

# MAINTENANCE OUTSOURCING: A step towards Product Service Systems



Amir Toossi, Helen Lockett and Emma Macdonald (Cranfield University)  
Rick Greenough (De Montfort University)  
Ewout Roozendaal (Rockwell Automation)

**Abstract**

*Intense competition in the current global business environment and the need to increase profit have caused companies to seek competitive advantage through the provision of services. In this new service-oriented world companies are providing integrated 'Product-Service Systems' instead of selling only tangible products. In addition, companies are continually trying to reduce their costs, and one primary focus is to minimise the cost of processes like maintenance – which has always been considered a cost centre.*

*This paper considers Product Service Systems as an emerging approach to creating a win-win situation for OEMs and their customers, and discusses maintenance outsourcing as a step towards applying this new concept. Two key elements in successful maintenance outsourcing are to understand the risks to the service providers in taking responsibility for their customers' maintenance activities, and understanding the value that is delivered to the customers by the maintenance service provider. The concept of 'value-in-use' will be introduced as an improved decision criterion for maintenance outsourcing, and the need for a tool to assess value-in-use will be explained.*

**OUTSOURCING MAINTENANCE**

Faced with intense global competition on one hand and operational risks, limited resources and new technologies on the other hand, companies are trying to optimise their resources. Increasing numbers of companies are outsourcing their 'non-core' activities in order to reduce the risk of operation. The activities selected for outsourcing are those for which the risk of losing know-how into the supply chain is low. The desire for outsourcing results from an economic climate where the emphasis is on cost savings and increased profits, and where outsourcing can reduce costs and increase quality (especially for 'Lean' operations). This is achieved by concentrating on a company's core competencies and outsourcing all activities for which the company has neither a strategic need nor a special capability, which results in increasing their return on internal resources.

Once a company has taken the decision to outsource, the next step is to identify which operational functions and activities offer the most potential for outsourcing. These are usually support services which are not part of the organisation's core competencies. Suitable support services are routine, well defined, can be measured and managed at arm's length, and are provided by suppliers in a



# MAINTENANCE OUTSOURCING: A step towards Product Service Systems

competitive marketplace. They may include services that are critical and specialised as well as those that are routine<sup>1</sup>.

Not surprisingly, some maintenance activities (see Figure 1) are good candidates for outsourcing. This is most apparent where uptime, capacity and precision of equipment are critical and there is a shortage of skilled and experienced maintenance engineers<sup>1</sup>. The following is the Plant Maintenance Resource Center's 2001 list of reasons for outsourcing maintenance activities:

- To increase labour productivity and work quality
- To reduce maintenance costs
- To allow in-house personnel to concentrate on core activities
- To reduce management effort
- To obtain specialist skills not available in-house
- To level fluctuations in workload
- To reduce risk
- To increase access to specialist equipment
- To increase equipment uptime/performance

low labour costs has directed product suppliers towards differentiating their products by offering supplementary services to their customers. In other words, product suppliers are 'moving away from the transactional business imperative and offering more integrated and value adding services to their customers'<sup>3</sup>. This increased service element can result in sustainable profit margins higher than product sales [4]. In fact, the provision of product support or services could lead many products to achieve greater customer satisfaction and provide a competitive advantage in marketing, and as a result be a considerable source of revenue and profit.

According to Auramo et al<sup>1</sup> there are three reasons for this shift in enterprise rationale:

1. An installed base of products with long life cycle could generate substantial, and more stable, revenue.
2. In many companies concentration on the core competencies has resulted in demand for more services.
3. Services can be a sustainable source of competitive advantage.

product and service offering that delivers value-in-use' and define an organisation's shift toward this kind of offering as 'servitization'. Companies such as Rolls-Royce and GE with their 'power by the hour' type of contracts and Xerox with their document management services are outstanding examples of this kind of approach.

Applying this kind of business model shifts the interaction between product suppliers and their customers from transactional to relational. Product Service Systems refer to services that are managed on the basis of ongoing co-operative agreements between supplier and customer, where operational risks are transferred from the customer to the supplier.

Traditionally, product support and service merely constituted maintenance and repair. However, the scope of product support has broadened over the past decade, to include such aspects as installation, commissioning, training, maintenance and repair services, documentation, spare parts supply and logistics, product upgrading and modification, software and warranty schemes, telephone support, etc.<sup>8</sup>

As products become more advanced and complex many manufacturers find themselves supplying more services related to product exploitation, maintenance, modifications and upgrade. Markest and Kumar report that 'product support appears to be important for industries where the equipment is complex, where it fails frequently or has serious failure consequences (high risk)<sup>9</sup>. They divide product support into two categories: support to customer and support to product (which includes installation, maintenance, upgrading etc.) Therefore, product support is closely related to maintenance and operations, as well as the customer's logistics and inventory system. Indeed, many manufacturers now realise that a significant part of their turnover comes from repair, maintenance and modernisation or modification services. Historically, maintenance has always been considered as a cost centre and a necessary evil, but there is an emerging view that it not only reduces business risk but should also be seen as a value-adding process in today's dynamic and competitive business environment<sup>10</sup>.

## VALUE AS A DECISION CRITERION FOR MAINTENANCE OUTSOURCING

The move towards Product Service Systems has shifted the focus from

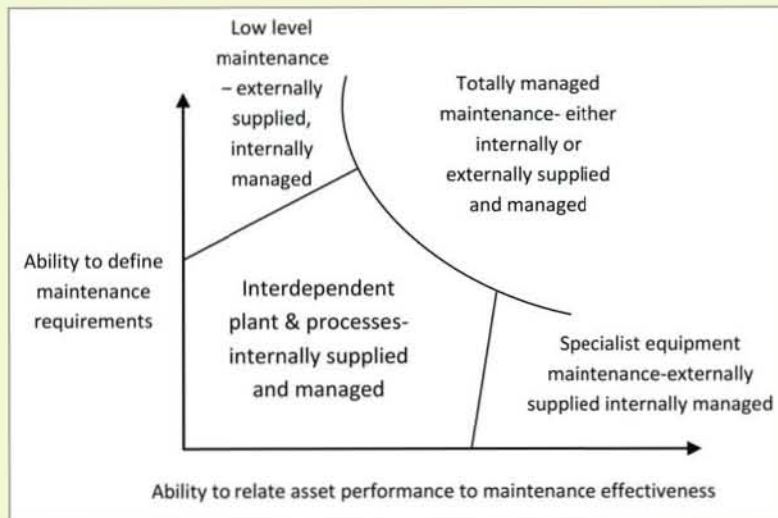


Figure 1 Maintenance outsourcing strategy<sup>1</sup>

## MAINTENANCE AND PRODUCT SERVICE SYSTEMS (PSS)

In order to survive in the current global competitive environment, companies often follow either a differentiation strategy or a cost leadership strategy<sup>2</sup>. Competition from countries with

In this respect, new concepts such as product-service offerings, bundles or, lately, Product Service Systems (PSS)<sup>5</sup> have emerged. Greenough and Alomair have asserted that 'the complex relationship between products and services is shifting and a larger component of added value offered to the customer is now being provided by services'<sup>6</sup>. Baines et al<sup>7</sup> define Product Service Systems as 'an integrated



attracting new customers to maintaining the relationship with existing customers by increasing customer satisfaction. Customer satisfaction is a function of the value which is created through these new offerings<sup>11</sup>. In fact, PSS providers add value by creating unique benefits for their customers. Not only do they take on the risk of managing customers' in-house activities, they also develop new settings for products and services to work together as an integrated system to increase the overall value of the solution for the customer<sup>12</sup>. It is therefore important for PSS providers and customers to understand how value is created in this new business model.

In the business marketing literature value is defined as the 'monetary worth of the economic/social, technical, service and social benefits a customer receives in exchange for what it pays for a market offering'<sup>13</sup>. Monroe provides an alternative definition of customer perceived value as the ratio between perceived benefits and perceived sacrifices<sup>14</sup> while Zeithaml similarly defines value as the 'overall assessment of the utility of a product (or service) based on perception on what is received and what is given'<sup>15</sup>.

The decision making criteria used to measure the value that is delivered through maintenance outsourcing must therefore incorporate a combination of both economic and non-economic factors. Wolff et al. concur with this view, stating that the currently adopted criteria for investment decisions are not exclusively economic in nature, but also take into account social and environmental considerations in appraisal of the security of investments<sup>16</sup>.

The economic value of the outsourced maintenance services can be evaluated using a number of different methods. For example, Value Driven Maintenance (using life cycle costing methods and performance measurement benchmarking), Reliability Engineering methods and Risk Engineering are examples of approaches to quantifying the economic value of maintenance, but they do not consider the non-economic value of maintenance.

The closer customer to supplier relationships required for the provision of Product Service Systems necessitate a more holistic approach in defining the value concept, such as 'value-in-use'. Vargo and Lusch define this as 'a customer's functional outcome, purpose, or objective that is served directly through the product/service consumption'<sup>17</sup>. This definition is different from the embedded value concept, which they define as 'performance against

product/service attributes for which the customer is prepared to pay'. In fact, in the emerging service dominant logic the customer is a co-producer of value and the value is perceived and determined by the customer in terms of value in use. In other words customers are active participants in relational exchanges and co-production<sup>17</sup>.

## UNDERSTANDING THE VALUE OF MAINTENANCE SERVICES

Assessing the value-in-use delivered by maintenance services is particularly difficult, because a well managed planned maintenance service which ensures high levels of equipment availability may be less visible to the customer than the 'fire-fighting' associated with unscheduled maintenance, even if it is providing a better service. This situation presents a problem for suppliers of maintenance services in how to ensure that their customers recognise the value-in-use delivered by their services.

In fact, understanding how the value of maintenance services is assessed in an organisation from an overall perspective creates a good opportunity for both suppliers and customers of maintenance services. According to Anderson and Narus<sup>18</sup> 'to persuade customers to focus on total costs rather than simply on acquisition price, a supplier must have an accurate understanding of what its customers' value and would value'. Also, this assessment would help suppliers to design and tailor a better service for customers, gain new customers by integrating value knowledge with marketing efforts and finally 'better sustain customer relationships by documenting its delivery of superior value over time and by discovering new ways to update and reinvigorate those relationships'. On the other hand, understanding value will help customers to have reliable decision making criteria for maintenance outsourcing. In fact, 'many customers understand their own requirements but do not necessarily know what fulfilling those requirements is worth to them'. In order to understand the overall value of maintenance services we have to analyse the different hierarchical levels of an organisation as well as considering the dynamic nature of value over time.

Cranfield University is currently conducting a multi-disciplinary research project funded by the Engineering and Physical Sciences Research Council (EPSRC) and the Cranfield Innovative Manufacturing Research Centre (IMRC) to understand the value created by

maintenance and to aid decision making in both the supplier and customer sides of the PSS relationship. The project is also supported by Rockwell Automation, which is a provider both of automation products and of maintenance and asset management services. This research project is being conducted in both qualitative and quantitative stages and will result in a tool to assess the combination of tangible and intangible values of maintenance and their possible inter-influences. The project is currently at the qualitative stage and semi-structured and structured interview techniques are being used with Rockwell Automation's customers to understand the value-in-use of maintenance services.

A model has been developed by the project team to represent the ways in which value-in-use may be co-created in a Product-Service System. A graphical representation of the model is shown in *Figure 2 opposite*.

This model will be further developed and combined with a model of economic maintenance value as a part of the quantitative stage of the research. Building this tool will result in a better understanding of customer needs, designing better maintenance plans and strategies, better demonstration of value, and creating a win-win situation for customers and suppliers in a mutually beneficial value-creating atmosphere. The project will also deliver a workbook that can be used by companies wishing to assess the value delivered by the services they offer. ❁

## REFERENCES

1. Campbell J D. *Outsourcing in maintenance management: a valid alternative to self-provision*. Journal of Quality in Maintenance Engineering, Vol 1, No 3, pp 18-24. (1995)
2. Levery M. *Outsourcing maintenance - a question of strategy*. Engineering Management Journal, Vol 8, Issue 1, pp 34-40. (1998)
3. Auramo J et al. *Increasing operational efficiency through improved customer service: a process maintenance case*. International Journal of Logistics: Research and Applications, Vol 7, No 3, September 2004.
4. Joseph D et al. *After the sales; how to manage product service for customer satisfaction and profit* (4th Edition). The Solomon Press, January 2000.



# MAINTENANCE OUTSOURCING: A step towards Product Service Systems

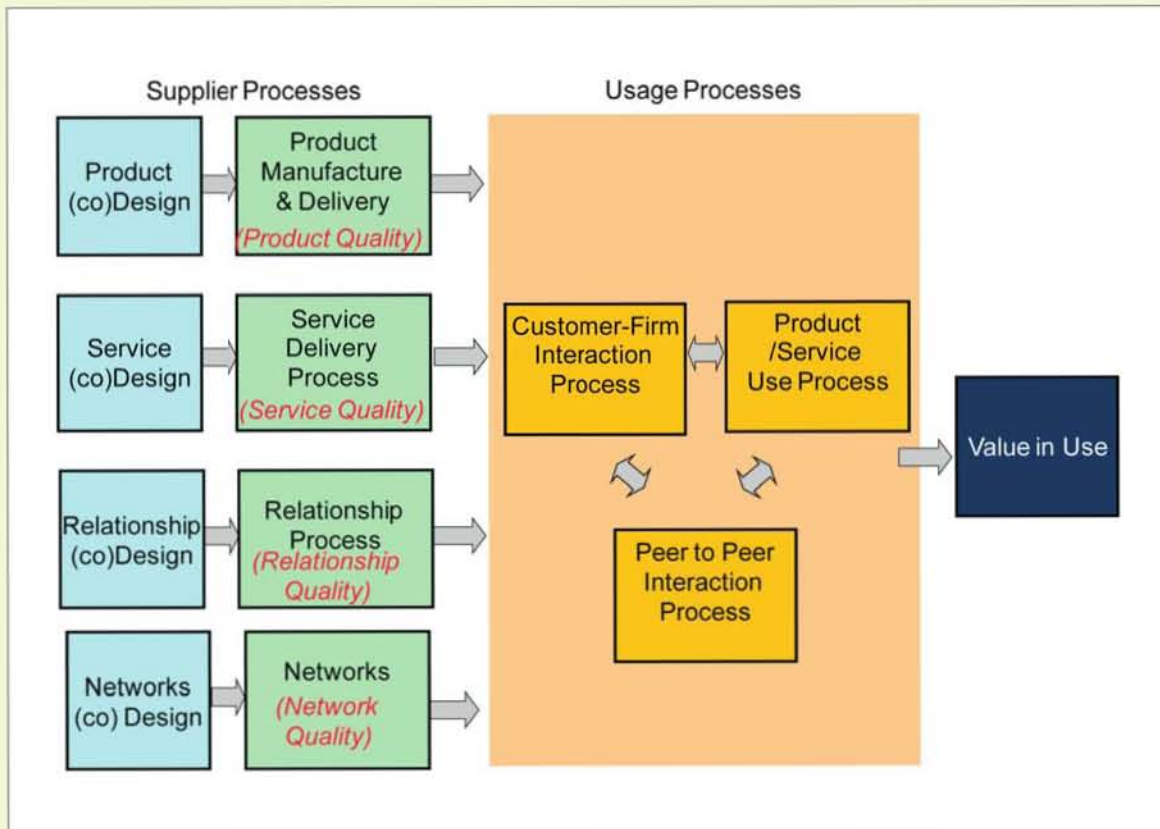


Figure 2 Model for assessing value-in-use<sup>18</sup>

5. Tukker A and Tischner U. *New business for old Europe: product-service development, competitiveness and sustainability*, Greenleaf Publishing 2006.
6. Greenough R M and Alomair M S. *Towards a better understanding of the risks of servitization*. Proceedings of the 3rd World Conference on Production and Operations Management, Gakushuin University, Tokyo, August 2008.
7. Baines T et al. *State-of-the-art in Product Service Systems*. Proceedings of the Institution of Mechanical Engineers, Part B, Journal of Engineering Manufacture, Vol 221(10), pp 1543-1552. (2007)
8. Blanchard B S and Fabrycky W J. *Systems Engineering and Analysis, 3rd Ed*. Prentice-Hall, Upper Saddle River, NJ. (1998)
9. Markeset T and Kumar U. *Dimensioning of product support: issues, challenges, and opportunities*. IEEE RAMS Symposium, 2004.
10. Liyange J P and Kumar U. *Towards a value-based view on operations and maintenance performance management*. Journal of Quality in Maintenance Engineering, Vol 9 No 4, pp 333-50. (2003)
11. Ravald A and Gronroos C. *The value concept and relationship marketing*. European Journal of Marketing, Vol 30, No 2, p 19-30. (1996)
12. Brady T et al. *Creating value by delivering integrated solutions*. International Journal of Project Management, Vol 23, pp 360-365. (2005)
13. Anderson J C and Narus J A. *Business marketing: understand what customers value*. Harvard Business Review, Nov-Dec 1998.
14. Monroe K B. *Pricing: Making Profitable Decisions*. McGraw-Hill, New York, 1991.
15. Zeithaml V A. *Consumer perceptions of price, quality and value: a means-end model and synthesis of evidence*. Journal of Marketing, July 1988.
16. Wolff R et al. *Indicators for sustainable development*. Proceedings of the SPE International Conference on HSE in Oil and Gas Exploration and Production, Paper SPE 61320 (2000). Available at: www.spe.org
17. Vargo S and Lusch R. *Evolving to a new dominant logic for marketing*. Journal of Marketing, Vol 68, pp 1-17. (2004)
18. MacDonald E K et al. *Developing a framework for assessing the value-in-use of product-service systems: a case study*. EIASM Naples Forum on Service: Service-Dominant Logic, Service Science and Network Theory, Capri, June 2009.