Servicing PC industry products: how to choose the best strategy?

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Krisztina Demeter
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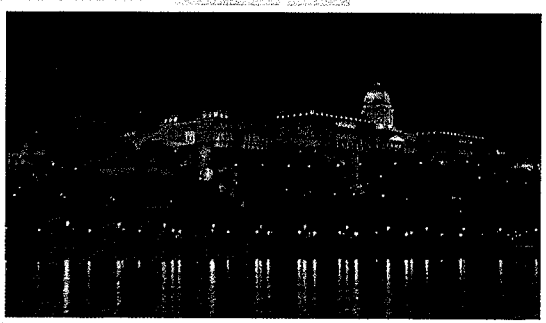

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Service Operations Management

Teaching Issues in Operations Management

SERVICING PC INDUSTRY PRODUCTS: HOW TO CHOOSE THE BEST STRATEGY?

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ABSTRACT

This paper presents some results of a research project whose aim was to provide a reference model for the after–sales strategy assessment. In this work such reference model is applied to PC industry. Results achieved, can be summarized as follows: there are several factors, related to products, manufacturers and customers that determine the way products have to be repaired and the kind of technical assistance networks where reparations have to take place. The paper is organised as follows: section 1 provides introductory information about the research project and its motivations, section 2 provides the background for paper comprehension (literatures, basic definitions and assumptions, etc.), section 3 provides the reference model development and a discussion about the model drivers and its application to the PC industry products; then, in section 4, some conclusions and future outlooks of the research are pointed out

Keywords: After–sales, PC industry, configuration, field service.

INTRODUCTION

As well–known, competition in world–wide mass–market is more and more focusing on accessorial services, such as after–sales services. This shifting from a *product–centric view*, where the focus is on product performance (such as quality, reliability, etc.), to a *customer–centric view*, where the focus is on customer expectations in the whole product life–cycle, has assumed significant relevance, especially in mature markets (e.g. automotive, consumer electronics and computer industry, domestic and household appliances). In fact, in mass market, products tend to have more and more similar features and performance, thus differentiation is achieved only by providing an integrated product/service offer, the so called *extended product* (Thoben et al, 2001). Among accessorial services, technical assistance has assumed strong relevance, especially when complex products are sold to customers who don't have skills to use or maintain them properly. Field service capabilities, such as installation, maintenance, on–time spare parts delivery, can consequently attract customers' purchase intention and then determine their retention.

Because of this increasing importance, after–sales services modeling, has been subjected to a deep study, in a 2–year research project, named ASAP Project (After–sales Advanced Planning, see www.progettoasap.org). The main objective of this paper, whose information and data come from case studies carried out in the ASAP project, is to provide a reference model to describe *why* and *how* a specific after–sales service strategy must be developed. Then, an application of the model to PC industry products has been carried out to validate the model itself.

BACKGROUND

After–sales services: goal and scoping

As a starting point, good definitions of what after–sales service is can be found in Cohen and Lee (1990), Urbaniak (2001), Ehinlanwo and Zairi (1996), Asugman et al. (1997). Assuming the point of view of value creation, we agree with Patelli et al. (2004), defining after–sales service as the sum of activities taking place after the sale of a product, devoted to:

1. assure customer with an expected availability of product, re–establishing its functioning in consequence of faults;
2. solve, or suggest solutions to, problems encountered by the product user;
3. give support in configuring processes where product is involved;
4. support the customer at the end of product life with reverse logistics activities;

These objectives are achieved by developing several decisional processes, aiming at defining at a strategic, tactical and execution level, the service mix to be offered (Lele, 1997), the resources to be dedicated (Mathe and Shapiro, 1993), the managerial policies (Gaiardelli et al., 2004), the lacalisation of technical assistance centers and the spare–parts distribution and inventory policies (Fitzimmons and Fitzimmons, 1998) (Klimberg and Bennekom, 1998) (Cohen et al., 2000) (Haksever et al., 2000). As a result, an after–sales service strategy is formalised first defining the service mix to be offered, that, in turn, influences the configuration and management of the after–sales network. Basically, a strong coherence between the design/manufacturing strategy and the provided after–sales services must be assumed *ex–ante*, as stated by several authors (McLaughlin et al., 1991), (Kellog and Nie, 1995), (Ng et al., 1999), (Adenso Diaz et al., 2002), (Johansson and Olhager, 2003). In particular, Lele (1997) developed an useful framework to define the most appropriate service strategies, using a bi–dimensional diagram whose dimension are, respectively, the variable cost and the fixed cost customers sustain whenever their product fails. Variable cost depends on product downtime, being related to some sort of opportunity–cost. Fixed cost is directly related to reparation and service cost. With reference to this model, a product can be classified as *disposable* (low fixed cost and low variable cost), *repairable* (high fixed cost and low variable cost), *rapid responses* (low fixed cost and high variable cost) and *never fail* (high fixed cost and high variable cost); for each product type, some key–drivers, concerning service strategy, are then defined. Even if not explicitly mentioned in Lele's work, a product is assumed to be part of more than one group, since variable cost can remarkably vary with reference to the kind of use of product itself. This has solicited us in reviewing Lele's conclusions, deriving an advanced model more appropriate to analyse mass–market such as the PC industry, where a product (e.g. a laptop PC) could be used either for business or private use. According to the model, to identify the most appropriate service strategy, the efforts made by service provider must be also considered in order to define *how* this service can be cost–effectively provided. To this aim, PC industry is paradigmatic because several service strategies, simultaneously adopted to support different products (e.g. on–site assistance, on–center assistance, product swapping, etc.), can be totally addressed in the model.

PC industry: a brief overview

As well known, since its inception PC industry has been characterised by an high degree of horizontal specialisation: PC devices and peripherals could be produced separately and then assembled in a final product, thanks to open standards and IBM–compatible modular architecture. Since the beginning, international PC companies (first of all, IBM) outsourced parts production to foreign suppliers (mainly Far East companies), thus creating a world–wide value–chain (Dedrick, L. Kraemer 2002a). As a result, PC industry is nowadays composed by a high number of key–suppliers, involved in designing and manufacturing components (such as microprocessors, or hard drives), subassemblies (such as motherboards), complete systems (such as PC's and peripherals), OS and applicative software. Besides components' producers (such as microprocessors, flat panel displays, storage devices, etc.), the so called Original Design Manufacturers (ODM's) produce both

subassemblies and complete systems as contract manufacturers for a big vendor, such as an international PC company. PC companies, promoting and selling world–wide branded PC's and/or peripherals, can be divided in *direct companies* (such as Dell, Gateway) and *indirect companies* (such as HP/Compaq, Toshiba). Direct companies sell products directly to customers, via e–commerce sites. On the contrary, indirect companies sell products via traditional (dependent or independent) distribution channels. Some minority shares of PC's markets are fulfilled by *local assemblers*, SME's assembling and selling for a local (national) market. The value–chain description is ended up considering international or national distributors and resellers/retailers. Reselling is done by specialised trade operators and computer–shop networks (mainly dedicated to private consumers), by vortals (both private and small business), by Value–Added Resellers (VAR's) and system–integrators (dealing with medium and large accounts and public administrations). After the sale, PC industry products are serviced in Technical Assistance Centers (TAC's) (*on–center assistance*) or within the customer premises (*on–site assistance*). According to products, customers and distribution channels, on–center assistance can be provided in several ways: from small decentralised laboratories to bigger and more centralised structures. The service providers can be mono–mandatary or pluri–mandatary, independent firms as well as owned or controlled by the PC company organisations.

In recent times, technical assistance services have assumed a major role in this world–wide industry, in fact, as well–known, profits from PC's sales are reducing: key–suppliers such as Intel and Microsoft concentrate the most gross margin of the value–chain, because of their unquestioned capacity of market leaders in defining, as a continuous innovation, the HW and SW standards to be adopted; as a result, PC companies have been more and more focusing on the provision of accessorial services both before (e.g. customisation) and after the sale. This strategy is clear enough: serviceability provides differentiation in offering the same products, thus obtaining a premium price in the product sale, making directly profits when high–value services are sold, fostering brands and increasing customers' loyalty. The importance of after–sales services in PC industry is also figured out by data coming from a recent survey (AMR Research, 2003): after–sales activities account for 24% of revenues and for 45% of OEM's profits in the U.S.

In order to face this market dynamics, almost all the PC companies have consequently produced efforts in order to:

a. *Prevent failures*, improving product reliability and offering preventive maintenance programmes and on–line monitoring for *never–fail* products
b. *Avoid unnecessary repairs*: an increasing number of service issues can be resolved by customers themselves, if provided with direct and indirect support (such as blended–routing call management call–centers, technical forums and knowledge–bases web sites, disaster recovery CD–rom, etc.);
c. *Reduce downtime when failures occur*: maintainability has been improved by better modularity and maintenance functions (such as *hot swap*) and more effective diagnostic systems.
d. *Configure an on–field service network*, able to support each kind of product in the most appropriate way, so to fulfil customers expectations.

After a broaden evaluation of the field service network organisation, on the basis of the good–practices observed in the ASAP project case studies, the drivers affecting the field service configuration have been identified; thus, starting from the Lele's work, a reference model to select and justify the proper service strategy has been developed.

AN AFTER–SALES SERVICE REFERENCE MODEL

The model is based on the following hypothesis: the way products have to be repaired and the type of TAC's where reparations have to take place in a satisfactory and cost–effective manner, are determined mainly by two drivers, that are product value and on–field service effort. Thus, after providing a formal definition for these drivers and after grouping PC industry products having

homogeneous characteristics in servicing, a specific area of a diagram will be assigned to each group in order to match them with a different way to provide technical assistance in terms of both *modus–operandi* (e.g. prevention, reparation, substitution) and type of structure where service activities have to take place (e.g. centralised, decentralised, etc.).

Drivers

a. Product Value

We consider the product value as the value perceived by the customer. It isn't an intrinsic characteristic of product at all, at least depending on three sub–factors:

1. *Substitution cost*: cost to face in order to buy a new product with similar characteristics.
2. *Recovery cost*: cost to sustain in order to restore entirely the process functionalities, as a consequence of substitution,. This includes:
   - *Configuration/installation cost:* inferred by OS configuration and applicative software installation.
   - *Migration cost*: related to data migration from the damaged product to the new one, including the cost related to files and relevant data destruction
3. *Unavailability cost:* cost depending on the product downtime given by:
   - *Opportunity–cost:* loss of revenues (as the value of lost production) during the product downtime;
   - *Wastes:* cost of idle resources (e.g. workers) which cannot be properly used during product downtime.

According to Lele's terminology and with reference the driver *product value*, products can be then classified as (see Figure 1, left–side diagram):

- *Never fail products*: high–value products, whose unavailability is not acceptable. For never fail products, failures should not ever occur, thus, field service would provide product availability through preventive (predictive or on–condition) maintenance. Referring to the PC industry products, mainframes, servers, data storage devices, etc. belong to this category.
- *Repairable products*: products whose value is usually higher than the cost of reparation. Reparation activities have to be carried out on–site rather than in TAC's, according to higher unavailability costs. Being product value determined by the utilisation, the same product (desktop or laptop PC's, for instance) can be assisted both on–center and on–site.
- *Disposable products*: low–value products, designed not to be repaired in case of fault, but simply replaced; generally, reparation would be too expensive if compared to product value. Mouse and keyboard, for instance, belong to this category.

b. Field service effort

A technical assistance intervention requires efforts that can remarkably vary according to both the product and the type of service tasks. There are several factors, basically coming from product characteristics, which determine these efforts, such as:

- equipments and skills required in order to perform diagnosis and reparation;
- availability and compatibility of component to be replaced;
- handiness of product, that is related to volume, shape, weight and fragility of product itself

In our model, the field service efforts influence the centralisation level of the technical–assistance structures. In fact, except for *never fails* products (preferably, assisted on–site) technical support, as explained before, can be provided in structures that span from distributed small laboratories covering a local area (such as a city or less) to highly centralised structures operating in an international area.

Products requiring a medium–to–high field service are usually assisted in centralised TAC's, where service tasks and operations can better be performed; instead, it would be too expensive to equip distributed TAC's with all the necessary instruments, skilled personnel and spare–parts. In addition, centralisation:

- lets scale economy operates, reducing the total amount of assets to fulfil a certain level of service demand
- reduces uncertainty in service demand, pooling service calls coming from a wider area, making spare–parts warehousing and operations scheduling easier
- allows specialisation economy, for instance coming from the organisation of field–engineers project teams to support specific products or solve particular problems
- allows a better monitoring on the perceived quality and a better gathering of information in order to improve product reliability

Through TAC's centralisation, the average total cost of reparation would considerably decrease. That's why an increasing number of PC companies are more and more centralise the technical assistance for laptop, PDA, high–end printers and in general for all the products requiring medium–to–high efforts in servicing (this process is well enabled by both the progressive reduction of logistics cost and the availability of web–based interconnection for information sharing among TAC's, 3PLs and customers, wherever they could be in a wider area). On the contrary, products requiring small efforts to be repaired, can be cost–effectively assisted in a more distributed structure, getting thus a faster assistance. For instance, repairs on desktop PC's generally consist in component replacement; this is easily performed by unskilled personnel, with simple tools; moreover, spare–parts are available as well, due to the compliance to interfacing standards.

As a result, a strong correlation between the field service efforts and the TAC's centralisation degree seems to be present. Therefore, we have used Figure 1, right–side diagram, to represent this correlation and suggest the different degree of centralisation of the service networks, then distinguishing between on–site and on–center assistance. Obviously, for disposable products, no servicing networks will be provided, but rather other types of after–sales service (such as a call–center, to give information on substitution procedures).

Recently, manufacturers have been increasingly adopting the "swap" strategy for low–value products whose reparation requires relative high efforts. Swapping consists in a rapid substitution of the damaged product with a new one (or a reconditioned one). Then, substituted products are repaired (reconditioned) in centralised TAC's. Swap allows both a good service performance (faster restoration) and low costs due to TAC's centralisation; unfortunately, swap is not supposed to be the right strategy for products storing relevant data or having bad handiness and high product value. As a result, the swap strategy limits its interest area in the bottom–right corner of the framework.

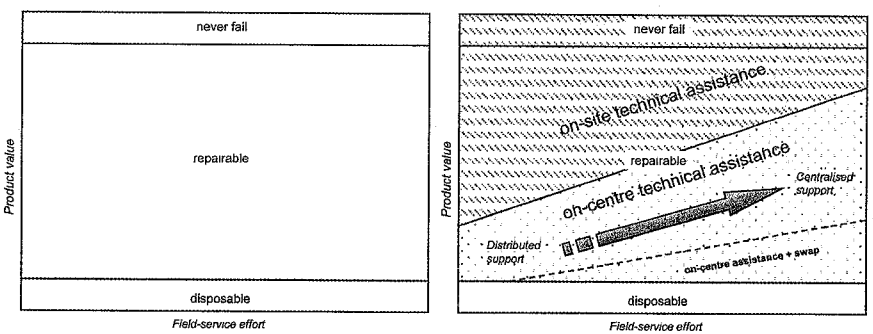

Figure 1 – After–sales service configuration reference model

Application of the reference model to the PC industry products

For our purposes, PC industry products can be grouped as follow:

1. Customer Removable Units (CRU's): disposable low–value accessories always replaced in case of failures (efforts to be done in reparation are not ever justified). These products are not interesting from the servicing point of view.

2. Personal Digital Assistants (PDA's): these devices require skilled personnel and not common equipments to be repaired. The product value is, more or less, coincident with market value, because data as well as applicative software are usually backed–up in the PC's, thus recovery and unavailability costs are not so high. As a result, these products are usually repaired (or at least reconditioned after swapping) in highly centralised TAC's, even considering the relevant easiness in good transportation.
3. Desktop PC's: this group includes both the "white boxes" produced by the local assemblers and the branded products, provided by international vendors. Desktop PC's cover a wide area in the matrix: in fact, despite low service efforts, product value can remarkably vary for both recovery and unavailability costs. Thus, according to use, desktop PC's could require different kind of service: on–site assistance (al least in case of business costumers), or on–center assistance provided at different level of centralisation, depending on the type of distribution channel.
4. Laptop PC's: this group includes notebook and tablet PC's. Laptops are increasingly replacing the desktop PC's, in both the consumers and business markets. As a consequence, Laptop PC's have the same recovery ad unavailability costs if compared to desktop PC's, but a higher substitution costs; thus, the average product value is higher than the desktop PC's one. Because of a major complexity in servicing (mainly due to a lower modularity), laptops require higher on–field service efforts, making centralisation of service network a good strategy.
5. Monitors and other complex peripherals: these devices present a medium average value and a medium service effort to be repaired. They are thus usually repaired or, at least, reconditioned after swapping, in medium centralised centers.
6. Low–end printers: low–value products whose unavailability doesn't affect the owner with significant costs; only scale economy, especially in spare–parts warehousing, makes repairs viable. Consequently, these products are usually repaired (or reconditioned after swapping, at least), in medium–to–high centralised centers.
7. High–end printers, such as departmental laser printers: here the swap procedure is not viable because of a higher substitution costs, recovery costs are relatively low, whilst the unavailability ones can be relatively high; as a result, product complexity coupled with a bad handiness make on–site assistance the best choice, even if some companies assist this kind of product in centralised TAC's.
8. Servers/storages: presenting very high unavailability, recovery and substitution costs, these products have got a remarkable value; low handiness and a relatively higher complexity than a desktop or laptop PC, make the field service efforts higher as well; for these products, assistance is usually provided on–site. Moreover for mission critical server, failures shouldn't simply occur; thus, technical assistance mainly consist in a preventive/on–condition maintenance.

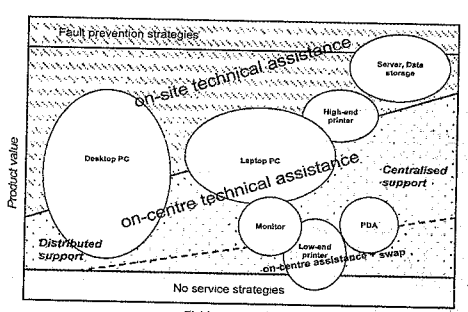

Figure 2 – After–sales service strategy for the PC industry products

Empirical results

The proposed model has been used to represent the Italian PC industry market after–sales service strategies. Data and information were gathered during the ASAP project research processes, directly interviewing managers from a wide sample of companies, including several TAC's, local PC assemblers (e.g. Brain Technology, Frael, CHL), international PC companies (e.g. HP, Epson, IBM, Olidata) and collecting data indirectly through web sites and call–centers of other Italian (e.g. Tecnodiffusione, CDC) and international (e.g. Dell, Toshiba, Acer, Asus) companies. As a result of this empirical analysis, some key–issues have been observed: besides the proposed drivers (*product value* and *field service effort*), also the company's distribution strategy affect the way products are assisted in terms of both *modus operandi* and TAC's centralisation. In order to make this clear, we have grouped companies adopting the same distribution strategy, thus distinguishing among:

A. Local assemblers ..
B. Indirect PC companies
C. Direct PC companies

Local assemblers (A) own (or control, as a franchisor) a sales network well deployed in the territory (e.g. Essedi shops for Brain–Technology, Computer Discount shops for CDC, Frael point shops for Frael, Microlink, Strabilia and Vobis shops for Tecnodiffusione). Relying on several points of sales, local assemblers generally choose to physically locate TAC's directly in the shop premises, in order to reduce, or not to store at all, spare–parts inventories, since components, such as a hard–drive, can be used for sales or for field service at the same time. These TAC's, however, repair almost desktop PC's, while notebooks (sometimes commercialised by local assemblers with their brand but not directly produced), requiring an higher field service effort, are repaired in centralised TAC usually located within the production plant premise.

Unlike local assemblers, the distribution channel for indirect PC companies (B) is quite more complex, made of distributors and resellers such as internet vortals, trade dealers and shop–networks. Such a various kind of final resellers, together with a wide diffusion of different products, encouraged indirect PC companies to centralise, usually at a national level, the technical assistance (except for products requiring on–site support), at least outsourcing the Desktop PC's assistance to qualified organisation, having distributed first–tier TAC's. Low–value but rather complex to be repaired products (e.g. LCD monitors, printers) are more and more often swapped and repaired/reconditioned in centralised structures (e.g. HP swaps low–end printers, Epson is going to adopt the same strategy in a shortwhile).

As a concluding remark, direct PC companies, not having a traditional distribution channel and being highly deverticalised, choose to outsource most of the field service to specialised companies. Technical assistance tasks are carried out mainly on–site, except for some PC desktops and laptops, assisted in centralised structures (Dell, for instance outsources the on–site assistance for the european market to Unisys and Getronics, providing also some repair service in the logistics hubs where PC units are brought together with monitors, peripherals and other add–ons for distribution to end user (Dedrick and Kraemer, 2002c)). Swap procedure is here widely adopted, especially for printers and handheld devices.

In order to show the relationship between the distribution channel and the support strategy, the area related to on–center assistance has been further subdivided (Figure 3 – left–side diagram) in three different sections, each corresponding to a different level of centralisation and thus to different kind of TAC's: first–tier TAC's (covering a metropolitan area or less), second–tier TAC's (operating in a national area), third–tier TAC's (operating in a wider area such as EMEA). Then, referring to the capital letters used in the previous list, the behaviours and the servicing choices of the assessed case studies have been characterised and associated to a specific area of the framework itself (Figure 3 – right–side diagram)

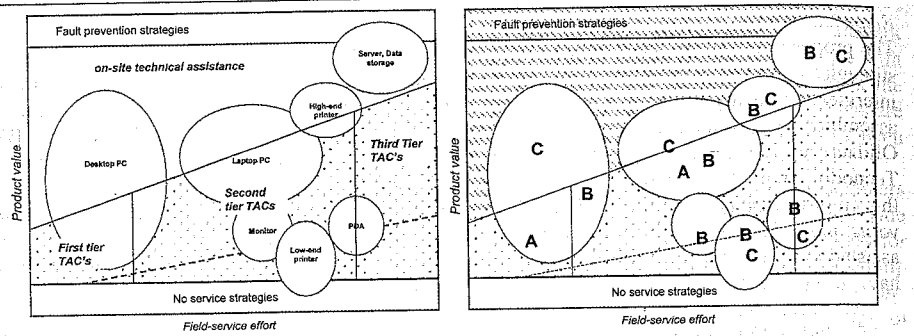

Figure 3 – Relationships between field service and distribution strategies

As a result of the empirical analisys and as well shown in Figure direct PC companies (B) tend to centralise the technical support, at least, at a national level, for an increasing number of products, while indirect PC companies (C), through their service partners, tend to provide more and more on–site assistance, swapping low–value products. Finally local assemblers centralise laptops support while desktops are repaired in first–tier TAC's. Obviously, some exceptions to this general behaviour have been noticed. In addition, it's worth to point out that the framework has been developed and should be used, to describe and explain the after–sales strategy and configuration to be adopted for product under warranty.

CONCLUSIONS AND RESEARCH OUTLOOK

This work aimed at proposing a reference model for describing different after–sales service strategy for mass–market products, such as PC industry products. Depending on some drivers for service configuration, the placement of products requiring different strategies for servicing, has been proposed. The model is therefore intended to have both descriptive and normative power, allowing to define the optimal after–sales network configuration according to the results, good practices and studies coming from the ASAP project.

For the purpose of validating the model, an application for PC industry products in Italian market was discussed, providing empirical evidences.

Together with easy of use, the model representativeness comes from its capacity to be adaptive, depending its boundary on corporate strategies, on markets dynamics and product innovations. In particular, this last issue is currently subjected to further researches and a lot of work is still to be done in this direction. Another issue where research interest should be focused regards extending the model to be quantitatively descriptive. Even if it's very difficult to give a quantitative, rather then a qualitative assessment of the proposed drivers, procedures and guidelines for service–costs assessment and for product–value evaluation, in some cases, could be provided.

REFERENCES

Adenso Diaz B., Gonzalez–Torre P., Garcia V., 2002, *"A capacity management model in service industries"*, International Journal of Service Industry Management, vol. 13, No. 3, p. 286–302

Armistead C., Clark C.,1991, *"A Framework for Formulate After–sales Support Strategy"*, International Journal of Operations & Production Management , Vol.11, No.3, pp. 111–124.

Asugman G., Johnson J.L, McCullough J., 1997 *"The role of after–sales service in international marketing"*, Journal of International Marketing, vol. 5, pp. 11–28

Bandinelli R., Rapaccini M., Tucci M., 2004, *"A Proposal of a Reference Model for the Information Management of the After–Sales Processes"*, International conference on Global Production Management IFIP WG 5.7, Bandung, Indonesia, September 5th–7th

Brun A., Corti D., Novakova G., Songini L., 2004, *"Conceptual Framework for Assessing Operative and Economic After Sales Service Performance"*, 13th International Working Seminar on Production Economics, Igls–Innsbruck (A), February 16th–20th

Brun A., Introna V., Pinto R., Rapaccini M., Saccani N., Songini L., 2004, *"After–sales service and network configuration strategies: a preliminary profiling and assessment of determinants"*, International IMS, Cernobbio (Como), Italy, May 17th–19th 2004, pp.171–179

Cavalieri S., Cesarotti V., Grassi, Spandri, 2002, *"Coordinated planning models for managing spare parts inventory in after sales service, 12th Intl. Working Seminar on Production Economics"*, February 18–22, vol. II, pp. 35–52

Cohen M., Lee H.L., 1990, *"Out of Touch with Customer Needs? Spare Parts and After Sale Service"*, Sloan Management Review, vol. 31, No 2, pp.55–66

Cohen M.A., Agrawal V., 1999, *"After sales service supply chains: a benchmark update of the North American Computer Industry, Technical Report, Fishman–Davids On Center for Service and Operations Management"*, the Wharton School, University of Pennsylvania

Cohen M.A., Cull, Lee, Willen, 2000, *"Saturn's Supply–Chain Innovation: High Value in After–Sales Service"*, Sloan Management Journal, Vol. 41, No. 4, pp. 93–101

Cohen M.A., Zheng Y., Agrawal V., 1997, *"Service parts logistics: a benchmark analysis"*, IEE Transactions, vol. 29, pp. 627 – 639

Ehinlanwo O., Zairi M., 1996 *"Best Practice in the Car After–sales Service: an Empirical Study of Ford, Toyota, Nissan and Fiat in Germany"* Business Process Re–Engineering & Management Journal, vol. 2

Fitzimmons J.A., Fitzimmons M.J.: 1998, *Service Management– Operations, strategy and information technology*, McGraw–Hill, Singapore

Gaiardelli P., Pinto R., Saccani N., 2004, *"The firm grows with the after–sales service"*, Logistica Management (in Italian),

Grant R.M.,1991, *Contemporary strategy Analysis. Concepts, Techniques, Applications* , Oxford, Blackwell

Haksever C., Render B., Bussel R.S., Murdick R.G., 2000, *Service Management and operations*, Prentice Hall, Upper Saddle River, New Jersey

Jason Dedrick and Kenneth L. Kraemer, 2002c, *"Dell Computer: organisation of a Global Production Network"*, Technical Report, Center for Research on Information Technology and Organisations (CRITO), University of California, Irvine

Jason Dedrick and Kenneth L. Kraemer, 2002b, *"Globalization of the Personal Computer Industry: Trends and Implications"*, Technical Report, Center for Research on Information Technology and Organisations (CRITO), University of California, Irvine

Jason Dedrick and Kenneth L. Kraemer, 2002a, *"The impact of Information Technology, The Internet and Electronic Commerce on Firm and Industry Structures: The personal Computer Industry"*, Technical Report, Center for Research on Information Technology and Organisations (CRITO), University of California, Irvine

July Johansson P., Olhager J., 2004, *"Industrial service profiling: matching service offerings and processes"*, International Journal of Production Economics, Volume 89, No 3, pp 309–320

Kellog D.L., Nie W., 1995, *"A framework for strategic service management"*, Journal of Operations Mangament, vol. 13, No. 4, pp. 323–337

Lele M. M., 1997, *"After–sales service – necessary evil or strategic opportunity?"*, Bedford, Managing Service Quality, Vol.7, No 3, 141–145

Mathe H., Shapiro R.D., 199, *Integrating service strategy in the manufacturing company*, Chapman and Hall, London.

McLaughlin C., Pannesi R., Kathuria N., 1991, *"The Different Operations Strategy Planning Process for Service Operations"*, International Journal of Operations & Production Management, Vol. 11, No. 3, pp. 63–76

Ng I.C.L., Wirtz J., Lee K.S., 1999, *"The strategic role of unused service capacity"*, International Journal of Service Industry Management, vol. 10, No. 2, pp. 211–238

Patelli L., Pelizzari A., Pistoni A., Saccani N., 2004, *"The After–Sales Service for Durable Consumer Goods. Methods for process analysis and empirical application to industrial cases"*, 13th International Working Seminar on Production Economics, Igls–Innsbruck (A), February 16th–20th

Perona M., Saccani N., Tucci M., 2004, "*Factors influencing after-sales service configuration for durable goods. A preliminary model and an empirical research*", 11th International Conference, Euroma 2004 International Conference Fontainebleau (FR), June 27th–29th

Thoben K.–D., Jagdev H., Eschenbaecher J., 2001, "*Extended Products: Evolving Traditional Product concepts*," Proceedings of the 7th International Conference on Concurrent Enterprising: Engineering the Knowledge Economy through Co–operation. Bremen Germany, 27–29th June, 429–439