

Product-Service Systems across Life Cycle

Life-Cycle-Oriented Product-Service-Systems In The Tool And Die Making Industry

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Abstract

The tool and die making industry from Western Europe, characterized by single and small series production, faces increasing global competition with low-wage countries. Challenges are the increasing product-derivatization, shorter product life-cycles and lower factor costs of global competitors. The Western European high quality tool and die making industry is not able to face the increasing cost pressure, caused by the international competition, by reducing the acquisition price. Therefore prices are insufficient as a differentiation criterion. However, differentiation is possible through individual services replenishing the product. The solution presented in this paper concerns the configuration of a customized life-cycle-oriented Product-Service-System that incorporates product and service modules to address clients' preferences.

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1. Introduction

Due to its key position between product development and series manufacturing the tool and die making industry is significantly influencing the manufacturing sector [1]. As the enabler of product development, it is the base for the high-performance manufacturing sector in Western Europe [2]. The tool and die making industry is one of the major influencing factors to ensure production of high quality products at high quantity and economical prices [1, 3, 4].

For a while, established companies from traditional tooling countries see themselves more and more faced with new competitors from Asia and Eastern Europe. Those increased their competences and will continue expanding. As a result those firms serve more frequently the same markets as the Western European tool and die making industry [5]. Due to lower factor costs in countries like China, established market participants can not differentiate via tool prices to remain profitable in competition [6]. Especially considering that the tools' quality is adjusting as well, this factor is no longer a unique selling proposition to justify higher prices. Shorten tools' life cycles enhance the price pressure to tool making firms as well [7]. In addition the world economic crisis in

2009/2010, from which the European branch has not completely recovered until now, showed that new strategies and product portfolios are necessary to ensure long-term competitiveness [8, 9].

Therefore it is advantageous to expand the product range horizontally to the customers' value creation process. This range of services is called Product-Service-System and means the integration of up- und downstream customer relationship into the product portfolio [10].

This article considers the potentials and challenges, which are given by the usage of Product-Service-Systems, like increased customer loyalty and higher profit margins on the one side and necessary new abilities on the other side, as well as their design principles. Furthermore different models are analyzed, that describe the design of those systems and the need for a successful implementation into the company's product portfolio. After following this paper will especially explain the work at the Laboratory for Machine Tools and Production Engineering (WZL) at RWTH Aachen University of creating individual methodologies to apply those Product-Service-Systems to the tooling branch and its special circumstances. The paper consists of 3 chapters which will illustrate more detailed the mentioned aspects of the

motivation to implement Product-Service-Systems in the tooling industry from current challenges, Product-Service-Systems as a possible answer for a changing competition and customized Product-Service-Systems in the tooling industry. Some short concluding remarks will finalize the paper.

In the following, the word “tool” is used to describe tools as well as dies. Therefore, companies of the industry are described by the expression “tool making company” and the industry itself by the expression “tool making industry”.

2. The Western European Tool Making Industry

2.1. Overview of the Western European Tool Making Industry

The Western European tool making industry is characterized by small and medium-sized enterprises with a high product competence [11]. In Germany e.g. about 80% of the totally approx. 54,000 employees are employed in companies with less than 20 workers [12]. The product range includes die-casting-, sheet- and massive forming- as well as injection molding tools and varies depending on the country. In Portugal, for example, 91.5% of the production is attributable to injection molding tools, whereas Germany shows a balanced output of sheet- and massive forming tools (45.3%) and injection molding tools (49.6%) [11]. However, their commonality is the sharp drop in sales during the world economic crisis in 2009/2010 between 24% (Austria) and 40% (Spain). Up to this day not all markets have recovered completely from these consequences. On the one hand for example, Italia, as the second largest producer of tools in Western Europe with a production value of 4,320 M. € in year 2014, still has a lower output than before the crisis in 2008 (5,352 M. €). Spain also could not reach the pre-crisis level yet (2008: 1,057 M. € / 2014: 891 M. €). On the other hand countries with a positive general economic situation, like Germany, already exceeded the pre-crisis level (2008: 10,715 M. € / 2014: 10,772 M. €) or Portugal (2008: 56 M. € / 2014: 84 M. €) [8, 9].

2.2. Potentials and Challenges for the Western European Tool Making Industry

To ensure the competitiveness in future, it is important to diversify from your competitors. Schuh et al. identified five factors of value creation, which have to be addressed nowadays by the Western European tool making industry to ensure their operative excellence [13]. These five factors are life-cycle costs, time-to-market, innovation, quality and productivity.

Life-cycle costs: Experts assume that 60% of total production costs are determined by the production tool and the aspects like maintenance and repair [14]. Innovative tool concepts enable customers to realize significant cost-saving potentials over the product's life-cycle because of the tools' high productivity. Therefore, tools' life-cycle costs become one of the most important lever [15].

Time-to-Market: Due to its key position between product development and series manufacturing the speed of the order processing is a major influencing factor for the time-to-market

of a new product. In times of decreasing product life-cycles the tool making's influence of the product success increases constantly.

Innovation: Innovations constitute an important factor for enterprises in high wage countries. Novel processes and tool concepts enable an efficient production and therefore an active contribution to the customer's product development [15, 16].

Quality: To ensure a high customer satisfaction a high quality perception is needed. Therefore not only the tools' quality needs to meet the requirements but also the interaction between tool and machine has to be optimized. The only way to achieve this is by using innovative organizational measures and technology developments, e.g. automated sensor-actor systems [17].

Productivity: The importance of acquisition price in the competition can be decreased by reducing tools' life-cycle costs. For that, high tool availability and thus a high productivity in use must be addressed. However, it can be hard for the customer to perceive this value because of the challenging measurability.

Even though tool making industry in Germany and most of the other Western European countries are in a good general economic situation again, as shown in Chapter 2.1, the companies will face new challenges in the future. To manage these challenges it will not be sufficient to only address value creation in terms of life-cycle costs, time-to-market, innovation, quality and productivity.

As a result of the still raising expertise of Asian and Eastern European companies, companies from these countries will compete with the established market participants on a comparable quality level [18].

Considering the higher production costs in Germany than in Asia, the actual tool price per kg nevertheless can be used as an indicator for the tools' quality and complexity. In Germany, as a representative of an established market offering high quality tools, this price is 16.67 €/kg. Whereas in China, as a representative of a raising market, it is only 8.30 €/kg [7]. However, it must be taken into account that the Chinese tool making industry is highly inhomogeneous, so that isolated companies are already able to produce high-complex tools [11].

The lower factor costs of global competitors set companies from high-wage countries additionally under pressure. For that reason it is difficult for them to enter the competition over the price of the tool [19].

Especially the tool making industry is also pressurized by shortened tool life-cycles and the advancing product diversification, which implicates decreasing tool budgets [20].

The combination of raising importance of global competitors from low-wage countries and their lower factor costs as well as the shortened tool life-cycles leads to the fact that differentiation by operative excellence of value creation only will not be able to keep the Western European tool making industry successful in competition [21].

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