of the commercial product is essential in product definition, and also intangible dimensions like services, work flows and processes should be considered as a part of product definition.

Service business and network issues introduce a new set of requirements and they need to be considered as a part product definition and product knowledge management in the project-based manufacturing. Terminology issues and how to define key concepts and terms in a way that comprises both physical equipment and intangible services is important as well as stretching the scope to cover network issues, information needs of different stakeholders and different stages of lifecycle including also R&D, pre-sales and sales, delivery and maintenance, upgrades and disposal.

Following areas were recognized interesting for future research: Identifying the business critical information and information needs of different stakeholder groups along the lifecycle, identifying potential similarities and commonalities among the information needs, applying the modular product architecture in project-based manufacturing, including service-related information in the product definition, and applying platform thinking in product management in the project-based manufacturing.

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