Chapter 7
Service 4.0:
The Reasons and Purposes of Industry 4.0 within the Ambit of After-Sales Maintenance

Eduardo Castellano
IK4-IKERLAN, Spain

Gerardo Pagalday
IK4-IKERLAN, Spain

Patxi X. Zubizarreta
IK4-IKERLAN, Spain

Jone Uribetxebarria
IK4-IKERLAN, Spain

Adolfo Crespo Márquez
University of Sevilla, Spain

ABSTRACT

In recent years, the concept of Industry 4.0 has been significantly advanced in industrial circles as an aspect that provides a competitive differential. Through the technologies involved, machines can now monitor and relay information on their operating conditions for analysis and decision-making, as well as for prompting action. These new functions generally involve the development of technological projects and significant investments. This renders it expedient to explain why certain systems should be monitored, but not others, as well as the use to be given to the data gathered as a way of generating income for a firm. This approach is especially important in certain corporate operations, such as after-sales maintenance. This article introduces a reference framework that permits the effective and efficient management of after-sales maintenance services. This framework relates after-sales service technologies with product technologies (Industry 4.0), and therefore covers the reasons and purposes of Industry 4.0 within the ambit of after-sales service.

INTRODUCTION

Until recently, the bulk of the turnover for many capital goods manufacturers was generated by the sale of new machines, with their after-sales service being an obligatory extra to be provided with the new sale. For these kinds of firms, therefore, an after-sales service has been seen as a necessary evil and, in short, as an added cost.

As a result of the current crisis and the greater difficulties facing the sale of new machinery, together with the tighter margins in new sales, this viewpoint has gradually changed, and many capital goods manufacturers have begun to consider their after-sales service as both a business opportunity for generating recurring income from the pool of machines sold and a driver of customer loyalty.

The services that may be provided at this stage of the life cycle for machinery and equipment are linked to the actual servicing of the items sold (e.g., repairs, spare parts, preventive maintenance, and retrofitting), contracts for guaranteeing machine availability, contracts on the use of machinery (e.g., renting and leasing), services related to energy efficiency, process enhancement, and training, amongst others (Cohen, Agrawal & Agrawal, 2006).

The following figure provides a schematic view of the reference framework for industrial maintenance management proposed by Crespo (2007), which has been adapted to apply to the after-sales ambit.

The reference framework for after-sales maintenance described in this chapter consists of a number of initial phases that use the cost incurred by the unreliability of a machine's different parts to identify which ones should be remotely monitored and supervised by means of *Condition Based Maintenance (CBM)*. In other words, identification is made of those systems in the machine that require investment in technological development, and those which do not; hence the reason for Industry 4.0 in the after-sales maintenance service. Later phases, on the other hand, permit acting upon the alerts generated by these Industry 4.0 technologies for fine-tuning the necessary resources (i.e., management of stocks of spare parts, and dynamic scheduling of maintenance tasks) for the service's deployment; hence the purpose of Industry 4.0 in the after-sales maintenance service. The after-sales maintenance framework thereby provides information on the return on investment of Industry 4.0 for machinery, through the after-sales maintenance service, which is of particular interest for a firm's business outlook (e.g., funds spent vs. funds generated).

The next section describes the types of firms that have taken part in the case studies. A comparison between the reference framework for industrial maintenance (Crespo, 2007) and those firms' after-sales operations and specific techniques identified in the literaturehas been used to constitute the reference framework for after-sales maintenance services that is described in the third section. The fourth section identifies three typical levels of maturity for the after-sales maintenance service identified based on an analysis of the case studies, and lays out a roadmap for advancing toward higher levels of development.

CASE STUDIES

Based on the industrial maintenance management framework propounded by Crespo (2007), as shown in Figure 1, and the *Maintenance Effectiveness Survey* (Marshall Institute, 1999), a semi-qualitative questionnaire (Patton, 2001) has been compiled for each one of the phases. The questionnaire has been designed for use in industrial firms in the capital goods sector to identify those more salient differences existing between the approach to industrial maintenance and the consideration of the after-sales mainte-

Related Content

Data-Driven and Practice-Based Evidence: Design and Development of Efficient and Effective Clinical Decision Support System

Hamzah Osopand Tony Sahama (2016). *Improving Health Management through Clinical Decision Support Systems (pp. 295-328).*

www.irma-international.org/chapter/data-driven-and-practice-based-evidence/138651

Big Data Analytics in Mobile and Cloud Computing Environments

Muhammad Habib ur Rehman, Atta ur Rehman Khanand Aisha Batool (2017). *Decision Management: Concepts, Methodologies, Tools, and Applications (pp. 1478-1496).*

www.irma-international.org/chapter/big-data-analytics-in-mobile-and-cloud-computing-environments/176815

Fuzzy Multi-Objective Linear Programming Problem Using DM's Perspective

Vishnu Pratap Singh, Madhura Deshmukhand Kirti Sharma (2022). *International Journal of Decision Support System Technology (pp. 1-17).*

www.irma-international.org/article/fuzzy-multi-objective-linear-programming-problem-using-dms-perspective/286695

Analysis of Risk and Reliability in Project Delivery Methods

Robert Schultz, Ahmad Sarfarazand Kouroush Jenab (2013). *International Journal of Strategic Decision Sciences (pp. 54-65).*

www.irma-international.org/article/analysis-of-risk-and-reliability-in-project-delivery-methods/94661

Integrating Spatial Planning of Protected Areas and Transportation Infrastructures

Mihai Rzvan Ni, Mihit Iulian Niculaeand Gabriel Ovidiu Vânu (2016). *Using Decision Support Systems for Transportation Planning Efficiency (pp. 311-329).*

www.irma-international.org/chapter/integrating-spatial-planning-of-protected-areas-and-transportation-infrastructures/135403