

Performance measurement of the after-sales service network—Evidence from the automotive industry

Paolo Gaiardelli ^{a,*}, Nicola Saccani ^b, Lucrezia Songini ^c

^a *Department of Industrial Engineering, Università di Bergamo, Viale Marconi 5-24044, Dalmine, Italy*

^b *Department of Mechanical and Industrial Engineering, Università di Brescia, Via Branze 38-25123, Brescia, Italy*

^c *Department of Accounting and Finance, Università Commerciale Luigi Bocconi, Via Sarfatti 25-20136, Milano, Italy*

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Abstract

The after-sales activities are nowadays acknowledged as a relevant source of revenue, profit and competitive advantage in most manufacturing industries. Top and middle management, therefore, should focus on the definition of a structured business performance measurement system for the after-sales business. In addition, since many actors are involved along the after-sale service supply chain, an integrated and multi-attribute set of measures needs to be designed consistently at every level of the supply chain. Nonetheless, little attention was devoted by scientific and managerial literature to this topic. The paper aims at filling this gap, and proposes an integrated framework for the after-sales network performance measurement, and provides an empirical application to two automotive case companies and their official service network. The cases show that performance measurement systems of different supply chain actors should be aligned in order to achieve strategic consistency. In particular, the performance of different actors at the process level of the framework concurs in determining the after-sales service overall performance towards the final customer. In addition, linkages at other levels (mainly the business and activity ones) may be needed or helpful in ensuring consistency between strategic and operational objectives, inside the organisations and thus for the whole supply chain.

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1. Introduction

In a context of global competition and decreasing profits from product sales, the after-sales services and activities (i.e. those taking place after the purchase of the product and devoted to support customers in the usage and disposal of goods) constitute a relevant profit source as well as a key differentiator for manufacturing companies and resellers [1,2]. Profit generated by after-sales services is often higher than the one obtained with sales; the service market can be four or five times larger than the market for products [3] and it may generate at least three times the turnover of the original purchase during a given product's life-cycle [1]. It is estimated that service networks in only four US industries – consumer electronics, personal computers, power tools, and vacuum cleaners – could

generate revenues of \$6 billion to \$8 billion a year from after-sales service, parts, and ancillary products [4]. Besides being a long-term potential revenue source, the after-sales service constitutes a mean to uncover customer needs and a strategic driver for customer retention. It represents, in fact, “one of the few constant connections that customers have with a brand” [5] influencing customer satisfaction and loyalty. Finally, after-sales service is a way to allow a continuous improvement of product design and quality [6–8].

The perception of after-sales as a source of competitive advantage and business opportunity requires a shift from a traditional product-centric view, in which after-sales is considered a “necessary evil” [9], to a customer-centric view. Moreover, it requires the definition of a structured business performance measurement system. Since more actors are involved in the service chain, a consistent, integrated and multi-attribute system of metrics needs to be properly designed and deployed throughout the supply chain.

This paper discusses the peculiarity of after-sales service networks and processes and the implications on performance

* Corresponding author.

E-mail addresses: paolo.gaiardelli@unibg.it (P. Gaiardelli), nicola.saccani@ing.unibs.it (N. Saccani), lucrezia.songini@unibocconi.it (L. Songini).

measurement systems. The paper aims: (i) at proposing an integrated framework for after-sales network performance measurement; (ii) at developing a case study research into the automotive industry in order to explore the performance measurement systems adopted, their strategic consistency, and issues of network relationships and communication. Therefore, the paper is structured as follows: the next section provides a brief review of literature about supply chain performance measurement systems and their applications to after-sales service networks, while Section 3 presents the reference model elaborated by the authors. Section 4 describes the after-sales service network in the automotive industry and illustrates two specific case studies, while Section 5 discusses the empirical findings. Section 6 proposes some concluding remarks, discussing the managerial and scientific implications of the paper.

2. Background

2.1. Supply chain performance measurement systems

As observed by Neely [10], a dominant research topic in the 1990s concerned the development and deployment of balanced performance measurement systems. Scientific literature and industrial practice, in fact, addressed the integration of financial and operational measures in performance measurement systems, as well as the integration of long-term oriented metrics, related to strategic planning, with financial short-term oriented indicators. Balanced and multidimensional frameworks and methodologies have therefore been developed, such as the performance measurement matrix [11], the results and determinants framework [12], the balanced scorecard [13], the performance pyramid [14] and the performance prism [15]. As organisations adopted the proposed measurement frameworks – especially the balanced scorecard – research moved to an “empirical investigation” phase (for example [16,17]), which led to developing questions about the theoretical validity of measurement frameworks and methodologies [10].

On the other hand, the natural extension of performance measurement from the single firm to supply chains or supply networks emerged in recent years as a research topic. The role of networks was already underlined by Porter [18], observing that the coordination of complex global networks of company activities was becoming a prime source of competitive advantage. Since then, supply chain management as well as supplier networks and buyer–supplier relationships have become popular subjects in operations management and the industrial marketing literature. Supply chain management can be defined as “the systemic, strategic coordination of the traditional business functions and the tactics across these business functions within a particular company and across businesses within the supply chain, for the purposes of improving the long-term performance of the individual companies and the supply chain as a whole” ([19], p. 18). Performance measurement, thus, acquires an inter-organisational perspective. Performance measurement systems, moreover, may serve as a method to ensure, enforce or strengthen the coordination between organisations inside a supply chain or a network.

Supply chain networks, however, may have a higher or a lower degree of focal firm influence [20], or differ for resource integration, partner selection, risk and benefit sharing, decision making, conflict resolution and knowledge management practice [21]. Different kind of relationship may exist among firms, ranging from adversarial to partnerships (see for instance [22–25]). In relation to this are the issues related to trust, power and interdependency among supply chain actors, addressed among others by [26,27] and [28]. These aspects may influence the way a performance measurement system is structured, developed and used by the different actors in the network. According to [29] a supply chain measurement system must place emphasis on three separate types of performance measures: resource measures, output measures, and flexibility measures. Each of these three types of performance measures has different goals: resource measures are oriented to reach high levels of efficiency, output measures to achieve customer satisfaction, flexibility measures to respond to a changing environment in limited cost and time. Chan [30] analyses seven performance measurement areas (or attributes): cost, resource utilisation, quality, flexibility, visibility, trust, and innovativeness. For each of them, he proposes a set of measures that can be included in supply chain performance measurement systems. Spekman and Carraway [31] state that, in performance measurement systems supporting inter-firm collaboration, benefits need to be considered in system-wide perspective (what is good for one partner is good for all); moreover, performance metrics must change when moving from an adversarial to a collaborative environment. Key enablers for an effective inter-firm collaboration are trust and customer focus. These factors, in fact, enable the information sharing among the parties, the emphasis on decentralisation and participation throughout the supply chain, and the effective adoption of information technology. In collaborative supply chains the traditional internal perspective of balanced scorecards expands to a process-related one, crossing functional and organisational borders. In addition, “*focus shifts to the drivers of financial performance: end-customer satisfaction and learning*” [31]. The assessment of process-oriented metrics, thus, should be a distinguishing feature of supply chain performance measurement systems. The SCOR (supply chain operations reference) model [32], for instance, defines four main processes (source, make, deliver, return) and can be used to describe virtually any supply chain. The performance metrics incorporated in the SCOR model are inter-organisational and process-oriented, and combine customer-facing areas (reliability, responsiveness and flexibility) and internal-facing areas (cost and assets).

Other frameworks and methodologies for supply chain performance measurement exist in literature, developed recently, which adopt a balanced scorecard approach. Starting from the consideration that “supply chain performance measurement is a largely uncharted territory”. Brewer and Speh [33] propose a model based on four perspectives: internal, customer, financial, innovation and learning. A set of goals and consistent measures are suggested for each perspective. Lambert and Pohlen [34] develop a framework focused on managing customer relationships and supplier relationships at

each link in the supply chain. Metrics should be defined by analysing the impact of customer and supplier relationship management on the economic value added.

Folan and Browne [35] propose an extended enterprise performance measurement system. At each node of the extended enterprise, firms should measure indicators (in the areas of cost, time, quality, flexibility, precision, innovation) consistent with the company mission and strategy, according to the perspective impacted (i.e. internal, supplier, customer, supplier, extended enterprise). The model proposed by [36], instead, is based on the assumption that extended enterprises emerge through collaboration among firms at the business unit level. Therefore, their model includes five scorecards, differing in the organisational level (business unit, enterprise, extended enterprise) and in the orientation (process or organisation).

But how could a performance measurement system be defined and deployed consistently across the different organisations in a supply chain?

Holmberg [37] analyses supply chain performance measurement problems from a systems perspective. Several types of problems are identified, namely: (i) lack of connection between strategy and measurements, (ii) biased focus on financial metrics, (iii) use of inappropriate measures, and (iv) lack of system thinking.

Lambert and Pohlen [34] also identify as main obstacles the lack of supply chain orientation, the unwillingness to share information and the complexity of capturing metrics across multiple companies. In six case studies, Storey et al. [38] investigate, among other issues, the consistency of performance metric system deployment. The predominant methods of performance measurement are the use of KPIs (or, in few cases, a balanced scorecard) that cascaded down from top level business objectives and measures, through the organisations into a series of functional measures. This approach helps to link metrics at different levels, but, on the other hand, does not take into account that “the sum of the parts does not equate to the whole”. Moreover, in this way metrics tend to be coherent with functional targets, overlooking the performance of the supply chain as a whole.

2.2. Applications to the after-sales service

A review of the literature dealing with performance measurement systems in after-sales service is presented in [39]. They identify four theoretical approaches to after-sales services, and analyse their orientation toward performance measurement systems.

The product life-cycle research stream [40–42], stresses the importance of product design over the product delivery and support systems during its whole life-cycle. Proposed metrics focus on cost, adopting either the perspective of the supplier, such as life-cycle costing [43,44] or of the customer, such as total cost of ownership [45], and should take into account also after-sales related costs. Little if any attention is given to non-financial performance.

The after-sales strategy literatures [6,46–53] surprisingly neglects the area of performance measurement. Frameworks or

recommendations are given on how to design the service mix, to adopt pricing decisions, or to design the after-sales service network (e.g.: the choice of distribution channels and the level of vertical integration in the field technical assistance provision). Although some of these works adopt a network perspective, only [53] suggests a set of performance metrics as a tool to test and verify the coherence between the strategic objectives and the effect of the actions undertaken.

The spare parts logistics literature (see [54–58]) focuses on the management of spare parts inventory and/or distribution system. Therefore, performance measurement is limited to very specific efficiency (e.g. inventory cost) or effectiveness (e.g. spare parts availability) indicators, while often the perspective is the one of a single company.

Supply chain and process-oriented literature dealing with after-sales and addressing the issue of performance measurement systems is very limited. Cohen and Lee [59], highlighted how: (i) end-customer oriented service measures should be implemented, and (ii) service measures should be applied to all the parties involved in the supply chain (e.g. component suppliers, product manufacturers, dealers, warehouses, technical assistance centres). Mathe and Shapiro [60] touch the different areas related to the design and management of an organisation that delivers after-sales services. They stress the importance of identifying service performance criteria and tools for auditing performance. Moreover, they show that many companies do not have adequate performance measurement systems. Although they provide guidelines about the design of control systems and examples of performance measures, the work does not develop a supply chain perspective on performance measurement.

Turning to case study research, Cohen et al. [61] describe the case of Saturn, an automotive company which achieved the highest spare parts availability and customer loyalty in the industry. Main reasons behind its success are found to be: (i) the design of the spare parts distribution network (matching the level of service criticality); (ii) the collaboration and information sharing between Saturn and retailers, and within retailers. Management techniques adopted include the pooling of inventories and the definition of metrics oriented to the final customer, such as off-the-shelf availability [61].

This brief review shows that there is still a need for the definition of frameworks oriented to the performance measurement of supply chains (or networks). In addition, the issues of implementing performance measurement systems across organisations, and of overcoming obstacles related to relationships between companies, should be further analysed. In particular, no specific model was developed in literature for the after-sales service, nor specific empirical research about performance measurement systems was carried out.

3. A reference framework for after-sales service network performance measurement

In the following, a new multi-layered performance measurement framework for the after-sales service supply chain is described based on the framework proposed in [39],

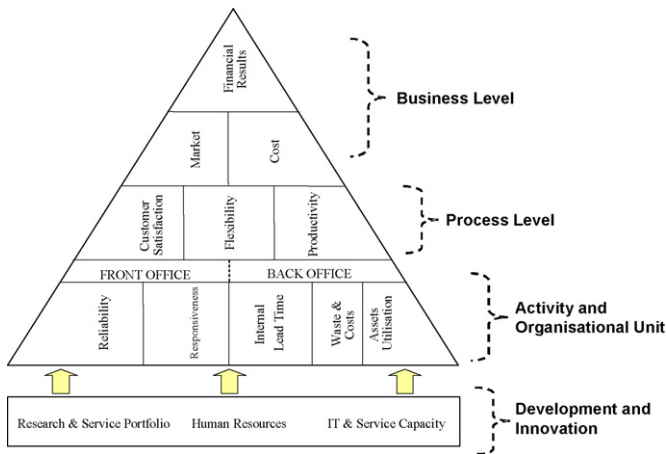


Fig. 1. A performance measurement system for after-sales (from [33]).

which adopts a single company perspective. The framework aims at linking the strategies of each different actor involved in the after-sales service with their related performance attributes, levels and indicators, encompassing a short-term and a long-term perspective, as well as efficiency and effectiveness performance areas.

3.1. Company level

The performance measurement system (PMS) at the company level was built taking as a reference point [13,14,32,62] and merging and adapting their contribution to the peculiarity of after-sales, that constitutes at the same time a business, a process, a service and an organisational unit.

The PMS is articulated in four levels (Fig. 1), described in detail by [39], that are: (i) the business area, (ii) the process level, (iii) the activity and organisational unit level, and (iv) the development and innovation level. Different areas of performance at each level are defined and linked consistently with their impact on effectiveness (performance areas in the left side of the framework) or efficiency (in the right side).

At the strategic business area level, the PMS considers the overall after-sales financial performance. Financial results (measured by indicators such as operating profit, ROA, ROI, etc.,) are generated both by market results impacting on revenue and by the efficient consumption of resources (cost). At the process level, according to [14], performance is measured with regard to customer satisfaction, flexibility and productivity.

Customer satisfaction metrics allow identifying the existing gap between the expectations of the customer and the performance level of the firm, with regard to the characteristics of the output delivered. Flexibility measures the firm’s ability to efficiently satisfy the customer expectations, both from an external perspective (related to output customisation and its delivery time) and an internal one (centred on the process lead time and the ability to manage activities without loss of time). Finally, productivity measures refer to the overall efficiency in resource consumption. The third level considers the performance of organisational units that report to the after-sales department, in dealing with their specific activities. As suggested by the SCOR Model [32], reliability and responsiveness performance can be evaluated for front office activities, while internal lead time, waste, costs, and asset utilisation are assessed with regard to back office activities.

The need to integrate the short-term with a long-term perspective [12,13,62,63], is fulfilled with the development and innovation dimension, which aims at capturing the drivers of future competitive and financial results, through: (i) investments in new product and services; (ii) investments in intangibles, such as human resources; and (iii) investments in infrastructures (IT and service capacity). This level stands at the base of the model and “feeds”, in the long-term, all the other levels.

Relationships exist among the four levels, areas and indicators: the performance of lower levels and areas influence the results of the upper ones. The integration of the operating unit level, focused on activities, with the business and process levels allows a company to relate strategic performance with the operative one, and to assess the cause and effect relationship between operational drivers and financial and competitive results, as well as to evaluate the efficiency and effectiveness of single activities [14]. For instance, a systematic and adequate investment in training the field service engineers impacts on the reliability of the maintenance and repair activities, which influence customer satisfaction. The latter may improve the market share with a positive effect on revenues and, at last, on profit.

3.2. Service network level

The new framework is composed of a sequence of systemic and hierarchical PMSs referred to each single company involved in the service delivery chain, as illustrated by Fig. 2. The framework consists of a sequence of independent

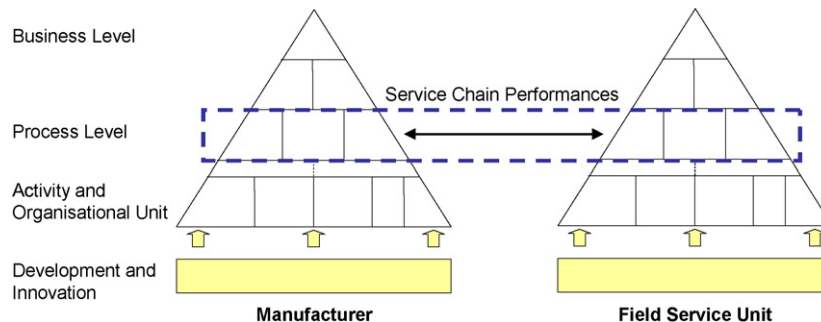


Fig. 2. After-sales service chain performance measurement system framework.

PMSs integrated at the process level and describes the performance of the overall service chain as well. Moreover, it allows identifying the contribution of each single actor to the performance of the whole after-sales network. For the sake of simplicity, Fig. 2 presents a very simple after-sales service network, consisting of only two tiers, and two actors, a manufacturer and a field service provider, or Technical Assistance Centre (TAC). The framework, nonetheless, can be extended to multi-tier and multi-actor after-sales supply chains or networks.

A fundamental element of the proposed framework is the explicit recognition of the process, as a peculiar measurement dimension for the overall service chain. In fact, after-sales is a process, composed of different activities, carried out by multiple actors. Efficiency and effectiveness of each activity at each actor impact on the overall service chain performance in terms of customer satisfaction, flexibility and productivity, i.e. typical performance attributes at the process level [14]. Therefore, it is at this level that we can connect the different PMSs of various actors operating along the after-sales service chain (Fig. 2).

The following section presents the empirical application of the framework to two different case studies in the automotive industry.

4. Empirical evidence

4.1. Methodology

Two case studies have been carried out, concerning the Italian after-sales operations of two car manufacturers. The automotive industry has been chosen for several reasons. First of all, the after-sale service in the European market contribute for up to 40–50% of total revenue, with a gross profit resulting from service (14%) and parts (39%) significantly higher than

the one resulting from the sales of new cars [64]. Moreover, this industry is one of the most advanced among the durable goods, and historically takes the lead in the development of inter-firm management techniques. Examples are the lean production and just-in-time paradigms, the advances in supplier relationship and supplier network management and the definition of new product development techniques, allowing for time-to-market compression and early supplier involvement. Finally, due to the high competitive pressure and the complexity of the supply chain in the car industry, customer satisfaction, loyalty and profitability can be obtained only through consistent actions pursued by different actors in the supply chain.

Data collection focused on research variables describing the company, its after-sales unit and the after-sales service network, in order to point out the configuration of the after-sales supply chain, the relationships among actors and the performance measurement system structure and actual usage. Case studies were carried out through semi-structured interviews, a detailed questionnaire (available from the authors upon request), direct observation (e.g.: warehouse tours) and the analysis of secondary sources (such as company documentation, corporate website, specialized press). Informants included the after-sales managing director, the manager(s) in charge for after-sales in Italy, the spare parts warehouse and material planning managers, and the customer care manager. A couple of dealers of the two companies were interviewed in order to cross-check the information gathered at the manufacturer. The several informants and the different data sources used allowed for triangulation in order to check the internal consistency of data [65].

4.2. The automotive after-sales service supply chain

Before presenting the two case studies, the characteristics of the after-sales service supply chain in the automotive industry

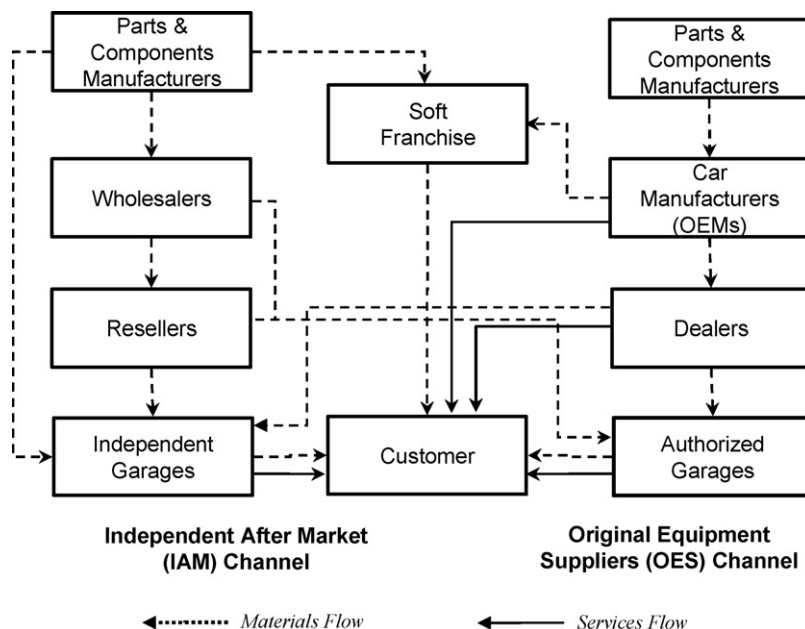


Fig. 3. The after-sales supply chain for automotive industry.

needs to be introduced. The growing dynamism of the sector, the enlargement of markets, the changes in the strategic position of suppliers, the introduction of new rules and the diffusion of the internet, have had a great impact on firms' after-sales configuration and organisation. For instance, the block exemption regulation (BER) promulgated by the EU and aimed at boosting competition, introduced a number of changes such as a new definition of original spare parts. Moreover, it created the opportunity for independent repair shops to obtain technical information from carmakers, both in terms of product characteristics and of diagnostic and reparation equipment, and therefore to compete on the market.

Fig. 3 maps the automotive after-sales service chain and its main actors (shortly described hereafter). Apart from the traditional dealers and authorized repair shops new players and new channels developed, reviving competition.

- Parts and component manufacturers sell spare parts with their own brand both to the “unauthorized” channel (independent garages, spare-part resellers, independent “fast fit”, petrol pump stations, tyres repairers, electrical workshops) and to the “authorized garages” and dealers;
- Manufacturers, the brand owners, produce and sell cars to dealer chains. Manufacturers usually buy spare parts from suppliers, and distribute them to the authorized assistance network (dealers and garages) and “fast fit”;
- the final customer purchases the finished product and may require after-sales assistance;
- the assistance centres are responsible for repairing the product. Several channels can be identified: the ones authorized (through contractual agreements) to sell and repair (*dealers*), or to repair only (*authorized garages*), the generic ones (*independent garages*), the specialized ones (*tyres repairers, electrical workshop, etc.*), the *fast fit* (independent or authorized) specialized in handling minor repair works and the *soft franchise* network (independent, owned by a component supplier or by a distributor). In most cases, only dealers and, to a minor extent, authorized garages bear direct and continuous relationships with the manufacturers.

Two case studies of manufacturers and their after-sales networks follow, focusing on the authorized channels (dealers and garages).

4.3. Company 1

Company 1 is the Italian branch of a successful European group, one of the worlds leading automobile and motorcycle manufacturers in the premium sector. The group consists of around 100,000 employees, with a total worldwide revenue of close to €50 billion in 2005. Operations in Italy are carried out in accordance with the Headquarters strategy, aimed at a long-term profitable growth and at strengthening its brands. Customer satisfaction is sought through high quality, technologically innovated, safe and reliable products and through a complete set of services, covering the whole product life-cycle.

In order to provide a wide range of after-sales services, Company 1 leverages its assistance network, composed of about 200 exclusive official centres (in Italy).

The strategic role of the after-sales service has affected the whole performance measurement system. At the business level, a Balanced Scorecard is adopted for the after-sales division, in order to define strategic goals and to monitor the performance of the different actors involved in the service network. The main results monitored are related to margins and profits, customer satisfaction and brand image. Several KPIs measure financial performance (e.g. revenues, equity, long-term debt, net profit/loss per year, equity ratio on industrial operations, cash flow, cash flow on capital expenditures) and assess competitive results (e.g. volume growth, market share, new segment penetration).

Consistently with its strategic approach, the after-sales division imposes by contract or leverages by specific benefit programmes the financial goals of the assistance network, in order to monitor and enhance their financial and competitive sustainability in the long-term. The financial performance of dealers can be compared and analysed, through the information collected with the reports imposed on the assistance network, submitted quarterly through an extranet. This allows assessing the dealers' profit and losses in four different areas: sales of new cars, sales of second-hand cars, sales of spare parts, and workshop services. Indexes calculated include: the working capital, the equity on assets ratio, the current ratio, the quick ratio, the revenue per segment, the employees per segment, the monthly revenues per employees, the labour cost as a percentage of revenues, the ROE, ROI and ROS. Each dealer is also enabled to evaluate its performance, compare it with the network average and with the best performer, through an electronic benchmark tool provided by Company 1 on the web.

At the process level, the emphasised dimensions are the end-customer satisfaction, and the relationships with the dealer network. The indicators of customer satisfaction are calculated every 3 months. The main indicators are: (i) the customer service index, which monitors the effectiveness of the after-sales process as a whole, assessed through questionnaires and phone interviews to final customers carried out by European Headquarters; (ii) the dealer satisfaction index towards Company 1 after-sales division; (iii) the customer satisfaction towards dealers, which measures the customer perception about service quality provided by the service network. The last indicator considers four different areas: customer care service (quality of treatment and courtesy), technical assistance (capability, availability and courtesy provided during the repairing activities), time management (dealer responsiveness), and garage performance (dealer reliability in managing repairing and maintenance processes). A benefit programme based on customer satisfaction indicators stimulates the assistance network at stressing this performance area. The strategic perspective of Company 1 privileges short-term performance and is reflected in the indicators measured and suggested at the manufacturer and network levels. Nonetheless, although with lower emphasis, after-sales flexibility and productivity are quarterly monitored through indicators such

as the S.A.F. (sales and after-sales) index which measures the percentage of direct and indirect costs of all dealer's activities covered by the AS margins. On average, the after-sales services generate 10% of total revenues of a dealer, but they may cover about 60% of all direct and indirect costs.

Consistently, at an operative level the focus is mainly referred on reliability (e.g. fill and error rate, number of stock-outs per month) and responsiveness (e.g. warehousing service level, average and maximum spare parts delivery time, mean time of service delivery, mean time to response). Efficiency indicators related to internal lead times (mean time to repair, calls per hour), costs (order-line cost) and assets utilisation (number of customers per employee), are less emphasised. An automatic tool was created to support the assistance network in the measurement of performance related to critical maintenance and repair activities. Thanks to this tool each dealer can monitor in real time its performances using different indicators relevant to measure reliability, responsiveness, internal lead time, costs and assets utilisation.

Finally, although the after-sales business unit invests significantly in research and service development (several projects have been developed to improve the service portfolio and the business capacity), performance measurement in this area is not highly developed. Indicators include the number of training hours per employee per year, while IT and Service Capacity are evaluated through the number of the installed equipment and the number of available ramps and repair shops.

4.4. Company 2

Company 2 is the Italian branch of one of the worlds leading automakers (7.4 million units sold in 2005 with a total sales of around \$170 billion). The Italian branch, established in 1990, experienced an exponential sales growth passing from 15,000 vehicles sold in 1996 to about 130,000 sold in 2005. Today it employs about 170 people and it is organised in three business units directly depending on the CEO: sales; finance; and after-sales. The after-sales business unit, is divided into four main areas: customer and network technical support, logistics, customer relation and business development.

The adopted strategy focuses on customer satisfaction and retention, and it is pursued by four key variables: (i) Product functionality, innovation, quality, time-to-market and reliability; (ii) supply chain configuration, in accordance with JIT principles; (iii) hierarchical dependence of the logistic function on the marketing function; and (iv) consistent performance measurement and evaluation of the network.

The assistance network, composed of about 190 exclusive official centres placed in Italy, should comply with a number of control and management standardised processes defined by the manufacturer. Moreover, each service centre has to pursue explicit customer retention goals.

At the business level, Company 2 emphasises competitive results, such as market share and penetration. Financial performance is measured through ROI and ROE. Company quarterly monitors the dealer network performance through two indexes based on financial indicators, monthly provided by

each dealer through a dealer communication system (DCS). In particular, the MSI index measures the ratio between the number of dealer's customers and the total number of potential customers (after-sales market share). On the other hand, the BM index refers to dealer costs, revenues and margins and it is calculated considering four different businesses: new cars sales, used cars sales, spare parts and accessories sales and technical assistance activities.

However, the performance measurement system, both at the company and the assistance network level, is focused mainly on operative aspects. Several process indicators measure customer satisfaction, flexibility as well as service productivity for logistics, after-sales business development, customer relation, and technical assistance.

The focus on customer loyalty stresses emphasis on the relationships between Company 2 and its dealer network. The dealer evaluation has been implemented to monitor their customer relationship management and the level of customer satisfaction and retention. Several KPIs are adopted by Company 2 to control the process effectiveness. The most important are: customer service satisfaction (calculated every 6 months by the European Headquarters for each national branch) and customer satisfaction towards the network (calculated quarterly by every National branch). According to the latter, the 30 worst dealers are identified and a reorganisation process is launched to improve their performance. Flexibility and productivity are monitored through two specific indicators: the percentage of variable cost for flexibility and total costs of after-sales for productivity.

At the activity level, several metrics evaluate the following aspects:

- *service quality*: e.g. transportation damages on delivery, number of order-lines fulfilled, number of resolved complaints, % of immediate responses, number of customer care calls not fulfilled;
- *external time*: e.g. warehousing service level, customer calls abandon rate, response and repair time, percentage of responses below time limit, number of parts delivered in delay;
- *internal lead time*: e.g. warehousing picking and download time, diagnosis time, time between repairing and spare parts receiving, transport time, invoice delivery time;
- *costs*: e.g. spare parts and technical assistance costs, cost of picking errors, transportation damages on supply.

Finally, service capacity is measured through: stock available per month, stock rotation index, number of technical reports per employee, percentage of equipment used. Company 2 launched a programme to control and optimise all processes carried out in the service network, to improve its performance. The dealer after-sales processes (classified in: check in, repair, service management and warehousing), are mapped monthly and assessed weekly through an electronic tableau de board. This tool allows Company 2 to evaluate in real time how the network manages each single process and to apply corrective actions if needed.

The vision of after-sales as a long-term competitive weapon is reflected in performance indicators used by Company 2 to evaluate and measure the service portfolio (e.g. number of services offered, frequency of introduction of new services, number of requested services that were not offered previously), human resources (e.g. frequency of training courses, number of courses per employee per year), IT and Service Capacity (number of after-sales personnel, number of workers per repair shop, number of installed ramps, number of tester for diagnosis on line, availability of internal tyres centre, number of technical assistance centres) as well as the communication effectiveness in the service supply chain (e.g. frequency of network reports, number of technical reports per month).

5. Discussion

Companies 1 and 2 seem to cover adequately all the performance dimensions identified by the proposed framework, although adopting different PMSs, respectively the Balanced Scorecard and a self-developed PMS. At an internal level, moreover, both companies show a link between corporate strategic objectives, after-sales goals, and after-sales performance measures and indicators.

Both companies also adopt a supply chain perspective in performance measurement: in addition, company 2 developed a common definition of after-sales processes, transmitted at the dealer level. Company 1 and Company 2 devoted great effort in aligning the PMS of the authorized assistance network with their PMSs. Fig. 4 highlights the main performance dimensions considered by both manufacturers and dealers as well as the frequency of reporting from dealers in the two cases. Each cell of the pyramid is filled with a different shade of grey according

to the emphasis given to that specific performance area. Dark grey indicates that the company puts high emphasis on the performance measurement of that area, and that multiple indicators are measured. At the opposite end, the colour white indicates that a performance area is not measured by the company. Fig. 4 suggests that in both cases the dealers’ PMSs consider with similar emphasis the same performance areas as the manufacturers. Moreover, they aim at capturing mostly customer satisfaction, efficiency of logistic activities and profitability. The process dimension is highly emphasised in particular by Company 2, while Company 1 focuses mostly on customer satisfaction. The activity level has the highest number of indicators and most frequent reporting in both cases, in order to monitor dealers’ efficiency and effectiveness.

In addition to that, it is noteworthy to point out that Company 1 and Company 2 monitor systematically their dealers’ profitability, e.g. the highest level of their performance pyramid. Only high profits generated by after-sales services, in fact, ensure the long-term survival of dealers. Actually, the sales of cars give very low margins (around 2% of revenues), while after-sales services account for up to 40% of total dealer revenue, and generate most of their margins.

The two case studies analysed also show that the manufacturers often suggest and sometimes impose on their dealers by contract the use of performance measurement systems aligned with their own ones. This is represented by the black arrows in Fig. 4.

However, the cases suggest that the specific relationship between each couple of PMS reflects the existing level of collaboration between the companies involved in the after-sales supply chain. Adopting the taxonomy proposed by [31], the relationship between manufacturers and dealers in the

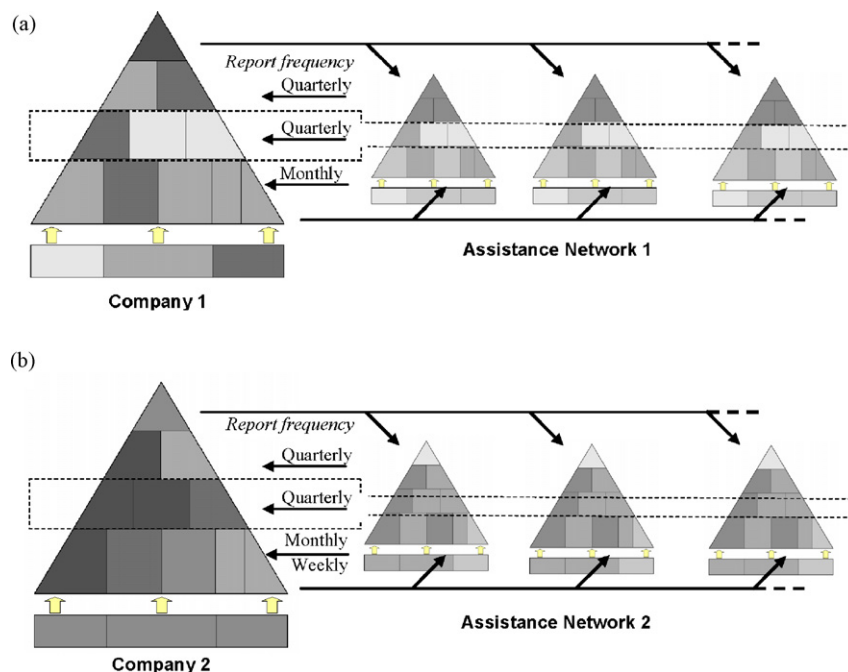


Fig. 4. (a) The alignment between Company 1 and its service network PMSs and (b) the alignment between Company 2 and its service network PMSs.

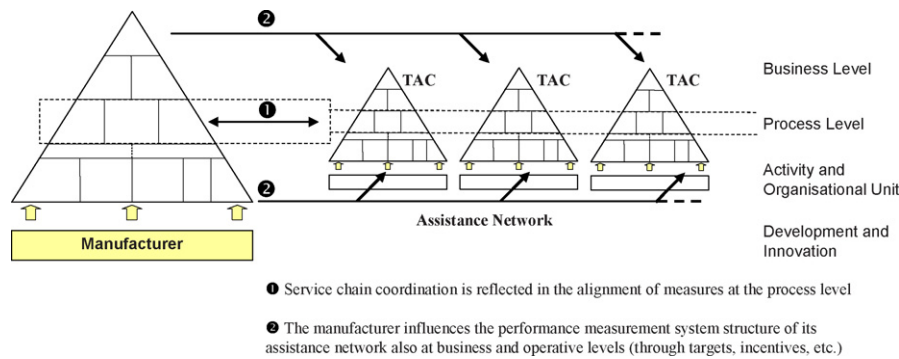


Fig. 5. The linkages at the different performance dimensions.

automotive industry seems to be an example of collaboration strategy, which asks for an alignment and integration of PMSs.

6. Concluding remarks

The paper explored the performance measurement systems in supply chain and networks, with specific reference to the after-sales services of manufacturing companies. Although recognized as a significant source of revenue and profit, after-sales and in particular its performance measurement system has not been thoroughly addressed by management research as well as industrial practice. The first aim of the paper was, therefore, to propose a reference framework for the performance measurement of after-sales results and activities adopting an inter-organisational perspective. Since many actors are involved along the service chain, an integrated, multi-attribute and consistent set of measures needs to be properly designed at every level of the after-sales supply chain. The fundamental linkage among the performance measurement systems of the different actors stands at the process level, where effectiveness measures are oriented to the final customer of the supply chain (i.e. satisfaction and flexibility) and internal efficiency measures (i.e. productivity) of the whole after-sales process are obtained. Since companies often evaluate customer satisfaction and flexibility, but without considering that they depend on the effectiveness and coordination of the whole service network, the need for an explicit recognition of this linkage emerges, allowing us to point out the causes of performance results, as illustrated in Section 3.1.

Two case studies, then, allowed for an empirical application of the framework to evaluate its soundness. In the two case analysed, an alignment occur between the performance measurement systems of the manufacturers and the dealers (one of the main channels that provide after-sales services in the car industry). This is promoted by the manufacturers, which aim to assure high profitability and satisfaction of their dealers, that in turn have direct contact and relationship with the final customers.

Considering the manufacturer–dealer interface, the framework proposed in Section 3 seems to be valuable for a descriptive and explanatory purpose in both cases. In addition to giving credit to the proposed direct linkage of PMSs at the process level, the case studies suggested that indirect linkages

also exist, concerning the financial results and the activity level of the pyramid, as pointed out in Fig. 5. The manufacturer may set targets, provide incentives and verify the dealers' performance at those levels. That is an effect of the relations among the different levels of each company's PMS (described in Section 3.1). In fact, since internal consistency between strategic objectives and operational measures inside each organisation is needed, and due to the direct and short-term linkage among the companies' performance at the process level, a consistency among the metrics and actual performance of the firms at the business unit and activity levels is needed in order to achieve and preserve success in the long-term. Thus, the focal firm of the after-sales service network exerts some control over the other companies PMSs, their targets and actual performance results.

The proposed framework, through a systematic view of the whole service chain's objectives and results, allows after-sales managers to: (i) capture the discrepancies in emphasis and metrics between their performance measurement system and the ones adopted by the other actors; (ii) derive the desired "to-be" future state, aligning the strategy and the management practices with the supply chain ones; (iii) define and reconfigure the performance measurement system, by aligning the new strategic vision and goals with the tactical and operational objectives. Finally, the framework can be used to identify the impact of the specific performance results obtained by each actor on the overall after-sales service supply chain performance, at the process level (through a direct relationship) and at the other levels (indirectly).

Some remarks arise concerning limitations of the present work and suggestions for future research. First of all, although the framework is intended to be general, the empirical application was limited to a specific industry and to the interface between two specific players. Further evaluation of the framework is thus needed, involving more industries and more supply chain levels. Moreover, the power of one firm over the network (the focal firm, i.e. the carmaker in the case studies) and the relationships among actors are aspects that determine the possibility to align and reciprocally influence companies' PMSs. Different configurations of power, relationships and dependence among actors need then to be addressed from both a conceptual and empirical standpoint in order to assess more thoroughly the validity of the framework. Finally, the

implementation of supply chain PMSs for the after-sales and their evolution over time should be studied: the adoption of a longitudinal perspective in case research would be helpful to this objective.

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Eng. Paolo Gaiardelli is a researcher in the Department of Industrial Engineering of the University of Bergamo. He is assistant professor in operations and industrial plants management. His main research topics are logistics and operations management, with a specific interest in the field of after-sales services.



Nicola Saccani is a post-doc fellow at the University of Brescia (Italy), where he received his Ph.D. in operations management in 2005. He graduated in industrial engineering at the Politecnico di Milano (Italy) and at the Ecole Centrale de Lille (France). His research topics include production planning and control, buyer–supplier relationships and the configuration and management of after-sales services.



Lucrezia Songini is a lecturer at Bocconi University, Milan and senior faculty member of the Accounting and Control Department of the SDA Bocconi School of Management. She is professor of management accounting at the Università degli Studi del Piemonte Orientale “Amedeo Avogadro”, Novara, in the Business Administration Department in Casale Monferato. Her main research topics are strategic cost management and performance measurement and evaluation, with a specific interest in the field of after-sales Services.