

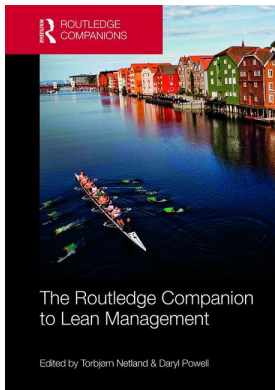
This article was downloaded by: 10.2.97.136

On: 01 Apr 2023

Access details: *subscription number*

Publisher: *Routledge*

Informa Ltd Registered in England and Wales Registered Number: 1072954 Registered office: 5 Howick Place, London SW1P 1WG, UK



The Routledge Companion to Lean Management

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Lean After-Sales Services

Publication details

<https://test.routledgehandbooks.com/doi/10.4324/9781315686899.ch21>

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Published online on: 28 Dec 2016

How to cite :- Barbara Resta, Paolo Gaiardelli, Stefano Dotti, Dario Luise. 28 Dec 2016, *Lean After-Sales Services from: The Routledge Companion to Lean Management* Routledge

Accessed on: 01 Apr 2023

<https://test.routledgehandbooks.com/doi/10.4324/9781315686899.ch21>

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21

LEAN AFTER-SALES SERVICES

Barbara Resta, Paolo Gaiardelli, Stefano Dotti, and Dario Luise

Introduction

Lean principles were originally developed in industrial manufacturing operations and were operationalized as a set of tools and practices that managers and workers could use to eliminate waste and inefficiency from production systems—reducing costs, improving quality and reliability, and speeding up cycle times.

The recent transformation of manufacturing organizations toward the development of differentiation strategies founded on a product-service paradigm, well known as “*servitization of manufacturing*” (Vandermerwe and Rada, 1989), has encouraged scholars and practitioners to extend their discussions on lean production principles’ portability in the light of this changing manufacturing setting. Researchers have started to explore the linkage between the adoption of lean thinking and product-service design, development, and management and delivery through the analysis of how the deployment of the lean philosophy: 1) enables the alignment of value-adding activities with the customer value stream (Hines et al., 2011), 2) supports enterprise knowledge transfer through exploiting the capabilities of those involved, 3) increases the communication across functional boundaries (Tracey and Flinchbaugh, 2006), and 4) decentralizes the decision-making process, fostering a dynamic process of change to ensure a robust, flexible, adaptive, and responsive enterprise (Bozdogan et al., 2000).

In particular, managerial and practical studies have focused on understanding how lean initiatives can help organizations dealing with the first level of servitization (Oliva and Kallenberg, 2003), also called after-sales services, to improve and differentiate themselves while lowering costs and capital investments. Indeed, as a consolidated business strategy adopted by the majority of Western manufacturing companies, after-sales services require new ways and approaches to significantly increase operations performance. A lean approach can support companies to move in this direction.

On these premises, this chapter introduces an overview of the application of lean thinking philosophy in after-sales services. Through real examples and a case study, the chapter explores how lean principles, methods, and tools can advance both efficiency and effectiveness of after-sales service processes, underlining strengths and weaknesses, as well as opening issues and challenges in the adoption of lean thinking in the after-sales area.

After-Sales Services

After-sales services represent the activities that support products after they are sold and delivered to customers. Created to guarantee functionality and durability of a product, and support customers during the middle and end-of-life phases of a product life cycle, after-sales services can be grouped into four main categories (Legnani et al., 2013):

- 1 services provided during the process of transferring the ownership of the product to the customer to make it work, such as product installation, training, product documentation, or financial or insurance services as well as extension or customization of the warranty,
- 2 services provided to facilitate and improve the procedures for efficient use of the product by the user as well as to periodically assess any unforeseen issues that may arise, such as customer care, upgrades, and product check-up,
- 3 services associated with the recovery of product functions, such as maintenance and repair of products, and replacement of defective parts, and
- 4 services associated with product disposal, dismissal, or recovery at the end of its lifespan.

The relevance of after-sales services is demonstrated by the several advantages achievable by companies in terms of higher profit margins, more stable source of profits, and lower cash flow vulnerability. For instance, in the automotive industry, while the average sales profitability for car manufacturers and their dealer networks ranges between 0 and 2 percent, the after-sales business accounts for up to 23 percent of revenues and 50 percent of profits (SupplierBusiness, 2009), generating at least three times the turnover of the original purchase. Moreover, the huge number of vehicles in circulation can secure important and stable revenues over time. In addition, in a context of global competition and decreasing profits from product sales, the after-sales service is not only a profit source. It also becomes a key differentiator for manufacturing companies, supporting them in building up barriers to entry, and making market penetration by potential new competitors more difficult. Through long-term warranties, service contracts, or mandatory maintenances to preserve warranty rights, after-sales services represent a powerful marketing force for establishing durable customer loyalty and promoting the company brand image. Finally, data gathered from the field are a topical input for an effective undertaking of new product and service development, sales and promotion, as well as marketing and customer relationship management activities.

Nevertheless, escalating challenges characterizing the current after-sales market call modern organizations to rethink their after-sales operations processes and activities. Examples of such challenges include rising customer expectations (in terms of new and challenging levels of perfection, response time, and convenience), revenue, regulatory and competitive pressures, and increasing expenses requested to sustain the proliferation of complex and high-technological product-service offerings. In such a context, translating lean production philosophy to the management of after-sales processes may represent a valid managerial solution to enable organizations to meet their customers' expectations and sustain competitive advantage and growth.

What are Lean After-Sales Services?

Adapting the lean production definition provided by Shah and Ward (2007) to the after-sales domain, it can be stated that "Lean after-sales services are an integrated socio-technical system focused on the definition and the creation of successful and profitable after-sale value streams by

eliminating waste and concurrently reducing or minimizing supplier, customer, and internal variability.” By focusing on the value creation concept, a lean after-sales service approach supports companies in meeting the challenges and the additional complexities that are introduced when services are integrated into a product, notably (Pawar et al., 2009):

- defining the value proposition that will satisfy the customer,
- designing the operational system to deliver the value proposition, and
- delivering the value through a network of partners.

In particular, lean after-sales service is related to the revision and application of lean production principles, as defined by Womack and Jones (1996), that organized production work as an uninterrupted flow proceeding through all processes at a steady pace without rework, backflow, or inventories, for the flexible delivery of quality products in the shortest possible time and at minimum cost.

Principle 1: Specify After-sales Service Value

Identify what customers really want. In lean thinking, the value of a product or service is defined exclusively by the end-use customer. The product or service must meet the customer’s needs at both a specific time and price. Similarly, in after-sales the customer becomes an integral part of the process (value co-creator) and the consumption experience defines what is valuable to a customer (Smith et al., 2014). In particular, value tends to focus on product availability and performance, along with risk and reward sharing between customer and after-sales service provider (Baines et al., 2009). Therefore, the application of a lean production approach can create a powerful methodology for defining and designing the value proposition that will satisfy individual customer expectations over time. Thus, it will also create a powerful methodology for identifying the related value co-creation process.

Principle 2: Identify the After-sales Service Value Stream

Identifying the value co-creation stream means to understand all the activities required to provide an after-sales service, and then to optimize the whole process from the view of the end-use customer. The customer’s standpoint is fundamental for identifying activities that: 1) add value from waste, 2) add no value but are essential under current conditions (type 1 *muda*), and 3) add no value and thus can be eliminated immediately (type 2 *muda*). In after-sales, eight waste areas can be identified:

- 1 *Transportation*: Unnecessary, wrong, or slow movement of materials and/or information between employees and departments results in variable time being wasted. For example, the rejection of a loan to finance a product sale or expensive after-sale repair due to incorrect income calculations goes through multiple handoffs and approvals before it is corrected. Unnecessary transportation includes not only documents and materials, but also moving customers to different offices and desks to complete a process.
- 2 *Inventory*: The traditional manufacturing concept of inventory does not exist in after-sales services, since services cannot be kept in stock. However, poor balancing of workloads, particularly when work is processed in large batches, suboptimal housekeeping (for example, poor filing or record-keeping, or lost documents) and insufficient communication may cause excess items or supplies, activities backlogs, or, conversely, stock-out events.

- 3 *Motion*: Inefficient work routines caused by high levels of bureaucracy and/or unproductive and unstructured layouts involve the creation of unnecessary movements not required for performing a service activity. This implies an inefficient management of the service level promised to customers.
- 4 *Waiting*: Unbalanced workload among employees, too few office machines and working stations, lack of a clear process, and quality problems cause delays with customers waiting for service delivery.
- 5 *Over-processing*: Unclear communication with customers generates too much information. This creates unnecessary duplication of service activities (e.g. re-entering data) that, in turn, implies confusion among the employees, who get stressed and start to make mistakes.
- 6 *Overproduction*: A poor understanding of customers' true needs or failing to design the results of processes that conform to customer requirements generates the provision of unnecessary or non-added-value after-sales solutions. Moreover, any rework takes up effort that actually should be going into a fresh transaction. For example, a misdelivered spare part results in extra pick-up from and delivery to the destination.
- 7 *Defects*: Low-quality service delivery or a lost opportunity to retain or win customers by ignoring them, unfriendliness, or similar could result in a real adverse and very costly event that, unlike in manufacturing, can not be rectified. For example, the rework on an engine has no impact on the customer as long as the final product meets the specifications. Conversely, the wrong answer provided in a call center will leave a bad feeling with the customer even after the mistake is corrected.
- 8 *Employees*: Making insufficient use of employee creativity and commitment as well as customers' abilities causes underutilization of service delivery capacity. Underutilization also occurs when organizations fail to make full use of available knowledge, skills, and abilities, e.g. using highly trained professionals to perform tasks that could be performed by someone with less training.

Identifying the value stream means identifying the components of the after-sales service activities which add value to customers. However, customer expectations may vary both between customers and for individual customers over time. Therefore, identifying the adding-value activities is not a simple task. There is the risk that what some customers may see as waste, other customers see as adding value to their experience and hence to the whole system. Moreover, activities that may be considered waste in a manufacturing setting may create value in after-sales. For example, a technician illustrating product conditions after completing product diagnosis tasks may appear a non-added-value task from a manufacturing point of view, depleting highly expensive resources. In an after-sales service setting, however, information transparency achieved through such activities results in a fundamental increase in customer trust and thus improves their satisfaction.

Principle 3: Create the After-sales Service Flow

Get the activities that add value to flow without interruption. Flow can potentially improve both efficiency and customer satisfaction by minimizing provision delays or stoppages for after-sales services in which diversity of demand and customers' disposition to participate are low. This is particularly true for service activities that are evaluated by customers on technical quality determinants, like timeliness, responsiveness, and reliability (as with repair maintenance and spare parts delivery). However, when the customer participates to a greater extent with their own efforts and resources (e.g. in front-office activities), the application of the flow principle is more difficult. The customer helps create the service instead of being a flow-brick in the provider's

process, potentially resulting in reduced customer satisfaction. Indeed, actively pushing the customer through a standardized flow may negatively affect the customer's emotional experience (Carlborg et al., 2013).

Moreover, since after-sales value is mostly delivered through a network of partners, it is fundamental that flow identification and optimization encompasses the entire value chain. This means it includes all parts of the organization involved in value co-creation, as well as the external suppliers, partners, and stakeholders.

Principle 4: Establish Pull

The pull principle is typically embedded in the characteristics of after-sales services and, in general, of pure services, because they cannot be kept in stock or be produced before a customer's order is placed. However, the firm must constantly forecast after-sales service demand in order to have the right competencies and quantities of resources available (equipment, personnel, spare parts, etc.) to satisfy customers. The workflow must be simplified for everyone and the service team has to work to continuously improve the process with scientific methods like PDCA (plan, do, check, act) standards.

Principle 5: Pursuit of Perfection

Lean is a journey of continuous improvement rather than a destination, where value is constantly identified and waste eliminated. While perfection will never be achieved, it is a goal worth striving for because it helps maintain a constant guard against waste. Indeed, on the road of excellence every step must be scrupulously considered. This means that every company pursuing perfection in after-sales services must apply a high level of attention to everything it does, at all levels of its service network, from planning to execution.

Lean Operations in After-Sales Services

To grasp the lean after-sales service approach in an after-sales service provider, managers must focus on eliminating non-value activities from processes by applying a robust set of approaches, and emphasize excellence in operations to deliver superior customer service. Nevertheless, even though some current lean production methodologies are suitable for manufacturing as well as for the majority of after-sales service settings (process mapping methodologies dealing with workflow and from which the information flow can be identified), other methodologies can be more appropriate in specific circumstances. For example, standardization of procedures is a fundamental step in implementing every lean after-sales service. The standardization of processes is appropriate only for highly repeatable services with low customer involvement, such as back-office (planning and administration) and preventive maintenance activities. Such an approach is less suitable in the case of front-office activities that require stronger customer involvement and participation (such as help-desk support) and that are characterized by a lower repeatability (as in repair activities). On these premises, configuring lean strategies into after-sales services operations requires considering both structural and infrastructural characteristics. This is summarized by Resta et al. (2015) and briefly discussed in Table 21.1.

Lean After-Sales Services: Challenges and Opportunities

Benefits achievable from lean implementation in the after-sales business can be outstanding (see Figure 21.1). A survey carried out by Politecnico of Milan in 2010 on a sample of 100 manufacturing

Table 21.1 Lean after-sales service—structural and infrastructural characteristics

Characteristic	Description
<i>Structural</i>	
Process and technology	Lean after-sales services tend to utilize standardized procedures and simple, proven technologies as a way of reducing waste and non-value-adding activities (type 1 muda). Conversely, advanced technologies are avoided due to possible negative effects of the use of “black-box” solutions, and should only be applied once they have been sufficiently proven in practice. However, technology is seldom a substitute for people in after-sales services, but should rather be used as support instead of as a replacement (“automation with human intelligence” or “after-sales service autonoma-tion”). Thus, this will balance the overt need to provide users with a responsive service with the internal drivers of operational efficiency and budgetary constraints. This fundamental difference leads to a search for a methodology that first maps information flow. This would allow for identification of the components of the process rather than the opposite, as prescribed by the value stream mapping approach.
Capacity	Lean after-sales services tend to aim for spare capacity for flexibility to avoid delays which result from over utilization of resources. They tend also to create load balancing and a level schedule (through <i>heijunka boxes</i>) to support continuous material flow and reduce costs while still meeting customer expectations. Extra workers are added to the system to reduce <i>takt</i> time only if full capacity is reached.
Facilities	After-sales service facilities tend to be distributed and located optimally with the needs of the customer in mind. Inventories and warehouses tend to remain more centralized with effective and regular distribution in mind. Internally, the implementation of workplace organization programs (such as 5S, re-layout, <i>kamishibai</i> , or standard work procedures) as well as material flow analysis and optimization (such as <i>kanban</i> , water spider), facilitates the synchronization of processes, increases capacity utilization, and reduces idle times.
Supply chain positioning	Lean after-sales services tend to maintain both vertical and horizontal inte-gration. In order to assure an efficient and effective lean operation system, the headquarters design and apply the same organizational model in the subsidiaries and the network. Every function in the subsidiaries and net-work has to pursue the goal of customer retention in the whole product life cycle. The management of processes is standardized according to the headquarters’ guidelines. Internal lean production structure is replicated outside the manufacturing process in terms of lean procurement, distri-bution, and partnership. Multifunctional teams are responsible for super-visory tasks, while vertical integration systems relying on direct information flow are made available to the relevant decision makers, allowing for rapid feedback and corrective action. Long-term relationships with suppliers and supplier development are also fundamental.
Planning and control	Lean after-sales services tend to aim for product availability, first by reducing lead times, and then by increasing reliability of the product through high service levels (high customer orientation). However, if standardized activities cannot be applied, after-sales cycle time could vary and it is difficult to determine prior to service. By using balancing operation tools

(Continued)

Table 21.1 (continued)

<i>Characteristic</i>	<i>Description</i>
<i>Infrastructural</i>	(heijunka box), companies improve buying from suppliers and the use of equipment and team planning, leading to efficient use of resources, inventory reduction, and downtime and costs elimination, hence directing the creation of flexibility of processes.
Human resources	Compared with manufacturing operations, the after-sales area depends on human factors to a larger extent. On the one hand, human resources are responsible for the prospection, execution, and delivery of service to the customer, especially in contact-intensive activities where the crucial role of employees in delivering value to customers creates a permeable border between them and customers. This condition implies creating a core team of multi skilled and multi tasked operatives. This applies both in-house and in-field, and requires good product knowledge and understanding of customer value creation, including both technical and relational competences. The workforce is also involved in small improvement projects through work teams, but responsibility rests with after-sales managers in order to create a win-win and closed-loop relationship between workforce and management. Therefore, manpower is one of the most relevant and costly factors in doing the job. Functional analysis tools support the evaluation of employees by skill levels, competence areas, and activities to identify excessive worker divisions and diluted worker skill base. On the other hand, the customer is often an active participant to service creation and provision with their own efforts and resources.
Quality control	Lean after-sales services tend to maintain a system of quality control whereby measures are taken to guarantee service process quality in production, as well as during operation in the hands of the customer, and considering both technical and functional perspectives. Technical perspectives include those service determinants that refer to the results or outcomes of a service (i.e. what the customer is actually receiving). Examples include service flexibility, availability, timeliness and responsiveness, accessibility and comfort, reliability, technical competence, cleanliness and tidiness. Functional perspective relates to the manner or the process by which a service is provided (i.e. how the service is delivered). Examples include service customer care, attentiveness/helpfulness, friendliness and courtesy, information, communication, integrity, security, and commitment. In general, data and information quality becomes a key area of both strategic and operations management. It plays a superior role compared with manufacturing settings, where machines, automation, and quality of workflow are more important.
Product/service range	Lean after-sales services tend to offer standardized yet customizable products (mass-customization) with a variety of choices of supporting services, where efforts are made to reduce variation.
New product/service introduction	Lean after-sales services tend to have a core cross-functional team that is responsible for the development of new products and supporting services, with input from the customer and key suppliers.
Performance measurement	In manufacturing settings, the performance of workers is easier to measure. In contrast to measuring the effectiveness of after-sales professionals, dealing with various complexities during operation processes is much more

Table 21.1 (continued)

Characteristic	Description
	difficult. Therefore, lean after-sales services tend to address after-sales services at different levels, from business to process, activity, and development/innovation. This emphasizes both efficiency and effectiveness performance, and considers both internal and customer-oriented measures. In other words, a core set of balanced multi-layered and multi-levelled measures (e.g. a lean product-service system (PSS) balanced scorecard approach), that emphasizes system effectiveness and that is aligned with the strategy of the business, is used. Moreover, activities are coordinated and evaluated by the flow through the team or plant, not by individual departmental targets, to: 1) capture the discrepancies in emphasis and metrics among performance measurement systems adopted by different actors involved; 2) align the strategy and the management practices with those of the supply chain; 3) define and reconfigure the performance measurement system by aligning the new strategic vision and goals with the tactical and operational objectives; and 4) identify the impact of the specific performance results obtained by each actor on the overall after-sales service supply chain performance at any level.
Supplier relations	Lean after-sales services tend to work closely with suppliers in order to reduce supplier lead times and increase supplier quality, e.g. supplier development. Long-term supplier relationships are deployed. As such, suppliers are an integral part of the lean after-sales service operations. For example, supplier kanban programs with spare parts suppliers could ensure fast-fit repair services to customers.
Customer relations	Lean after-sales services tend to focus on customer value, which requires close contact with customers. Wasteful (non-value-adding) activities are systematically identified and eliminated. Customer-focused value creation is the main criterion for lean after-sales service. Customers are an integral part of lean after-sales service operations.

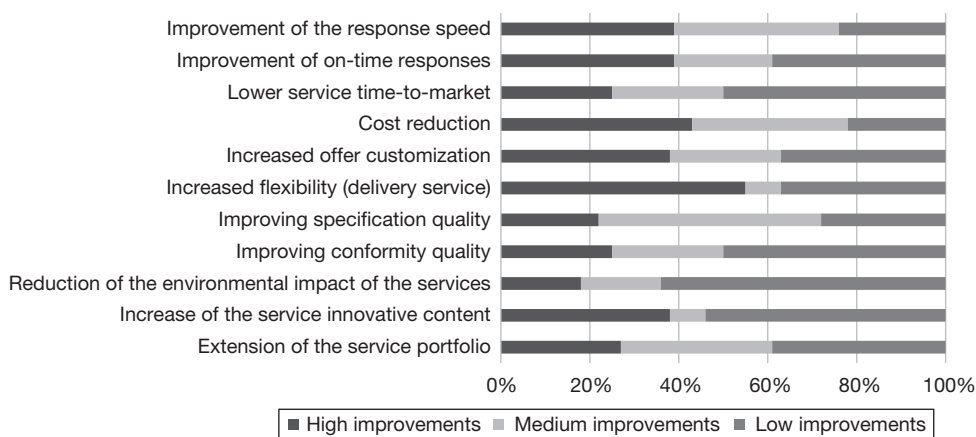


Figure 21.1 Lean after-sales service benefits

Source: Corti et al. (2011).

companies providing after-sales services underlined that the main benefits resulting from the application of lean philosophy principles to after-sales services refer to time, cost, and flexibility (Corti et al., 2011).

Despite the high benefits achievable through the application of lean thinking to after-sales processes, the level of adoption is still low. Indeed, lean implementation can be quite challenging. While the principles and learnings from lean manufacturing are conceptually applicable to after-sales, lean implementation needs to be tailored to the different contexts under which service processes operate.

Key challenges that make lean implementation a difficult proposition can be summarized as follows:

- *After-sales processes are not visible:* In a manufacturing context, waste is visible and, consequently, can be identified relatively easily. In the case of after-sales service, processes are not visible and commonly result in waste that is more challenging to pinpoint. Similarly, some activities seen as waste from a “manufacturing angle” should be treated as added-value processes due to their impact on customer satisfaction. Therefore, after-sales services require a high degree of skills and competences to distinguish what is really important from what is not. Tools such as the *lean opportunity questionnaire* and value stream maps can enhance such ability.
- *After-sales processes are complex and not standardizable:* In after-sales processes, some activities can be easily standardized, others cannot because they require the individual handling of the executor of the process. In addition, the task’s sequence could be unclear or more than one employee could be involved in the process. The complexity of processes also causes difficulties in defining suitable performance indicators that need to be aligned with the new specific lean target.
- *After-sales processes are multi-functional and multi-organizational:* In after-sales organizations, part or whole of an end-to-end process flows through several corporate functions and often requires the participation of external partners. In such a context, aligning external companies to the operational excellence target could be difficult. It requires a high level of commitment from all the actors involved in process engineering and execution, as well as integrated systems for coordination and performance measurement.
- *After-sales processes are people-intensive:* Aligning all individuals directly or indirectly associated with the process according to the improvement goals is a key aspect. Moreover, lean implementation for after-sales service processes should include improvement targets having both tangible and intangible components. The intangible elements depend on moods: how people are feeling at different points of time. This is also valid for people outside the organization, including the partners providing products or competences, as well as the customers receiving the service.
- *Specific knowledge on lean after-sales service is unavailable:* Lack of knowledge in after-sales implies a low level of commitment from management and staff. The usual reaction is that people and customers are not things. However, when training is provided, the staff gradually understand that there is a great amount of waste in their processes and applying lean principles could provide great benefits. Moreover, unlike manufacturing, only a few studies and analyses are available to support lean adoption in after-sales. Therefore educators need to be hired from the manufacturing sector. Unfortunately, they often talk manufacturing language and lack relevant examples from after-sales. This makes it more difficult for staff to accept the ideas of lean, and longer assimilation periods are requested. Moreover, when lean projects are carried

out, managers and practitioners usually have to translate lean production competencies and experiences into after-sales. This risks the adoption of non-adequate tools and methodologies.

Lean after-sales service enabling factors do not seem different from enablers of any other change initiative. There are three key factors that contribute to its successful implementation:

- 1 *Employees' full commitment and participation in the improvement processes:* Employees are experts at performing their work. Their full participation enables their professional competences, skills and experience to be used for corporate growth. Empowered staff are keener to realize their ideas and suggestions as opposed to an unenthusiastic staff feeling forced to carry out top-down process improvements. It is therefore crucial that staff feel the ownership and the control of lean initiatives.
- 2 *Focus on empowering people before developing organization:* It is crucial to provide training and give responsibility to employees, so they will be able to take improvement initiatives on their own. Training activities should be focused not only on theoretically teaching lean tools and methods, but also on empirically learning a new approach to thinking. This will allow employees to feel that they can make use of their skills and creativity, take initiative, and make things happen.
- 3 *Support from managers at all levels:* Top-level managers must show a genuine interest in the lean implementation work, pay attention to the results, and provide necessary resources. Managers at lower levels, leading units implementing lean, need to take ownership and responsibility of the change, and actively support their employees in the improvement process.

The Future of Lean After-Sales Services

The future of lean after-sales services is strongly related to the servitization of the manufacturing phenomenon. This is defined as the evolution of companies' business models from a "pure-product" orientation toward integrated *product-service systems* (PSSs) based on the provision of integrated bundles consisting of both physical goods and services. After-sales services can be placed at the first stage of the "servitization continuum," which can be described by the following dimensions (Gaiardelli et al., 2014):

- product-service ownership orientation, where the focus changes from product-oriented to use- and result-oriented services and the ownership of the product is shifted from the customer to the product-service provider,
- product-service process orientation, where the focus changes from the product to the process, measured in terms of relationship intensity and level of customization, and
- product-service interaction orientation, where the nature of the interaction between the customer and the product-service provider is characterized by different price policies and risk levels.

Moving along the first dimension, the decision-making power and process control is progressively transferred from the customer to the product-service provider. Consequently, the lean after-sales service approach should be enlarged to consider the entire product life cycle. It should include all the life cycle phases of a product-service solution, from PSS design and engineering, through PSS provision and delivery, up to PSS end-of-life management. Further, it should

expand a lean approach in all directions, between departments, divisions, and network partners. Applying lean principles to these new insights arising at the interface of marketing, product and service development, and multi-partner operations could enable manufacturing companies to embark on an efficient and effective servitization journey.

Considering the second dimension, the value moves from the physical product to the entire ecosystem. This requires new models and approaches to understand how product-service attributes contribute to customer value. Thus it stresses the importance of cross-functional and cross-partner problem solving to eliminate anything that does not contribute to customer-defined value.

When the nature of interaction between the customer and the product-service provider moves from transaction-based to relationship-based, digital and information technology becomes incrementally important. It improves the manufacturers' visibility of the assets in the field, increasing the ability to handle greater risk in asset performance, reliability, and availability implied by the provision of advanced services, such as revenue sharing, pay-per-use, availability contracts, etc. The convergence of data availability and information processing technology requires a redesign and a standardization of operating processes, which could be supported by introducing a lean thinking approach.

In the future the lean after-sales service approach will flow into a lean product-service system approach, where all the changes required by servitization transformation along its three dimensions will be included in an integrated lean system. This integrated lean system will encompass engineering, manufacturing, delivery, sales and after-sales, financial, and risk management activities managed by different actors operating in a product-service ecosystem. Nevertheless, the most important role of lean in servitization will be related to its ability to enable a cultural change; this represents the strongest challenge that manufacturing companies have to cope with in their servitization transformation.

Conclusions

Theoretical and industrial experiences show that lean initiatives appear very helpful for companies embarking on an after-sales strategy, due to their inclination toward making processes efficient. Moreover, such principles can help boost customer satisfaction measurably and sustainably through the adoption of several change management methods and efficient learning processes. These learning processes should support a shift of mindset that any organization embarking on a service transformation is called to interiorize. Moreover, the success of any lean initiative in after-sales, as in manufacturing, is achieved not just through applying good operational methods and approaches, but also through establishing a clear vision and strategy. In other words, management must be highly committed in adopting adequate methods to communicate the lean strategy, as well as implement necessary mechanisms to support the development and the diffusion of a lean culture across the overall organization. Nevertheless, operating in a context requiring more customer-intensive knowledge and more complex, multifunctional, and multi-organizational people-intensive processes makes lean principles in after-sales even more important than in manufacturing.

Case Study: Lean After-sales Services in DAF Veicoli Industriali

DAF Veicoli Industriali is the Italian subsidiary of an international group leader in the development, manufacture, and sales of a vast range of medium and heavy trucks. The product

offering is complemented by a range of financial and after-sales services, provided by the company either directly or through its technical assistance network. Despite the strategic importance played by after-sales services within DAF Veicoli Industriali's business, the profitability within this area has progressively shrunk. This is due to the harsh crisis that the Italian market has been experiencing since 2008. This situation has encouraged the management of DAF Veicoli Industriali to research, develop, and implement new approaches, methodologies, and tools to support the improvement of after-sales service productivity and effectiveness. On these premises, a lean project was launched to improve the existing after-sales management in the assistance network through new effective and efficient procedures. The project was carried out in a pilot case study in 2010 and then replicated during 2011–2012 at a few dealers. The main characteristics of each project, built upon five main stages, are briefly described below:

- 1 *Team definition*: First of all, a lean project team was created. The team was made up of two representatives of DAF Veicoli Industriali, acting as project manager and project sponsor, namely the service manager and the network development manager, and a lean consultant team made up of specialized practitioners in after-sales management. The dealer owner was also involved to establish internal commitment.
- 2 *Understanding customer value*: A preliminary market analysis underlined that customers were mainly interested in receiving services supporting high levels of truck availability over time. Such a consideration was in line with the main result of a gap analysis carried out to detect the main differences between customer expectation and perception for main value attributes. These attributes included both technical (e.g. timeliness, responsiveness, flexibility, promptness, reliability) and relational (e.g. attentiveness, courtesy, frankness, integrity) aspects.
- 3 *Setting the direction*: Brainstorming was carried out to complete a SWOT analysis aiming at identifying strengths, weaknesses, opportunities, and threats in after-sales business. It also developed a list of critical success factors. Of course, the results achieved in each SWOT analysis depended on the specific characteristics of the involved companies. Afterwards, matching the main results of the strategic assessment with the gap analysis allowed for the identification of what the key value stream should focus on. Two key processes emerged as critical: spare parts and warehouse management, and maintenance and repair management. Eventually, a list of relevant KPIs dealing with the selected key processes was created and the relative targets were defined.
- 4 *Detailed mapping and definition of improvement plans*: A detailed value stream mapping of the key value processes was carried out to depict the current state. A gap analysis followed to identify the main actions to be taken to improve selected processes. For each action, project responsibilities, the project plan, and timetable, as well as the main intended lean tools, were identified. Table 21.2 summarizes the list of the adopted lean tools together with the main value attributes involved in each single lean project.
- 5 *Develop improvement actions*: Each lean project was then carried out through the application of a lean process-oriented approach called PDCA (*plan, do, check, act*). This was followed by a standardization cycle called SDCA (*standardize, do, check, act*). Lean approaches, such as 3G (*gemba, genbutsu, genjitsu*), 5 whys, and Ishikawa causal diagrams, were adopted to enable participation and collaboration among people. A very high priority was placed on the human factor, because of the decisive role individual behavior plays in making service processes successful.

Table 21.2 Lean projects in DAF Veicoli Industriali

Project	Value attributes involved	Adopted lean tool
Mapping and development of technical and relational competences and skills	<ul style="list-style-type: none"> • Service capacity • Service flexibility • Service attentiveness and courtesy 	<ul style="list-style-type: none"> • Skill matrix • Empowerment boundaries
Reception desk area re-layout and process reorganization	<ul style="list-style-type: none"> • Service delivery time • Service reliability 	<ul style="list-style-type: none"> • Spaghetti chart • 5S and workplace organization
Reorganization of maintenance booking and planning activities	<ul style="list-style-type: none"> • Service capacity • Service delivery time • Service flexibility 	<ul style="list-style-type: none"> • Muda/muri/mura analysis • Visual management tools • Heijunka box
Reorganization of spare parts and warehousing management	<ul style="list-style-type: none"> • Spare parts availability • Spare parts delivery time • Service delivery time 	<ul style="list-style-type: none"> • Muda/muri/mura analysis • Kamishibai (work standards) • Water spider (mizosumashi)
Reorganization of the control process	<ul style="list-style-type: none"> • Service efficiency • Service productivity 	<ul style="list-style-type: none"> • Kamishibai (work standards)

Table 21.3 Results achieved from the implementation of lean after-sales service

Main result	Initial value	Final value	Achieved result
Customer satisfaction index	81.6	87.6	+7.3%
After-sales service productivity	106.3%	130.5%	+24.3%
After-sales service capacity saturation	87.5%	88.9%	+1.4%

As summarized in Table 21.3, which reports the relevant results coming from the application of lean projects, the implementation of lean thinking principles allowed for the maximization of efficiency, improvement of quality, elimination of unnecessary motion and inventory, and the saving of time and resources.

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