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Advanced maintenance as enabler for service oriented business models (BM) – An application in forklift trucks

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Abstract: The current phase of global economy competitiveness under economic downturn are pushing many sectors related to manufacturing industry to adapt and discover new ways to make profitable businesses. In particular, there is a trend for manufacturers towards service oriented business models: That is selling the usage or even the product performance.

However, these new business completely change the manufacturer's perspective over the costs and revenues arising during the product lifecycle, and therefore the relevance of concepts such as life cycle costs or maintenance management strongly increases. Thus, the reduction of costs related to the product usage and maintenance is mandatory in order to achieve a profitable business.

This paper presents an example of this transition to service oriented business models. In particular, it presents the business opportunities of an SME that produces forklift truck solutions. The paper will focus on how maintenance technologies are enabling the generation of new service oriented business and how these new technologies do influence in the main KPIs of the company.

Keywords: Condition Monitoring, Sensors, Signal Analysis, Failure Analysis; Maintenance Models and Engineering; Asset and maintenance management, Product-Service, KPIs.

1. INTRODUCTION

The current economic downturn and the global economy competitiveness are pushing many sectors related to manufacturing industry to adapt to an ever-changing business environment looking for new ways to diversify their business (Takata, 2013). In particular, there is a trend for manufacturers producing and selling durable products towards selling the usage of the product (e.g. renting, pay-x-use) or even selling the product performance (e.g. pay-x-performance). All these emerging trends fall within the equivalent concepts of 'Product-Service Systems' (Tucker, 2004) and 'servitization' of manufacturing (Vandermerwe and Rada, 1988).

These new business completely change the manufacturer's perspective over the costs and revenues arising during the product lifecycle. The relevance of concepts such as Total Cost of Ownership, life cycle extension or maintenance management strongly increases (Takata et al, 2004), and thus the control of costs related to the product usage and maintenance is mandatory in order to achieve a profitable business, even at the expenses of higher costs related to materials, production processes or supporting technologies.

Therefore, there is an important organizational and technological change requested, and this is why there is still today a limited diffusion of new business models (BMs), especially on manufacturing SMEs. Despite the expected benefits, the transition towards such models is slow and mainly concerning large manufacturers and multinationals. Smaller firms often lack managerial vision, competence and resources to revolution their Strategy, Organization (internal and inter-firm), Product Design, Maintenance/Repair/Renovation Services and Economic Performance Measurement Systems (towards customer lifetime value). Frequently capital goods manufacturers act as pure suppliers of pieces of equipment while they neglect the opportunities stemming from a more service-oriented approach. Thus, they tend to lose control over their installed base, and therefore lose the opportunity to offer additional customized services and products (Adrodegari et al, 2015).

This paper presents an example of a successful transition to service oriented business, related to a forklift truck integrator SME. This example is developed within an R&D project where different methodologies and technologies have been developed in order to leverage and support the creation of new BMs, in particular advanced maintenance technologies. Therefore, next chapter will show the use case, as well as the R&D background. Next, the specifics of the maintenance

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methodology will be shown, and this will conclude with the evaluation of the feasibility of the new service oriented model in terms of main KPIs.

2. THE USE CASE IN TRANSPORTATION

2.1 T-REX project – The transition to new service oriented BMs. Technology enablers

The European project T-REX[1] is targeting the development of specific technologies and tools (grouped into four different 'levers') that will empower the companies (specially SMEs) in the development of advanced service-oriented BMs for new Product-Service Systems (PSS) offering, thus promoting a shift from value in exchange to value in use for customer needs satisfaction.

New BMs that do not transfer the product ownership offer extended opportunities, with respect to traditional BMs, regarding the redesign of the products, the after-sales services and supply chain, and the manufacturer-customer relationship (see Table 1).

This project has started in October 2013[2] to support companies satisfying current customer needs, enhancing the company's performance, enabling to diversify its business and achieving a competitive advantage. In particular, defining and implementing a new Product-Service Systems (PSS) offering is a demanding process, and T-REX understands that several methodological 'levers' should be deployed: Among these, we highlight two:

1- A framework and methodology to understand how to derive a new service oriented business from current activities;

2- A methodology for fast deployment of integrated local monitoring and fleet management, customizable to the industry requirement;

Firstly, the framework guides the identification of new BMs through a PSS typology organised in 5 different types of ownership-oriented and service-oriented configurations, as explained in (Adrodegari et al, 2015) and shown in Figure 1. Each type takes care of the needs in advanced maintenance technologies as potential enablers of the new model.

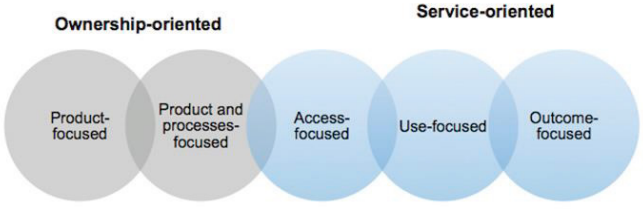

Fig. 1. PSS types (Adrodegari et al, 2015).

Table 1. Traditional vs. new BMs – main differences

	"traditional" BMs	"new" BMs
Product design	Product is designed for the minimum cost Lifetime should be enough	Product cost is less important. The relevant cost is the Total Cost of Ownership. The product is configured for the application. Product lifetime is enlarged.
Services, supply chain and customer relations	Product developer establishes conservative PM policies. Maintenance is made in house or by third parties After-sales services, mainly technical assistance and spare parts, are sources of revenue for the manufacturer (or third parties)	Product developer makes extra effort to minimize maintenance cost: leveraging on techniques and tools to optimise preventive and emphasize on prediction Services allow the increase of product availability
Customer relations and Cash flows	Product sales as a one-off transaction In the usage and end-of-life phase interactions between the manufacturer and the customer may not occur. If they occur their monetary value is often negligible compared with the product value Product developer is not aware of the conditions in which the product is in operation Dismantling is in charge of the user	Product-Service Systems provision as a relational, long-term process Stable and continuous cash flows from customer to manufacturer over the product lifecycle, of a smaller entity compared to product sales Cash flows cover both the product and service component of the offer Product developer is aware of operating conditions Information from the product is collected to increase product availability (e.g. Condition Monitoring), to increase service efficiency (e.g. remote control/ diagnosis) and to transform field feedback into input for designing new products and services End of life is in charge of the producer. Some modules could be re-used

Secondly, the methodology for fast deployment of a condition monitoring system retrieves the resulting business model as a main driver to construct a cost-effective solution.

[1] T-REX: Lifecycle extension through product redesign and repair, renovation, reuse, recycle strategies for usage & reusage-oriented BMs).

[2] www.t-rex-fp7.eu