

# Configuring the after-sales service supply chain: A multiple case study<sup>☆</sup>

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## Abstract

After-sales service in firms manufacturing and selling durable goods has a strategic relevance in its potential contribution to company profitability, customer retention and product development. This paper addresses the configuration of the after-sales supply chain. Three configuration choices are analysed: The degree of vertical integration, the degree of centralisation, and the decoupling of activities (i.e. how activities are decomposed and separated organisationally). Exploratory case study research was performed over seven companies belonging to durable consumer goods industries. The empirical findings show that configuration choices vary, suggesting that no “one best way” exists. Moreover, many firms develop multiple configurations. Choices are influenced by drivers, including the attractiveness of the after-sales business, the strategic priorities, the characteristics of the physical product and the services offered, and the configuration of the manufacturing and distribution supply chain. The paper discusses how these drivers may lead to consistent configuration choices, and how choices are related.

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## 1. Introduction

After-sales activities are acknowledged as a relevant source of revenue, profit and competitive advantage in most manufacturing industries. The after-sales service market has been found to be up to four or five times larger than the market for new products (Bundschuh and Dezvane, 2003). During the product life-cycle, after-sales services and spare parts may generate more than three times the

turnover of the original purchase (Wise and Baumgartner, 1999). Moreover, accepting the claim that returning customers are the most profitable ones, as they require less marketing effort and relationship building, after-sales service acquires a critical role as a mean to achieve customer satisfaction and retention (Alexander et al., 2002). Finally, after-sales activities may act as a lever to increase the success rate when introducing new products (Goffin and New, 2001; Goffin, 1999).

These premises may explain the change in the role of the after-sales function, traditionally seen only as a cost generator and as a “necessary evil” (Lele, 1997). The change is in favour of a view that considers after-sales as a source of competitive advantage and business opportunity (Armistead

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and Clark, 1992). As a consequence, the strategic management of the after-sales business and operations should acquire a major role in manufacturing firms.

The objective of this paper is to study the configuration of the after-sales supply chain for durable consumer goods, focusing on three configuration choices: Vertical integration, centralisation, and decoupling of activities (i.e. how activities are decomposed and separated organisationally).

The next section of the paper provides a conceptual background about the configuration choices analysed, and reviews specific literature about after-sales service. Section 3 presents the research design and sample. Section 4 provides the empirical evidence from seven case studies. Finally, Section 5 summarizes the main findings of this paper and proposes directions for future research.

## 2. Background

The configuration of a supply chain refers to how it is designed with respect to the activities carried out within it. Manufacturing strategy literature (Hayes and Wheelwright, 1984; Hill, 1995; Bozarth and McDermott, 1998) as well as service strategy literature (Schmenner, 1986; Chase and Hayes, 1991, 1992; Fitzsimmons and Fitzsimmons, 1998; Silvestro et al., 1992; Johansson and Olhager, 2006) address the issue of supply chain configuration. However, not much attention has been devoted specifically to the configuration of the after-sales supply chain (see Section 2.5).

Three configuration choices are analysed in this paper: (i) The degree of vertical integration of after-sales activities by the finished goods manufacturer, (ii) the degree of centralisation of the resources and actors that carry out the activities, and (iii) the decoupling of activities between and within different organisations. In the following, they are addressed from a conceptual point of view, and then literature about after-sales service is discussed.

### 2.1. Vertical integration

A firm is commonly positioned within a supply chain, or value network. The level of vertical integration refers to those parts of the value network that belong to the company. Increasing the level of vertical integration means to increase the number of value chain activities performed internally, thus expanding either towards the customers

(downstream), or the suppliers (upstream). A common trend in manufacturing, however, is to decrease vertical integration, by outsourcing activities in order to focus on core competencies (Pralhad and Hamel, 1990). Nonetheless, outsourcing, as well as insourcing, presents costs and risks that should be contained (Quinn and Hilmer, 1994).

### 2.2. Centralisation of activities

As pointed out by Christopher (1998), one common kind of centralisation is that of inventories and warehousing. The main reason behind the choice of many companies that centralise and close national warehouses in favour of ones covering a larger region lies in the cost savings achieved by reducing capital tied in inventory, and by reducing the number of locations. Nonetheless, the operating and inventory cost savings that are attained through centralisation should be traded off service performance (such as response time), in order to operate a choice consistent with the company objectives (Cohen and Lee, 1990). Especially for services, proximity to customers is a critical aspect, as the customer is often participating in service production. Cho and Park (2003) investigate how electronic commerce and other new technologies change this need for geographical accessibility, and find that it depends upon the characteristics of the services (and goods) provided. Specifically, off-line service activities are found as the main reason to provide customers with geographic accessibility. However, and quite surprisingly, on-line activities are also found to drive a need for closeness, indicating that there seems to be a general advantage of being close to customers.

### 2.3. Decoupling of activities

Decoupling is described by Chase and Tansik (1983) as an act to separate activities of an organisation, physically or organisationally, and placing them under separate supervision. When activities are decoupled from each other, they are carried out by different persons, or even by different organisations, so that a handover of work is required (Zomerdiijk et al., 2006).

This concept, although with different nuances, holds for manufacturing as well as for service processes. The definition of a decoupling point in manufacturing and logistics allows us to classify value-adding activities in terms of customer demand

information and clarify the need for different management approaches depending on whether the activities are upstream or downstream of the decoupling point (Wikner and Rudberg, 2005). In other words, activities downstream from the customer order decoupling point are executed after a customer order has been received, while activities upstream are executed before, and so with a certain degree of uncertainty with respect to the customer action. Thus, the two sets of activities may be buffered, and goods stocked right before the decoupling point.

A similar view is adopted by service research. A common way to decouple in service organisations is by separating the activities that require customer interaction (front office) from the ones that do not (back office), enhance specialisation in order to increase efficiency as well as to reduce delivery lead time (Chase and Hayes, 1992). Metters and Vargas (2000) suggest that back-office activities are potential candidates for centralisation, since they are buffered from randomness. This view is paralleled by the production-line approach to services (Levitt, 1972; Bowen and Youngdahl, 1998). On the other hand, Hammer and Champy (1993) strongly criticise a view of organisations structured around functions with highly fragmented, task-oriented jobs in favour of one in which organisations are structured around processes, with coupled activities and tasks.

#### 2.4. The after-sales services and supply chain

Levitt (1983) sees the initial sale of a product only as the start of a seller–buyer relationship, where a relation or system contract lasting over long periods of time are the key to long-term profitability, and thus making the after-sales function of a company crucial. Various terms are used in literature for what here is named *after-sales service*. Goffin and New (2001) list, for example: Customer support, product support, technical support, and service. Several definitions of after-sales service can be found in literature (Cohen and Lee, 1990; Ehinlanwo and Zairi, 1996; Loomba, 1996; Asugman et al., 1997; Boyt and Harvey, 1997; Urbaniak, 2001; Johansson and Olhager, 2004). Building on these definitions and keeping a general and comprehensive perspective, we say that the after-sales services for manufactured goods encompass the set of activities taking place after the purchase of the product, devoted to supporting customers in the usage and disposal of goods.

Earl and Khan (1994) classify after-sales as a *business network process*, since it has a direct impact on business performance and on the creation of competitive advantage, and since it is carried out by different organisations. Activities may be carried out through alternative channels and actors or through multiple channels and actors simultaneously. They might provide complementary services (e.g. field assistance and customer care) as well as competing ones (e.g. field assistance provided by sale points and repair centres, or by authorised and unofficial assistance networks). Moreover, the diffusion of Internet and other technologies “expands the number and variety of customer touch points and service delivery channels” (Hill et al., 2002), and, when looking at the supply chain structure, makes the picture even more complex.

#### 2.5. Configuration of the after-sales supply chain

Hull and Cox (1994), and more recently Nordin (2005) state that there is little published academic research about after-sales services in manufacturing contexts. Table 1 presents a list of papers dealing with the configuration of the after-sales service supply chain. They report results from empirical research and, in some cases, provide frameworks or guidelines for the supply chain configuration. Papers dealing exclusively with the after-sales strategy or the definition of the product-service offer, such as Levitt (1983), Lele (1986, 1997), Frambach et al. (1997), Wise and Baumgartner (1999), Mathieu (2001), and Oliva and Kallenberg (2003), are not listed in Table 1, since they do not address the supply chain configuration. Moreover, literature about optimisation policies for spare parts inventory management has not been included in this review, since it deals with management techniques rather than with configuration of the after-sales supply chain.

Three of the papers listed in Table 1 focus solely on the manufacturing organisation (Hull and Cox, 1994; Zackariasson and Wilson, 2004; Brax, 2005), without explicitly addressing the configuration choices described in the previous paragraphs.

A first set of papers focuses on the level of vertical integration in the provision of the field technical assistance (Armistead and Clark, 1991; Loomba, 1996, 1998; Goffin, 1999; Nordin, 2005; Amini et al., 2005). According to these authors, different drivers influence the choice of the after-sales support channel and the level of vertical integration:

Table 1  
A review of literature on after-sales service supply chain configuration

Author(s)	Empirical research	Main topics	Main aspects/findings
Cohen and Lee (1990)	Two case studies (automotive and mainframes)	Spare parts distribution network: Configuration and management	Policies for improving control are identified (stock pooling, analysis of demand and lead time uncertainty, grouping of parts, integrated information systems)
Armistead and Clark (1991)	Five case studies (computer, consumer goods, capital goods, white goods)	Vertical integration of product support activities (after-sales distribution channels)	Volumes and required in-house control influence the choice of the structure and vertical integration of the after-sales service delivery organisation. The product life cycle also influences the after-sales support activities configuration
Hull and Cox (1994)	Six case studies (consumer electronics)	After-sales organisational structure, management information systems, spare parts management in the manufacturing organisation	Emphasis on organisational issues, such as the inter-functional relationships inside the manufacturing organisation, or the centralisation of decision-making
Loomba (1996, 1998)	Case studies (computer industry) (Loomba, 1996). Survey (393 computer industry firms) (Loomba, 1998)	Vertical integration of product support activities (after-sales distribution channels)	(1) Relationship between sales and after-sales distribution channels (indirect vs. direct).(2) Relationship between product substitutability (“commodity” vs. “specialty”) and after-sales distribution channels (indirect vs. direct)
Cohen et al. (1997)	Survey of 14 companies in the computer, consumer electronics and mechanical industries	Benchmark analysis of spare parts logistics operations and performance	(1) Distribution network structures are often a legacy of past decisions. Rationalisation process, through the reduction of the number of echelons and stock locations.(2) Importance of defining proper (internal and customer-oriented) performance measures.(3) The adoption of advanced inventory managements methodologies leads to significant benefits in the cost-service trade-off
Goffin (1999)	Five case studies (telecommunications, automotive, vending machines, aircraft, household appliances)	Vertical integration of product support activities (after-sales distribution channels)	Five types of distribution channels identified. Drivers are: (1) sales channel configuration, (2) product characteristics, (3) desire to earn revenue directly, (4) control over service quality, and (5) costs of creating direct distribution channels
Cohen et al. (2000)	One case study (automotive)	Spare parts distribution network: Configuration and management	Collaboration practice with retailers and supply chain perspective are the main reasons for the high level of effectiveness reached by Saturn spare parts distribution network. A framework is proposed relating the degree of centralisation with the service criticality
Zackariasson and Wilson (2004)	One case study (industrial equipment)	Role of information technology in after-sales services	Impact on the quality of service provision and on the after-sales organisation
Brax (2005)	One case study (industrial equipment)	Service infusion in the offer of a manufacturer (service design, product-service mix)	Analysis of the internal organisational challenges
Nordin (2005)	Five case studies (mechanical, software, hardware, consumer goods)	Vertical integration of product support activities (after-sales distribution channels). Contracting, ordering and expediting activities are analysed	Influence of product complexity, market (business vs. consumer), profit contribution. “Maladjusted” configuration of the after-sales support supply chain are compensated through governance mechanisms or increased internal expertise
Amini et al. (2005)	One case study (diagnostic equipment)	Design of reverse logistics and repair service operations: (a) number, location of spare parts warehouses and inventory levels and (b) number, location of repair centres and allocation of customers to repair centres	Mathematical modelling allows to suggest design options that minimise inventory costs or that achieve cycle time objectives. These should be traded off existing constraints and traditions.

The service volumes and the required level of (in-house) control (Armistead and Clark, 1991); the existing sales distribution channel(s) and the product substitutability (Loomba, 1996, 1998); the desire to earn direct revenue through after-sales, the cost of creating direct distribution channels, and the required degree of control over customer support quality (Goffin, 1999). Nordin (2005) observes that the above factors may give ambiguous or contradictory suggestions, leading to choices that are “maladjusted” in some ways. Firms try to compensate for maladjustments by increasing internal resources and competence, or by reinforcing governance mechanisms. Amini et al. (2005), instead, propose a model for defining the number, location and customer coverage of a network of field assistance units, in the case of a diagnostic equipment manufacturer.

The second group of papers (Cohen and Lee, 1990; Cohen et al., 1997, 2000; Amini et al., 2005) deals with spare parts management and distribution networks. Cohen et al. (2000) propose a framework in which a decentralised structure matches a high service criticality (e.g. reducing response time), while a centralised structure matches a situation with low service criticality. They describe the case of Saturn, an automotive company that achieved the highest spare parts availability and customer loyalty in the industry. Amini et al. (2005) develop a decision support model, in order to identify the number and location of spare parts warehouses, as well as inventory levels, that minimise inventory costs in the analysed case.

From the picture drawn, it is possible to observe that the configuration of the supply chain specifically for the after-sales is treated sparsely in literature. Some considerations may be added. Firstly, most works focus on a single decision and on a single after-sales activity (e.g. the level of vertical integration of the execution of field technical support or the degree of centralisation of the spare parts distribution network), rarely addressing many decisions at the same time (except Amini et al., 2005). Moreover, the choice of the decoupling of activities has not been addressed yet, or presented simply as a result of choices concerning the level of vertical integration more than a design decision in itself.

A second point is that the works analysed do not consider the after-sales as a business, consisting of several activities, such as field assistance network, spare parts management, and customer care (typical and critical after-sales activities at least in durable

consumer goods industries). Since the after-sales service function, at least in multinational companies, is often a strategic business unit dealing with the configuration and management of field service provision, spare parts distribution, and customer care, there is a need to consider all of these activities simultaneously. In addition, the configuration of customer care in after-sales services seems to be neglected in empirical research, although research exists on the organisation of call centres (e.g. Zapf, 2004), but with no specific reference to after-sales.

Thirdly, only a few frameworks (Armistead and Clark, 1991; Cohen et al., 2000) or conceptual generalisations (Nordin, 2005) exist for the configuration of after-sales services, but they are bounded to a specific decision and a specific activity.

Therefore, the need arises for research that adopts a systemic view of the after-sales activities and which is oriented to building theories and frameworks for the configuration of the after-sales service and supply chain. We believe this kind of research about after-sales for manufactured goods to be still at a preliminary stage, although some valuable contribution can be found in the above quoted works: Thus, an exploratory case study research is the empirical methodology adopted in this study.

### 3. Research design and sample

The research design is based on multiple case studies. Due to the exploratory purpose of the research, case studies constitute an appropriate methodology (Yin, 1994). Moreover, case studies allow the study of phenomena in their context. Therefore, a systemic perspective can be adopted over the different configuration decisions in the different areas addressed by this study. Case study research, thus, allows for a richer knowledge of issues associated with the configuration decisions than would have been possible through a quantitative approach (Nordin, 2005). A rather large number of cases are needed in order to observe differences in the studied phenomena (Eisenhardt, 1989), particularly for configuration decisions, allowing for multiple options for each choice.

The sample is composed of seven companies operating in the consumer market, and belonging to the household appliances, heating, power tools and consumer electronics industries. The sample companies cover different degrees of product complexity, and vary in term of firm size and after-sales strategy.

Consistently with the systemic perspective adopted in this paper, three main after-sales service activities, critical in consumer industries, are addressed in the case studies. First is *field technical assistance* (FTA), encompassing installation, repairs (warranty work and out-of-warranty repairs), check-up, and product disposal. More precisely, the research focuses on the structure of the authorised network (i.e. the service units authorised by the manufacturer to repair products under warranty). The second activity is *spare parts distribution* (SPD), responsible for inventory management, delivery of spare parts, direct and reverse flows, and customer order management. The third is *customer care* (CC), providing technical and commercial information and services such as product registration, warranty extension and complaint management to end users.

For each activity, the supply chain configuration is analysed through the three configuration choices described in Section 2: Vertical integration, centralisation, and decoupling of activities. Table 2 couples the three after-sales activities with the three configuration choices, and represents the methodo-

logical instrument used in the empirical research. For each company, nine choice–activity crossings were analysed, with a total of 63 crossings over the entire sample. Moreover, considering the seven companies and the three after-sales activities, 21 different supply chain configurations were analysed in this work.

Data collection focused on research variables describing the company, its after-sales unit, and the after-sales supply chain configuration: In particular, the issues of vertical integration, degree of centralisation and decoupling of tasks were explored for each after-sales activity. Case studies were performed 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 websites, specialised 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. Using several informants and different data sources allowed for triangulation to check

Table 2  
After-sales activities and configuration choices analysed in the empirical research

	Field technical assistance (FTA)	Spare parts distribution (SPD)	Customer care (CC)
Vertical integration			
Centralisation			
Decoupling of activities			

Table 3  
Research sample

	Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7
Corporate revenue (€ in million)	2400	5900	168	956	262	68	36000
Analysed business(es)	Power tools (professional and DIY), garden tools	Small appliances; white goods	Wall hung boilers	White goods; floor care and small appliances	White goods	White goods	Audio–video
Revenue in Italy (analysed businesses; € in million)	N.A.	1640	78	240	108	39	255
Role of Italian site	Subsidiary	Headquarters	Headquarters	Headquarters	Headquarters	Headquarters	Subsidiary
After-sales employees in Italy	24	51	100	89	51	9	15
After-sales turnover in Italy (% of sales turnover in Italy)	5	1.6	6.7	2.6	4.1	1.9	~2

the internal consistency of data (Voss et al., 2002). The analysis consisted then of data reduction, data display (Miles and Hubermann, 1994), and cross-case comparisons, to identify the main differences and common behaviours among companies (Yin, 1994). Table 3 describes the sample companies: They are identified by numbers from 1 to 7 to preserve their anonymity.

#### 4. Case findings

A description of the studied companies and their configuration choices is provided in Appendix A. Fig. 1 summarises the case findings, for the three activities and the configuration choices analysed, according to the methodological framework provided in Table 2. Fig. 1 positions each company (identified by a number) in a continuum between the two opposite options for each choice and for each activity. In order to obtain a synthetic visualisation of the positioning of companies, a few main data have been retained. For the vertical integration decision, Fig. 1 shows the degree of outsourcing of the execution of each activity, and the degree of control over the outsourced activities (only for FTA). Moreover, the degree of centralisation of activities (at a European, national, or local level) is represented in Fig. 1. Finally, for the decoupling decision, the number of decoupling points or handovers needed in order to execute the activity are given. In this way, a profiling of companies is obtained, hereafter discussed.

##### 4.1. Cross-case analysis by after-sales activity

###### 4.1.1. Field technical assistance

Although configuration choices vary in the sample, as shown in Fig. 1, it is possible to identify a set of companies (i.e. company 2, 4, and 6) with a similar profile. It is characterised by outsourcing FTA to repair centres serving also competitors' brands, decentralisation and low decoupling. Common features for these companies are a relatively standard and mature product, a relatively simple or standard service activity, a medium to low substitution-to-repair cost ratio, a generally low attractiveness of the after-sales business, and a strategy oriented to reduce fixed costs of service execution, while keeping a proximity to customers. Moreover, all sample companies de-centralise FTA, although to a different degree, to ensure proximity to customers through local contact points.

Only Company 1 does not outsource FTA, and makes 60% of warranty work in-house (in its centralised repair shop). The choice reveals a focus on service quality and is favoured by the product characteristics (power tools can be repaired off-site and are transportable at low cost, compared to their value). Nonetheless, Company 1 has a number of repair and collection points on the Italian soil.

The degree of control over the outsourced network varies across the sample. Firms might resort to franchising contracts (Company 3 with 138 repair centres), or exclusive, monobrand, agreements (Company 5 with 40% of its repair centres and Company 3 with 41% of the 591 first-tier repair centres). Aiming at product and service differentiation, these companies craft tight relationships with the authorised repair centres. This choice might increase the costs related to the training and control of the network, but seems consistent with the after-sales strategy of the two companies. In the case of Company 5, it allows to preserve the image related with differentiated high-end, premium-price white goods, and in the case of Company 3, to keep a higher share of a quite attractive after-sales business through its authorised (and high quality) assistance network. On the other hand, the desire to reduce control cost, leads Company 7 (and, to a different degree, Company 3) to de-verticalise FTA, organising the network in two-tiers, and transferring control activities to a group of first-tier repair centres.

Finally, more complex product or service activities, requiring specific training and/or equipment, determine the decoupling of repair activities (Companies 1 and 7) in order to optimise resource utilisation. In particular, Company 7 relies on a two-tier network with diversified skills. In the case of Company 1, instead, the repair centres own only partially the skills to fix products, which in turn might be sent to the central repair shop. In both cases, the actual level of decoupling depends on the kind of product and the point of contact between the end customer and the after-sales supply chain.

###### 4.1.2. Spare parts distribution

Spare parts inventories are kept both at a centralised level by the manufacturer, and by repair centres at a local level. While most companies rely on a two-level SPD network, the wish to reduce inventory costs led Company 7 to a one-level distribution structure, resorting to fast deliveries to achieve a 48 h delivery lead time. In the case of

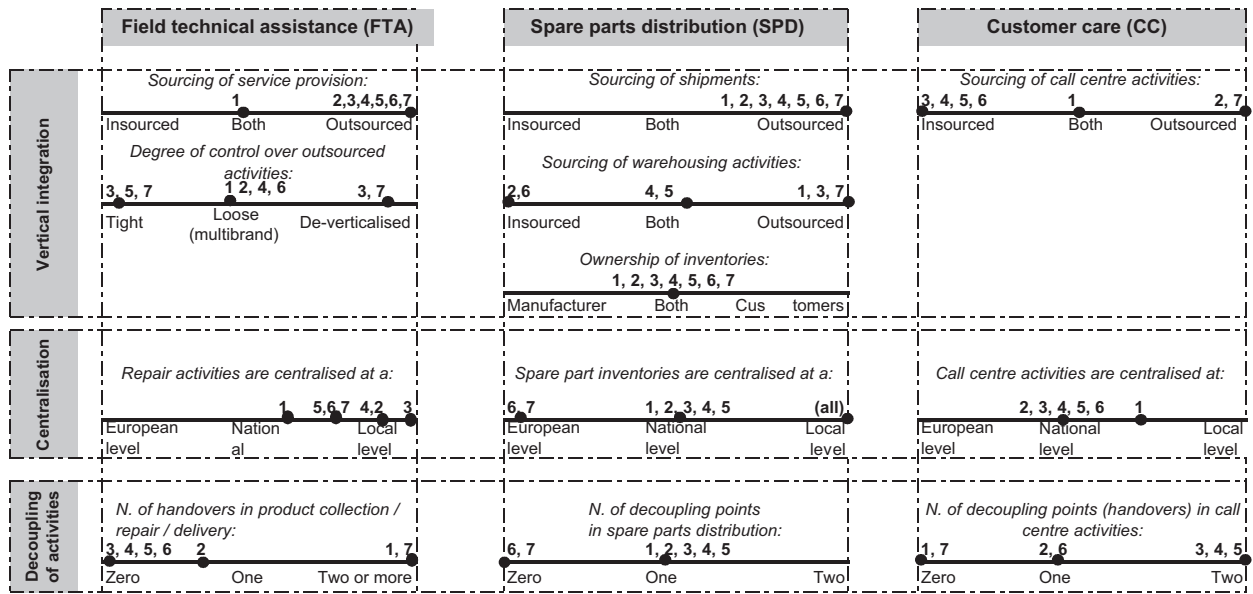


Fig. 1. Summary of findings.

Company 6, the choice is due to low volumes outside Italy. Moreover, local stocks (only of high rotation parts) are kept by repair centres in all cases, but they are not visible or controlled by the manufacturers, nor visible to other repair centres.

Among execution activities, shipments are outsourced by all companies, warehousing (at least partially) by five out of seven, showing an orientation to cut fixed costs of non-core activities.

4.1.3. Customer care

Customer care activities are also executed at different levels: Through a national centralised call centre, through the manufacturer’s website and through the local repair centres that provide technical information to customers. All companies resort to all the three channels: Nonetheless, the variety and personalisation of the service offer, and the wish to keep customer contact influence the way they are organised. Companies 2 and 7 outsource call centre activities, which are oriented to provide basic services. Companies 3, 4 and 5 provide also technical support through the central call centre, thus resorting to insourcing and decoupling activities in order to maximise efficiency. In these cases, a first automated level addresses the customer directly to the closest repair centre, a second level of employees provides basic and commercial information, and acts as a filter towards the third level of specialists, who provide technical support and

advice. Company 1, instead, separated an outsourced call centre for basic information from an insourced one for technical support: Along with efficiency, this solution is meant to reduce response time for professional users of Company 1’s products, which may directly address the technical phone number (which also generates revenue for Company 1). No company adopted a more centralised choice for call centre, for instance, of a European-based one.

4.2. Cross-case analysis by configuration choice

4.2.1. Vertical integration

Table 4 summarizes the decisions concerning vertical integration across the different activities. We notice that companies tend to outsource the execution of activities, except for the call centre insourced in a number of cases (Companies 1, 3, 4, 5 and 6). Company 7 is the most prone to outsourcing, in order to cut fixed and control costs, the latter through the de-verticalisation of the field assistance network. Company 1, on the other hand, adopts a focused mix of insourcing/outsourcing option. Service quality is considered a strategic priority; therefore, repair volumes are largely insourced, as well as the provision of technical support and advice to customer through a specialised call centre, while less value-added activities (e.g. warehousing, general call centre) are outsourced. The main difference amongst



the other companies seems related to the importance attributed to brand differentiation and customer contact. Company 3, for instance, keeps close control of a subset of centres through franchising and exclusive agreements, to enhance service quality and brand image. The importance of customer contact is paralleled by the recent internalisation of the call centre. Similarities can be found in the configuration choices of Company 5.

#### 4.2.2. Centralisation

The execution of activities is, in all cases, pursued at a local level. FTA is provided by a number of repair centres in Italy going from tens to over 1000; spare part inventories are held (also) by local repair centres and CC is provided (also) at a local level by the repair centres. As shown by Table 5, at the same time, a more centralised structure exists, in particular for SPD and CC. In the case of FTA, this happens only for Company 1, which centralises the majority of field technical assistance volumes, spare part inventories and call centre activities at a national level. Company 7 is oriented to centralisation, as shown by the one-level structure of the spare part distribution systems to reduce inventory costs. Structuring the field technical assistance provision to two levels, on the other hand, allows Company 7 to ensure customer proximity. At the same time, some physical activities are “centralised” at the first-tier repair centres in order to optimise resource utilisation. The objective of increasing

efficiency seemed to justify these choices. To reach effectiveness as well, fast deliveries are adopted in order to shorten spare parts delivery times, and advanced services are offered through the web rather than through call centres.

#### 4.2.3. Decoupling of activities

Table 6 analyses the decoupling of activities, showing the number of stages of material flows, involving different actors, and the number of handovers inside and between organisations that are requested to perform activities. The choice, therefore, is strictly interrelated with the decisions regarding vertical integration (and, to a lesser extent, centralisation). However, other factors help in explaining the differences found in case companies. First of all, product characteristics influence material flows and skills requested by the FTA units in order to support the product, thus the decoupling of field technical assistance execution. In the case of SPD, the number of decoupling points depends directly on the structure of the distribution network. Finally, for call centres, the decoupling depends on the complexity and variability of services offered: Technical support provided by specialist may be decoupled from general information, provided by generalists, who also filter requests to the next level (see Zapf, 2004). No handovers are found for Company 7, relying only on a generalist level, and Company 1, that parallelises resources, with one call centre focused on the generalist and another on the specialist level.

Table 4  
Cross-case analysis of vertical integration choices

Execution of activities is:		Field technical assistance (FTA)	Spare parts distribution (SPD)	Customer care (CC)
Insourced				3, 4, 5, 6
Both		1	2, 4, 5, 6	1
Outsourced	with enforced control	3, 5		
	outsourced	2, 4, 6	1, 3, 7	2, 7
	de-verticalised	3, 7		

Table 5  
Cross-case analysis of centralisation choices

Execution of activities is centralised at a geographical level:	Field technical assistance (FTA)	Spare parts distribution (SPD)	Customer care (CC)
European (+ local)		6, 7	
National (+ local)	1	1, 2, 3, 4, 5	1, 2, 3, 4, 5, 6, 7
Local (decentralised)	2, 3, 4, 5, 6, 7		

Table 6  
Cross-case analysis of decoupling choices

No. of decoupling points in the execution of activities	Field technical assistance (FTA)	Spare parts distribution (SPD)	Customer care (CC)
0	3, 4, 5, 6	6, 7	1, 7
0 to 1	2	1, 2, 3, 4, 5	2, 6
0 to 2 or more	1, 7		3, 4, 5

### 4.3. Discussion

The cross-case analysis suggests observations on a number of aspects, hereafter discussed.

#### 4.3.1. Variation of configuration choices

No shared configuration choice among the whole sample exists, except for two choice–activity crossings, sourcing of shipments and centralisation of call centre activities. Moreover, no company configuration profile completely overlaps with another, meaning that no equal configurations exist. This strongly suggests that *no one best* way in configuring an after-sales supply chain exists, but rather choices are influenced by drivers such as product, service and market characteristics, as well as strategic priorities. Nonetheless, in all activities, common trends might be pointed out, which may help in understanding in which way those drivers influence choices. Finally, the fact that no company adopts the same configuration choices consistently across activities suggests that the specificity of after-sales activities prevails in determining choices over the overall strategic orientation of the company. Partial exceptions are Company 7, which outsources the execution of all the three activities, and Company 1, which is oriented to centralise all activities at a national level. Those companies are able to act consistently at least in one configuration choice across the three activities.

#### 4.3.2. After-sales business attractiveness

As suggested by Wise and Baumgartner (1999) and Goffin (1999), the relevance of the after-sales business as a revenue and profit generator might influence configuration choices, in particular with respect to vertical integration. The figures presented in Table 3, shows a low relevance of the after-sales business for most companies, with the exception of Companies 1 and 3, for which after-sales overcomes 5% of the total turnover. On the other hand, for all companies, the provision of FTA is mandatory due

to warranty regulations. FTA under warranty by definition creates losses for manufacturing companies, while FTA after the warranty period does not provide high margins for medium-to-low value products as most of those analysed are, with a decreasing trend in the substitution-to-repair cost ratio. That explains the common choice of outsourcing FTA, consistent with Nordin's (2005) proposition. Company 1, instead, seeing business and strategic interest in the FTA, configures the supply chain (through insourcing and centralisation) in order to make it profitable or at least self-sustaining.

Finally the sale of spare parts provides higher margins for the manufacturers, that in all cases decide to act as intermediaries in the spare part business, producing and buying spares from suppliers and selling them to the authorised repair centres, but also to wholesalers, shops and generic repair centres.

#### 4.3.3. Role of strategic drivers

Case findings suggest that the strategic orientation of manufacturing companies acts as a major driver in determining their configuration choices.

One quite popular strategic priority is to reduce the costs connected with the execution of service activities. This leads to an outsourcing choice, pursued consistently across activities by Company 7. In addition, the desire to reduce control costs over the outsourced execution led Companies 3 and 7 to de-verticalise the network executing FTA in two tiers, delegating control activities to a subgroup of repair centres. Armistead and Clark (1991) suggested that an outsourcing choice might be favoured by high and geographically dispersed service volumes, and that the outsourcing choice reaches higher cost reduction in the case of consumer products, with respect to capital goods.

A second strategic objective pursued by some companies (in particular 1, 3 and 5) concerns the focus on service quality, or brand differentiation.

When the main mission of after-sales business is to sustain brand image, customer satisfaction and customer loyalty in the long term, in-house control of the execution of activities may be suitable (Armistead and Clark, 1991). This is shown in particular by Company 1, insourcing 60% of FTA volumes, and by Companies 3 and 5, which adopt enforced control mechanisms (such as franchising and exclusive agreements) with the third party providers of FTA. These companies also propose technical support and advice through call centres, which are insourced at least at the specialist level. These choices may trade-off the increasing operating costs suffered by the after-sales business unit in the short term with increased market share on new products (and consequently, revenue from after-sales) in the long term.

Finally, the desire to ensure customer proximity for products that need on-site service, leads companies to decentralise the execution of activities: As pointed out earlier, all activities and services, in fact, are provided (also) at a local level by outsourced resources. Quite surprisingly, though, no cost-service optimisation model (such as the one proposed by Amini et al., 2005) or policy was developed by the sample companies in order to design or assess the network facilities for FTA and CC (number and localisation of resources), rather based on tradition and on an evaluation of economic sustainability for the service provider. For the SPD network design, manufacturers tend to evaluate their inventory costs (Cohen et al., 1997), but an overall evaluation of the supply chain inventory costs is not undertaken.

#### 4.3.4. Role of product-related drivers

Product characteristics may provide support to the configuration choices adopted by the sample companies. First of all, product substitutability is high across the sample, and most products are relatively simple or at least standardised. Thus, the choice of outsourcing FTA respects previous findings in literature (see Nordin, 2005). Moreover, white goods such as washing machines or refrigerators, as well as wall hung boilers, need on-site intervention (because of their size and weight) and have relatively simple and standardised technologies. Therefore, simple but bulky products support low-decoupling FTA. The collection activity may be separated (e.g. sales points act as collection points) for products that are easily transportable and do not require on-site intervention (e.g. small appliances,

power tools, and consumer electronics products), thus allowing for decoupling and centralisation of activities. In the sample companies, this actually happens for complex products and/or products that may require particular skills or equipment for the diagnostic activity, as for Companies 1 and 7.

#### 4.3.5. Role of service-related drivers

Besides the role of potential profitability of after-sales services, discussed above, intrinsic characteristics of the services influence configuration choices.

The service volumes or intensity over time impacts on configuration choices. Mature products tend to have higher reliability, and therefore FTA requirements would be low. Contrary to what is stated by Nordin (2005), this factor seems to lead sample companies to outsource FTA, as suggested by Armistead and Clark (1991). Moreover, low service volumes per product are coupled with product with high substitutability and high diffusion among end customers (in particular white goods and audio/video products). These factors also influence the degree of decentralisation of FTA, and the opportunity to resort to non-exclusive (multi-brand) repair centres.

The degree of customisation as well as the degree of variation in the execution of services (Schmenner, 1986 and 2004) is another aspect that needs consideration. The more standardised a service is, the less the need for interaction and for especially skilled service employees. This may explain the (relative) centralisation of SPD and the outsourcing of its execution activities, as well as the orientation to insource call centre activities when specialised technical advice is provided. On the other hand, FTA although with a high degree of variation, is in most cases a labour-intensive activity. This also justifies decentralisation. In CC, the level of automation and interaction changes according to the kind of service (contact with the closest repair centre, general information, technical information), and the configuration choices regarding vertical integration and decoupling vary accordingly. The higher the customisation, the higher the option of insourcing, while outsourced, automated or alternative channels (e.g. the Internet) are adopted for standard services in order to reduce operating costs.

#### 4.3.6. Relation with distribution and sales supply chain

For all case companies, products are sold to the end customer through intermediaries, mainly retail

chains. SPD is managed similarly to product distribution, although often not jointly (different locations, different customers). As posited by Loomba (1998) and Nordin (2005) to an indirect sales distribution channel, may correspond an indirect after-sales distribution channel. As a matter of fact, our sample companies have outsourced and decentralised sales activities (to the end customer) as well as outsourced and decentralised FTA, with the exception of Company 1. Nonetheless, for CC and SPD direct (insourced) and centralised channels are adopted at least partially in the sample.

#### 4.3.7. *Just one configuration or many?*

As illustrated in the cross-case analysis, multiple options for each configuration choice exist, with different intermediate levels (or “shades of grey”) between the two extremes. Moreover, firms tend to adopt different options at the same time, building “multiple” configurations. Examples are the co-existence of insourced and outsourced FTA (Company 1), the coupling of de-verticalisation and enforced control towards different groups of repair centres (Company 3), the coupling of centralisation and decentralisation concerning SPD (spare parts inventories at a local and a central level, in all cases) and CC (customer care provided by the national call centre and by the local repair centres), the contemporary presence of low and high decoupling in FTA (Companies 1 and 7) and CC (Companies 3, 4, and 5). These dual choices can be interpreted as a way adopted by companies to respond to conflicting product, service, market or strategic drivers, which suggest opposite solutions for configuring the supply chain. In addition, multiple configurations could respond to the need to serve different customer segments, with different priorities and behaviours. Therefore, while product factors and strategic priorities enable, for instance, Company 1 to adopt an insourced and centralised FTA, the need for customer proximity is satisfied by a (relatively small) outsourced and decentralised network. The same company insources the call centre activity for the provision of a highly specialised service, while outsourcing it for the provision of an unspecialised one. Similar explanation may be found for other companies’ choices.

The presence of ambiguous or contradictory internal and external factors influencing the supply chain configuration has been observed by Nordin (2005), who proposed that firms tend to adjust “maladjusted” channel structure either with in-

creased internal resources and competencies or reinforced governance mechanisms. The crafting of multiple configurations, indeed, emerges as another way firms “adjust” their after-sales supply chain.

#### 4.3.8. *Relation among configuration choices*

A variety of configuration choices has been observed across the sample, and an analysis of factors influencing those choices was proposed. Nonetheless, interrelations among choices seem to be suggested by the empirical evidence collected. First of all, it is possible to notice that when the execution of activities is insourced by firms, it is centralised at least at a national level (Company 1 for FTA, several companies for CC and SPD). On the other hand, decentralised activities are always outsourced in the case studies. This relation might be explained with the need by manufacturing firms to reach economies of scale in order to accept to incur in the fixed costs required by insourcing. So it may be suggested that activities are insourced when they at the same time: (i) require specific skills (e.g. they are subject to variation and/or customisation), (ii) are considered of strategic importance (e.g. for customer satisfaction or for keeping the relation with the customer), and (iii) allow for centralisation. In other cases, efficiency objectives prevail, leading to outsourcing (and decentralisation) choices. Finally, decoupling of activities is used as a way to optimise resource utilisation in complex services (e.g. specialised CC), or as a way to reduce response time (for SPD).

## 5. Conclusions

Practitioners and researchers agree that after-sales services should cover a major role in manufacturing firms, for profitability and customer retention potential. Therefore, the design of the after-sales supply chain is of strategic value.

The empirical evidence presented in this paper suggests that no one best way exists in configuring the after-sales supply chain. A contingency approach is adopted by companies, based on multiple factors, such as the product characteristics (substitutability, complexity, life-cycle), the company after-sales strategy (e.g. focus on differentiation, service quality or cost), the service characteristics (intensity and customisation) and the product distribution supply chain. All the factors listed above determine the choice that would optimise a trade-off between cost and service performance.

Differently from previous research works, this paper analyses jointly field technical assistance provision and spare parts distribution, as well as the configuration of customer care activities. We believe this comprehensive perspective is required to truly understand the after-sales supply chain configuration, both empirically and conceptually.

A set of drivers influencing configuration choices and their relation have been analysed: Among the results, it is suggested that insourcing is adopted by sample companies only for complex and/or customised services which are considered to be of strategic importance and which are possible to centralise. Finally, the case analysis shows the presence of multiple supply chain configuration choices (and thus multiple supply chains) adopted by each company in order to respond to conflicting requests related to different contextual factors.

The quite varied sample suggests a possible generalisation of our findings to all the durable consumer goods industries. The systemic view of the after-sales business for durable consumer goods, including the configuration choices, the relation between activities, and the influence of a set of drivers, can be of help to managers in charge of after-sales operations in order to configure a supply chain from scratch or in order to assess its present

configuration. In particular, Section 4.3 provides suggestions to managers in order to understand if the configuration choices are consistent with internal and external contextual factors.

The findings of this paper, however, are derived from a limited number of cases, and relations among different factors and configuration choices are provided on a qualitative basis: A broader empirical research will help in transforming those suggestions into a normative model. Finally, future research should address the issue raised by this paper on the costs and benefits related to the management of multiple supply chain configurations.

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### Appendix A

In the following, the case companies and their configuration choices are described, also with the help of Tables A1–A3.

Table A1  
Field technical assistance (in Italy) in the case companies

		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7
Vertical integration	Sourcing of technical assistance	Outsourced except one owned repair centre	Outsourced	Outsourced	Outsourced	Outsourced	Outsourced	Outsourced
	Number of exclusivist (monobrand) repair centres	3	0	240	72	72	0	20
	Control activities (e.g. performance measurement)	Manufacturer	Manufacturer	Manufacturer (for 1st tier) and franchising centres (for 2nd tier)	Manufacturer	Manufacturer	Manufacturer	Manufacturer (for 1st tier) and 1st tier centres (for 2nd tier)
Centralisation	Number of repair centres	37	439	Around 1600	344	180	148	Around 160
	Additional points (or actors) of product collection	Sales points	In some cases sales points	No other points	Rarely sales points	Rarely sales points	Rarely sales points	Rarely salespoints
Decoupling	Number of stages in product flows	1–2	1	1	1	1	1	1–2
	Decoupling of collection-repair-delivery activities	Depending on the collection point of the product	No decoupling of execution activities	No decoupling of execution activities	No decoupling of execution activities	No decoupling of execution activities	No decoupling of execution activities	Physical activities may be decoupled among the two tiers depending on the product

Table A2  
Spare parts distribution network in the case companies

		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7
Vertical integration	Ownership of inventories (at the central warehouse)	Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7
	Sourcing of shipments	Outsourced	Outsourced	Outsourced	Outsourced	Outsourced	Outsourced	Outsourced
	Sourcing of warehousing activities (Italian warehouse)	Outsourced	Insourced	Outsourced	Partially outsourced	Partially outsourced	Insourced	Outsourced
Centralisation	Central warehouse (Europe)	Germany	Italy	Italy	Italy	Italy	Italy	UK
	Regional warehouses (Europe)	Italy and other countries	UK, France and others	UK and others	UK, France and others	Belgium and others	No	No
	Are assistance centres stocking units?	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Table A3  
Customer care in the case companies

		Company 1	Company 2	Company 3	Company 4	Company 5	Company 6	Company 7
Vertical integration	Sourcing of call centre	An outsourced and an insourced one co-exist	Outsourced with internal supervision (two persons)	Insourced	Insourced	Insourced	Insourced	Outsourced with internal supervision (one person)
Centralisation	Level of centralisation	Two call centres located (and serving) in Italy	On call centre located (and serving) in Italy	On call centre located (and serving) in Italy	On call centre located (and serving) in Italy	On call centre located (and serving) in Italy	On call centre located (and serving) in Italy	On call centre located (and serving) in Italy
Decoupling	Decoupling of call centre activities (no. of levels)	One call centre provides general information, the other specialised (technical) ones	Two levels (automated, general)	Three levels (automated, general, specialised)	Three levels (automated, general, specialised)	Three levels (automated, general, specialised)	Two levels (automated, general)	One level (general information)

### A.1. Company 1

Company 1 manufactures power and garden tools, and is based in a European country, with an important subsidiary in Italy.

#### A.1.1. Field technical assistance

Company 1 owns a repair shop, which is co-located with the subsidiary in northern Italy, and holds agreements with 36 independent service providers in Italy, with different competence and

levels of specialisation: 20 centres perform repair activities for all Company 1 products, while 4 are not qualified to repair all products, and send the others to the central repair shop. Finally, 12 centres are actually “intelligent” collection points, and send the products either to the central repair shop or to the closer local centre. Moreover, the final customer may send (or take) the product directly to the central repair shop. As a result, the central repair shop makes more than 60% of warranty work, and product flows are either one- or two-stage flows.

### *A.1.2. Spare parts distribution*

Company 1 has a central European spare parts warehouse in Germany, and some regional warehouses in different countries, including Italy. All repair centres manage an inventory of high rotation parts, except the main one (company-owned), which provides benefits of daily shipments of spare parts from the Italian warehouse, located less than 50 km far. Shipments and warehousing are outsourced to two service providers.

### *A.1.3. Customer care*

Some after-sales services are provided through the Internet, such as the identification of repair centres, the access to technical drawings, and advice for product usage. Moreover, the customer may call two different numbers for after-sales information. One, toll-free, number is outsourced to an external company, that provides the customer with basic information such as the data of the closest repair centre and enable the warranty extension; the second one (a paying number) deals with complaint management and provides information for the usage of products.

## *A.2. Company 2*

Company 2 is an Italian-based multinational company, which recently delocalised part of its production to China. Small appliances account for slightly more than two-thirds of its sales. Other businesses are white goods and air conditioning.

### *A.2.1. Field technical assistance*

Field support execution is completely outsourced by Company 2, to 439 independent repair centres spread all over Italy, usually small family businesses, servicing multiple brands. Most of them also run a shop selling small appliances, accessories, and spare parts.

### *A.2.2. Spare parts distribution*

The central warehouse (located in Italy) serves the regional warehouses located in Europe and USA, some companies distributing Company 2's products and parts in other countries, and the Italian customers (spare parts resellers and repair centres).

### *A.2.3. Customer care*

Besides offering some basic services through its website (identification of repair centres, download of instruction leaflets), Company 2 offers a call

centre service on a national basis. It is outsourced to a local company, but supervised by two internal employees, who coordinate the activities of the service provider and monitor its performance and the data collection in the recently established CRM system.

## *A.3. Company 3*

Company 3 is an Italian manufacturer of wall hung boilers and burners, managing two main brands with separate (sales and) support networks. Only one of them was analysed.

### *A.3.1. Field technical assistance*

Field support execution is completely outsourced by Company 3, to around 1600 installers and repair centres. Nonetheless, Company 3 directly manages agreements only with 591 of them, 240 with exclusive (monobrand) agreements. In particular, 138 repair centres in franchising serve only the brand object of this study. Moreover, they manage relationships with the more than 1000 authorised centres with no direct contacts with Company 3.

### *A.3.2. Spare parts distribution*

Company 3 central spare parts warehouse is located in Italy, and serves other regional warehouses in Europe, companies distributing its products and parts in other countries and the Italian customers (repair centres and installers).

### *A.3.3. Customer care*

The Internet is not used as a main customer care channel by Company 3, which through its website only allows to identify repair centres. Despite that, customer care is considered very relevant, and for this reason, Company 3 recently restructured and internalised its previously outsourced call centre for the Italian market. The call centre is organised on three levels: An automated level, redirecting customers to the closest repair centre, a generic information level that filters all calls, and a specialised level for technical support and advice.

## *A.4. Company 4*

Company 4 is a multinational, Italian-headquartered manufacturer of white goods (the analysed business), floor care and small appliances, among the main European players in the industry.

#### *A.4.1. Field technical assistance*

Company 4 outsources field support activities to 344 independent repair centres.

#### *A.4.2. Spare parts distribution*

Company 4 has a central European spare parts warehouse located at its main production site in Italy, which serves other regional warehouses in Europe, and direct customers in Italy (repair centres and part resellers). Shipments activities are outsourced, as well as the packaging (with a company-branded package) of original parts purchased from suppliers.

#### *A.4.3. Customer care*

Company 4 provides some services through its website (identification of repair centres, warranty extension, and instruction leaflets). The call centre is insourced and it is organised on three levels (automatic, general, specialist), as for Company 3.

#### *A.5. Company 5*

Company 5 is based in Italy and operates in the white goods business, and it is renowned for the particular old-style design and the wide range of colours offered to its customers.

#### *A.5.1. Field technical assistance*

Field support execution is completely outsourced by Company 5, to 180 independent repair centres spread all over Italy. A significant percentage of them (40%) have exclusive agreements, i.e. services only Company 5 products.

#### *A.5.2. Spare parts distribution*

Company 5 central spare parts warehouse is located at its main site in Italy. The central warehouse serves: The regional warehouses located in Europe, companies distributing its products and parts in other countries and the Italian customers (spare parts resellers and repair centres).

#### *A.5.3. Customer care*

Company 5 website offers some after-sales services, such as the identification of repair centres, the purchase of warranty extension, instruction leaflets, technical and cooking advices. A toll-free number is also available to customers. The provision of this service is insourced, and organised in three levels (automatic, general, specialist).

#### *A.6. Company 6*

Company 6 (the smallest in the sample), based in Italy and operating in the white goods business, operates production sites also outside Italy (in Portugal and through a joint venture in India).

#### *A.6.1. Field technical assistance*

Field support execution is completely outsourced to 148 independent, small repair centres in Italy, servicing multiple brands.

#### *A.6.2. Spare parts distribution*

Company 6 central spare parts warehouse is located in Italy and serves the Italian customers (spare parts resellers and repair centres), and companies distributing its products and parts abroad.

#### *A.6.3. Customer care*

Company 6 through its website allows customers to identify the closest repair centre, but no other service is offered. Moreover, a call centre service is run internally with only two levels (automatic and general). For technical advice, customers are directed to the repair centres.

#### *A.7. Company 7*

Company 7 is a very large Asian multinational operating in different businesses such as consumer electronics, telecommunications, and white goods. In particular, the audio/video business was addressed in this case study.

#### *A.7.1. Field technical assistance*

Company 7 outsources field support activities to around 160 independent repair centres, structured in 2 levels. Local centres perform the entire collection–repair–delivery–feedback cycle only for less complex products. More complex products which may require expensive equipment for diagnostics, instead, are sent to the closest regional centre (there are 20 of them in Italy). The regional centres own the skills and equipment to perform all repair activities. Moreover, they are responsible for the selection, training and control of second-tier centres.

#### *A.7.2. Spare parts distribution*

Company 7 operates a European central warehouse in the UK, which serves directly all the



European customers, among which Italian first- and second-tier repair centres and spare part resellers.

### A.7.3. Customer care

Company 7 website is considered a main channel for providing customer care services, such as warranty registration and extension, identification of repair centres, technical documentation and instruction leaflets, drivers (for hardware products) and also to verify the state of a repair order. Besides the website, a call centre is also active, outsourced to an external provider. The number of call centre operators allocated to Company 7 by the provider varies every day according to the volume forecasts provided by Company 7.

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