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The Concurrent Role of Professional Training and Operations Management: Evidences from the After-Sales Services Information Systems Architecture in the Automotive Sector

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1. Introduction

The automotive industry is one of the most successful and dynamic environments playing a key role in the economic market. The actors involved in it assume different functions by which they collaborate and interact for the operations and processes of production and innovation. As a part of the product development process, the manufacturing and the after-sales services are indeed connected and inter-dependencies occur among them for product development, customer satisfaction and economic performance. The management of the operations among the manufacturing and after-sales services is one of the most important bases for the development and life cycle management of the products.

The operations and their management are established according to the purposes of collaboration and are updated continuously by creating and adding elements to improve them and to achieve continuous positive outcomes. Besides, the human capital involved in the operations also needs competences and skills improvement in order to be aligned with the operations and its management. Thus, in this chapter, we question the role of professional training that is leading to the development of the competences of the people involved in the operations and their management, and investigate on the concurrent role of both through the presentation of the information systems architecture connecting a large firm in the automotive industry with its after-sales services partners.

First, we present the literature concerning the professional training to define it and to show the major role it plays as competences enhancer and developer, and the operations management to show that it is the focus of engineering and development. Then, we present the information systems architecture subject of the study, but before that we present the conceptual framework and research methodology. After that, we explain the need for strategic changes in the information systems architecture of the after-sales services, some issues for the changes, and initial proofs of the concurrent role of professional training and

operations management. Then, we derive a matrix model showing the concurrent role of professional training and operations management, and finally as a conclusion we further model their concurrent role for after-sales optimization, and we propose some future directions for research.

2. Professional training as competences developer and enhancer

The professional training is related to the development of the learners' capacities, competences and skills in the industrial and business environments. Those are managers, technicians, experts in specific fields and need to enrich their capacities for the ongoing high economic performance of their organizations. The professional training is subject to strategic regulations, learning strategies and actions that make it an important developer of competences and capacities (Paton et al., 2005); the professional training is a function of its regulations, structures, learning processes and experts (Figure 1). The training regulations are focused on the contribution to the economic performance of the organizations, thus, there are regulations leading to the intellectual capital protection and to the investigation on the needs of the trainees for the provision of the right professional training and according to their functions and roles. Besides, the organizations providing professional training must have the adequate resources in terms of human capital –experts- and technological infrastructures for a fast and high developed provision of learning (Allan & Chisholm, 2008), and the learners must have good absorptive capacities to assimilate new knowledge and information to develop their competences (Cohen & Levinthal, 1990).
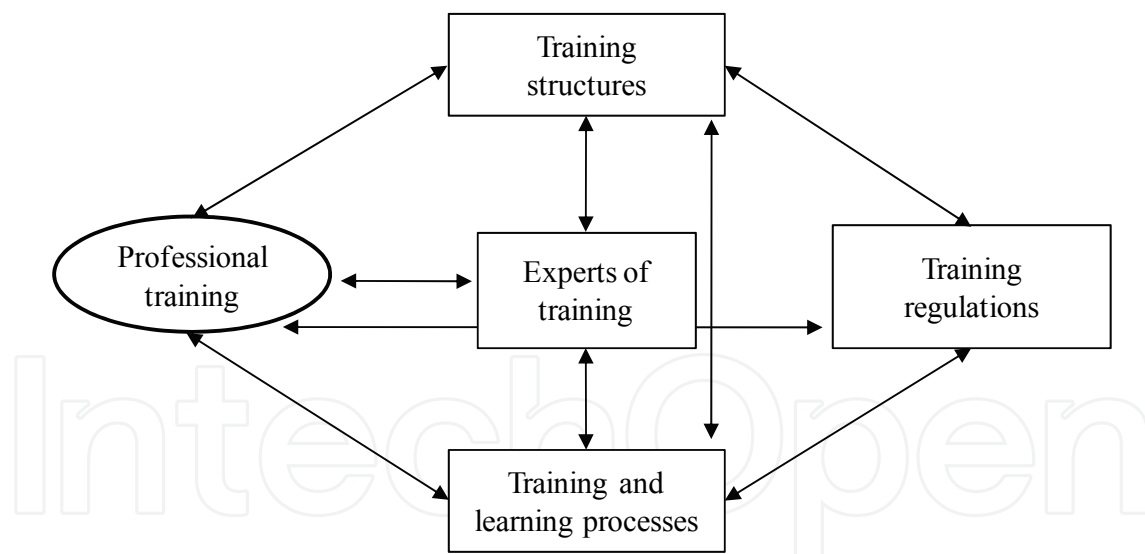

Fig. 1. The professional training success factors.

The professional training can be either internal to the firms through the creation of corporate universities that are entities in charge of fostering individual and organizational knowledge (Allen, 2002) and developing the individual competences and skills (Baets & van der Linden, 2003), and the creation of competences development projects and systems (Scalvenzi et al., 2008; Corallo et al., 2010c) leading to the optimization of the engineering skills and to the competences' development and enhancement of the managers at different levels in the business and industrial environments, or external to the firms through collaboration with higher education institutions, universities and competence centers for the participation of

the managers and technicians, as learners, in executive, technical and training programs dedicated to the development of new competences (Maglione & Passiante, 2009).

Besides, the factors leading to the need for a continuous professional training is the dynamism and complexity of the industrial and business environments. Firms must have dynamic capabilities to improve (Teece et al., 1997) the managerial, engineering and technological competences according to the changes in the economic markets in order to pace with the complexity of information and knowledge for high competitive advantage and economic performance. The changes follow specific procedures and processes in which the human capital is also subject to competences improvements and development accordingly (Lepak & Snell, 1999). There are organizational learning processes (Argyris & Schon, 1996; Nonaka & Takeuchi, 1995) for the effective human capital management and development (Bontis & Serenko, 2009) and the professional training is one of them consisting of specific types of systems and tools. Technology-enhanced learning is one of the most important methods of learning based on information and communication technologies by which people can learn and acquire knowledge in an optimal manner (Ambjörn et al., 2008).

3. Operations management as the focus of engineering

The processes of interactions and communications taking place among different actors for the work activities are directly related to the operations management which consists in ensuring the ongoing processes of production of products and services and using different resources as technological supports for the purpose of customer satisfaction and high economic performance (Slack et al., 2007). The operations management differs from one type of work activity to the other since there are various functions involved in the product development process and lifecycle. This makes it multi-faceted and heterogeneous, and increases the interest of scholars on the investigation on its systems' differences and similarities; There are for instance the ones dedicated to the design phase (Cisternino et al.,
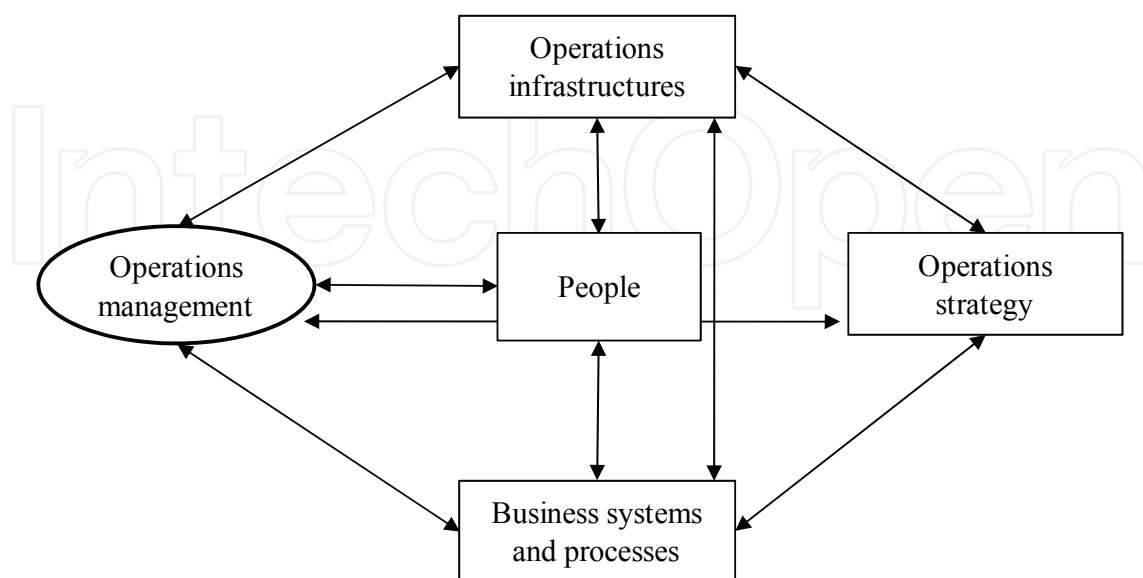

Fig. 2. The operations management success factors

2008, Corallo et al., 2009, Corallo et al., 2010a), to the manufacturing (Kundra et al., 1993), and the ones integrating different phases of the product development process (Corallo et al., 2010b; Taifi et al., 2012).

Various research organizations and centers study operations management and continuously provide standards of business operations, processes, and system engineering (Blanchard, 2004). Operations management is a function of its strategy, infrastructure, business processes and systems, and the people involved in it (Angell & Klassen, 1999) (Figure 2). Roadmaps and strategic guidelines are created (Adam & Swamidass, 1989) and used among professional, business and industrial networks developing or applying and collaborating through or for the operations management. For instance, as specific strategies, action research (Coughlan & Coghlan, 2002) and case research (Voss et al., 2002) provide diverse contributions to the systems and industrial engineering and by this participate to the development of the operations and their management. Also, the operations management uses the right technological infrastructures to achieve fast and optimal productions (Salvendy, 2001) as computer-aided tools for manufacturing or electronic data interchange systems or web and knowledge portals and applications, and the right organizational structures (Lucertini et al., 1995) connecting people involved in the operations and their management. For instance, there can be cross- functional groups or communities of practice (Taifi et al., 2011) dedicated to the operations and as mentioned above networks of research centers and universities for the development of the operations management.

4. Research into the concurrent role of professional training and operations management in the automotive industry

The purpose of this chapter is to investigate on the concurrent role of the professional training and operations management in dynamic environments –more precisely the automotive industry and to provide evidences about that. We focus on the interactions taking place among a large automotive company and its after-sales services partners –the dealers' network- to achieve our research goals. The idea behind the choice of this type of interactions is the strategic role the after-sales services plays for their proximity with the customers, their market positioning (Alexander et al., 2002), and the rich environment surrounding them in terms of systems, tools and technologies. Besides, the after sales services are seen as a relevant resource of revenue and economic performance (Saccani et al., 2007). In general, designing service systems requires a great knowledge about the specific details of each type of services to engineering them (Sakao & Shimomura, 2006), a services engineering strategy (Aurich et al., 2004) and a system strategy as well (Ramaswamy, 1996; Morelli, 2002).

Also, in the research on service operations management, there is a need for further focus on it through the creation of a research agenda and framework (Roth & Menor, 2009) and linking it to other areas as human resources management (Johnston, 1999). Thus, the investigation on the professional training and the services operations management in this context of after-sales services and their concurrent role is more than a strategic topic, leading to awareness about the importance of connecting these two subjects in the industrial and business environment, and in the fields of research on competences development and services operations management for the after-sales services optimization (Figure 3).
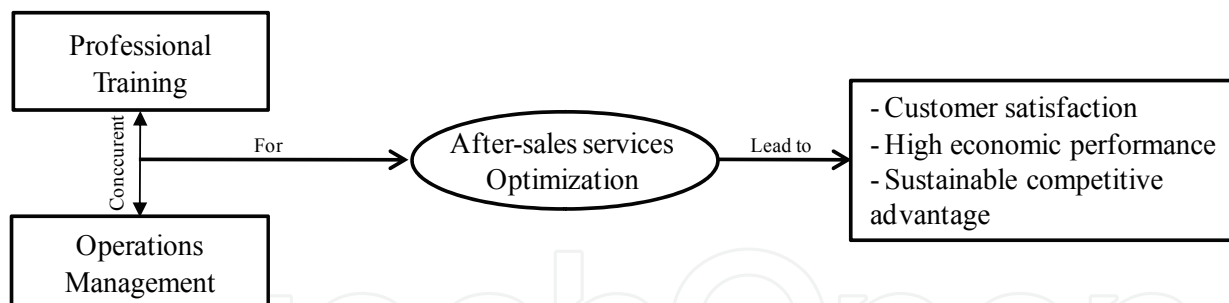
Fig. 3. Research into the concurrent role of the professional training and operations
management in the after-sales services.

As the focus of services operations management in this research, the after-sales services are
analyzed, explained in terms of operations and their management that is the operations
management for the after-sales services and the professional training dedicated to the after-
sales services is also detailed, presented and explained. It is possible to investigate on the
professional training dedicated to other functions and roles in the product development
process but the focus of the chapter is the after-sales services to present the link among
them; There will be some links presented in the operations management of the after-sales
services with the manufacturing since for the provision of some after-sales services there is
the need for the manufactured products' components but we precise that we are
investigating on the direct connections and not indirect connections of the operations
management and professional training for the after-sales services optimization and thus
customer satisfaction, high economic performance and sustainable competitive advantage.

Thus, in the automotive industry, in year 2007, we first interacted with the managers of a
large automotive industry for the acquisition of data through interviews concerning the
information systems architecture in which the professional training and operations
management is represented – the managers are key informants (Yin, 2003) and play a critical
role in the success of of the research. They are the head of the Professional Training
Department, the head of Quality–Technical Services Department, the manager responsible
of the Product Support Unit and the manager responsible of the Service Engineering Unit.
Second in order not to become dependent on a key informant, through a questionnaire,
dedicated to a significant sample from the population of the after-sales services –the dealers,
we investigated on their point of view concerning the professional training, the operations
and their management and all dedicated to the after-sales services. We adopted these types
of research methods and data collection methods so to have multiple sources of evidences
and allow their convergence (Yin, 2003; Creswell, 2003).

5. The information systems architecture among the large automotive firm and the after-sales services

The basis of communication among the large automotive company and its after-sales
services partners is a complex information systems architecture on which they share data
and information about the after-sales services and the automotive products for a wide range
of purposes that are knowledge codification, knowledge sharing, knowledge acquisition and
knowledge creation. The information systems architecture consists in systems, tools,
applications and web portals. These are mainly supported by information and
communication technologies (ICT) and also face to face means of communication so the
objective here is to see what these IT systems and tools are and how they are organized to

achieve the purposes of collaboration for the after-sales service and professional training, and to have a clear idea about the architecture. Thus, we present the types of ICTs used and the face to face mechanisms for the operations of after-sales services and for their management, and for the professional training, we present the areas, types of trainings provided, and the systems used.

Following are the types of systems and tools used for the after-sales services operations management (Table 1):

- The problem-diagnosis IT-tool: dedicated to the problem-diagnosis in the products' repair activities. This tool supports the technicians in their work; it provides a diagnosis about a problem occurring in the product and the technicians can consult the adequate problem-solving instructions in the e-manuals or the insights in the e-services news –IT-applications.
- The problem-solving IT system: dedicated to the products' problem-solving in the products' repair activities. An efficient procedure is followed in which the dealer communicates, through an IT-application- on the integrative IT-system knowledge portal of the firm-, the product's problem to the problem-solving IT system and this latter gives feedbacks to the dealer including repair packages consisting of the necessary equipment and special tools to be used.
- The e-manuals: are digital manuals comprising the instructions for the repair solutions. The dealers can consult and download them on the IT-systems through the homepage of the service portal of the firm in order to repair the products of the firm and by this provide the after-sales services. The e-manuals contain technical data, procedures descriptions and diagnosis tests instructions.
- The e-services news: as a digital regular newspaper, it provides news about new after-sales services mechanisms or new products' repair solutions, thus, spreading technical knowledge in the dealers' network.

ASS Operations Management	Definition
Problem-diagnosis tool	An IT-based tool supporting the technicians in the products' problem-diagnosis for the after-sales services.
Problem-solving system	An IT-based systems supporting the technicians in the products' problem-solving for the after-sales services.
E-Manuals	Digitals manuals that can be downloaded on the service portal of the firm to support the technicians in the after-sales services.
E-services news	Up-dated electronic informations that can be consulted on the service portal of the firm for the after-sales services.
Spare parts system	An IT-based system supporting the technicians in the ordering of the necessary spare parts for the after-sales services in the products.
Direct support	Technical support provided by the large automotive company to the technicians through personnel.

Table 1. The types of systems and tools for the ASS operations management

- The spare parts system: consists in the ordering of the spare parts for the after-sales services on the service portal of the large automotive company. Then, this latter delivers it to the after-sales services firms.
- Face-to-face support: consists in technical support provided to the dealers by the automotive firm for the investigation on repair solutions and in managerial support provided for the development of the after-sales services activities in general.

Concerning the professional training, which is the other critical element of collaboration among the large automotive company and the after-sales services partners, the technicians are the main focus. The professional training gathers the learners in a face to face manner through courses with instructors and trainers or IT-based manner through web-based courses and tutorials. Thus, the technicians -the learners- acquire new capacities through the acquisition of knowledge about new concepts and make practical experiments in laboratories before starting the after-sales services activities. The main IT-support used for professional training is the e-Learn system which is located on the service portal of the 'Training Academy' – The Professional Training Department of the large automotive firm and on which the technicians are subject to courses and online-learning. Besides, from the e-Learn system, the after-sales services partners can also download documents they can can read as either a support for the face-to face/online theoretical courses or for the practical experiments.

Professional training	Definition
Technical competences	Seminars, courses and practical experiments related to the development of the technical competences for the after-sales services.
Products' components	Seminars, courses and practical experiments related to the development of the technical competences regarding the products' components of the products.
Characteristics of the products' components of each brand	Seminars and courses related to the development of the technical competences regarding the characteristics of products components of each brand.

Table 2. The types of professional training for the after-sales services

The professional training is taking place when new or complex products and after-sales services are created by the firm. The professional training is technical and regarding the development of the competences of the technicians and the automotive products (Table 2). The automotive products area courses for the after-sales services are designed according to each brand of the large automotive company products and are adapted to the specific characteristics of each brands' products. These specific characteristics are on the products' systems, engines and transmission and technologies of the products. And, the technical competences area for the after-sales services consist in various types of courses as follows:

- Engines: which regard the development of the technical competences of the technicians on the engines of the products and also the development of their capacities for the provision of the after-sales services on these engines.

- Transmission: which regards the systems and components of the transmission in the products, as the gear box and transmission systems. Thus, there are courses for the development of the technical competences and the capacities for the after-sales services on this.
- Electronics: which are courses for the understanding of the electronic systems and components of the products as the airbag systems, the air-conditioning systems and info telematic systems and the development of the capacities for the after-sales services provision.
- Diagnosis: this regards the development of the technical competences of the technicians regarding the diagnosis tool features and operations for problem-solving and also the development of their capacities to use it for the provision of optimal after-sales services.
- Body: courses regarding the body of the product, thus for example the understanding of air and water leakage and also the methodologies for the provisions of the after-sales services to the body of the products.

Finally, after the courses, there is the 'Automotive Technician Accreditation' which are assessments for the accreditation of the technical competences of the technicians about the products and their after-sales services. The results of the assessments provide to the technicians the accreditation proving their competencies.

6. Strategic changes of the information systems architecture and issues

The professional training and the ASS systems and tools used are continuously the subject of evaluations and re-engineering to sustain competitive advantage, customer satisfaction and economic performance. For this purpose, the after-sales services organizations also provide their point of view and satisfaction level concerning them. In general, the key elements to investigate on for the satisfaction level is the perceived ease of use and usefulness of the systems and tools, the computer self-efficacy of the technicians and the usefulness and quality of the professional trainings (Taifi, 2008, a;b). These elements contribute to the continuous re-engineering and development of the information systems architecture of the after-sales services.

In 2007, the systems and tools used for the operations and management of the after-sales services were perceived as useful and easy to use by the dealers of the automotive company (Figure 4) (Taifi, 2008). As stated by a dealer: 'without the IT-tools and systems, we cannot provide the after-sales services to the customers'. However, the objective of the large automotive company is to achieve a complete satisfaction of the dealers about the systems and tools, thus for example, it is also integrating the IT and social interactions awareness of the dealers in dealing with the after-sales services. That is, the awareness of the dealers about the importance of the continuous integration of high-technological tools and systems in their work activities for the after-sales services and also their awareness about the importance of continuous interactions among different small and medium- sized after-sales services organizations ranging from direct to indirect connections in the network for collaborations and operations management, and knowledge sharing and creation about the after-sales services. For example, in 2007, the automotive company created a strategic community (illustrated in Figure 4) in which 50 expert after-sales services small and medium-sized organizations were invited to participate and share their expertise about the automotive products and after-sales services and by this to contribute to the new products and services development and their processes (Taifi, 2007; Taifi and Passiante, 2010; 2011) in an incremental or radical manner (Figure 5).
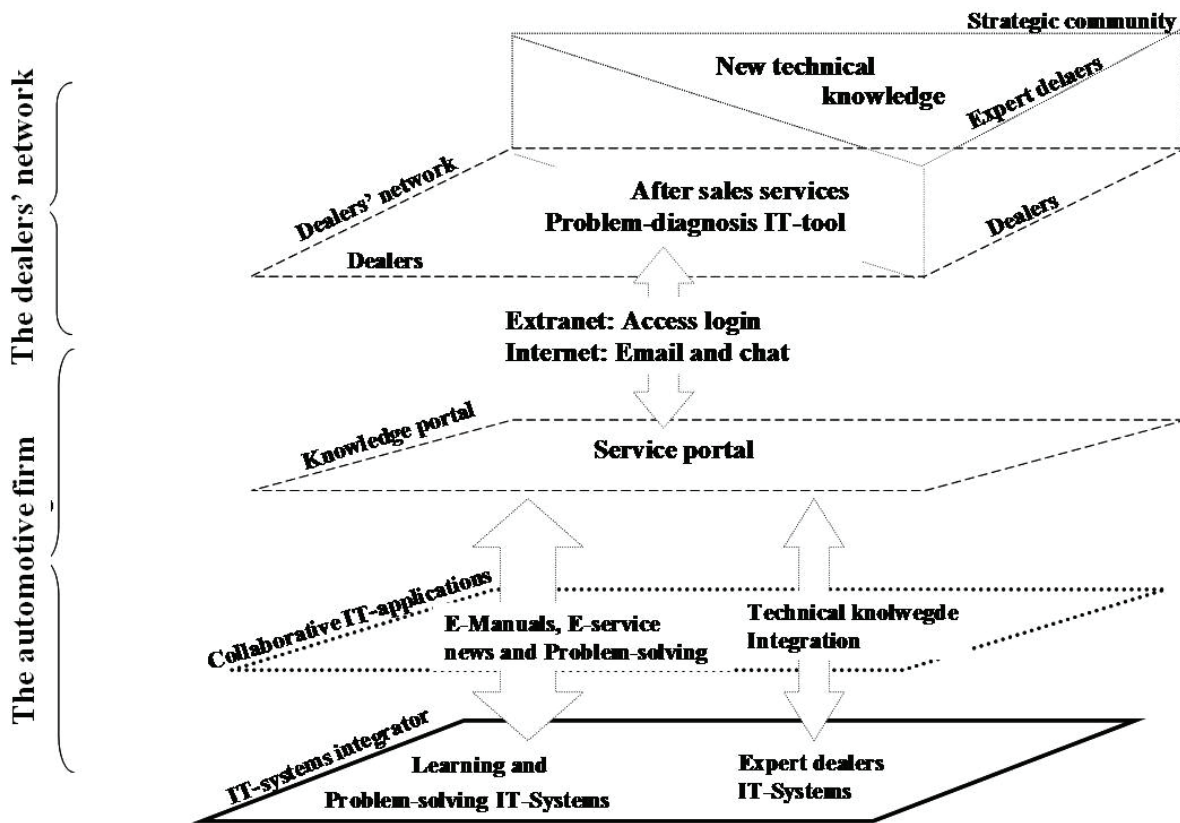
Fig. 4. The information system architecture of the professional training and the after-sales
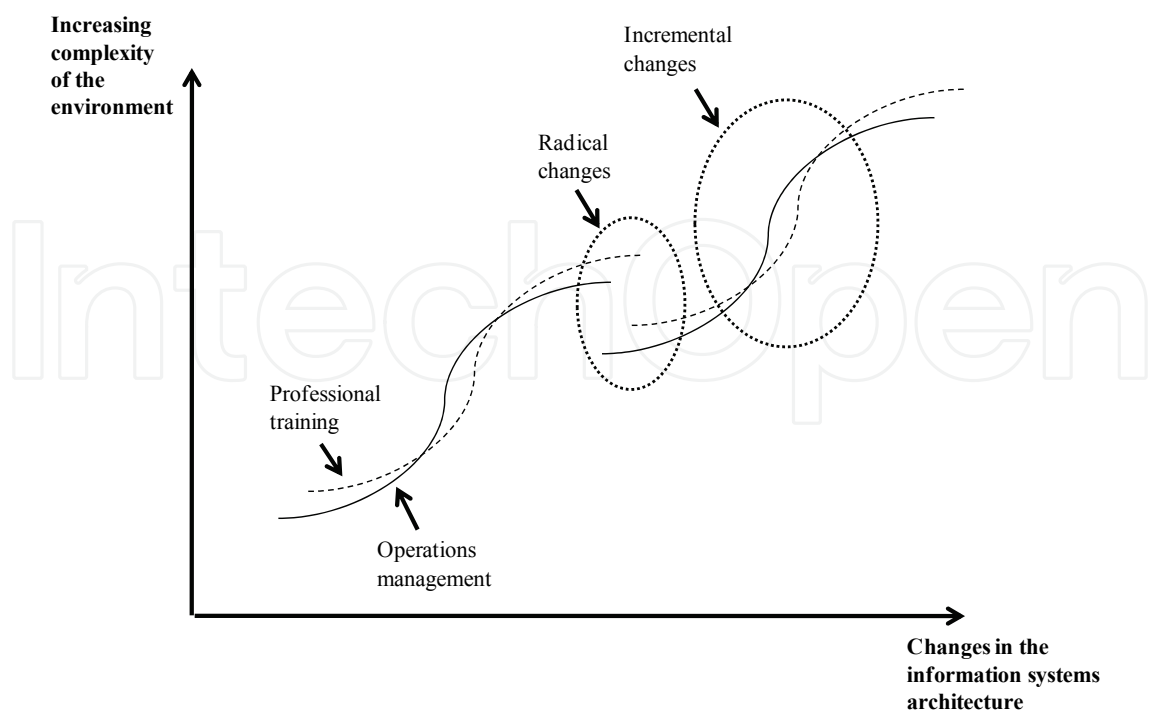services operations management.

Fig. 5. The environmental complexity and the architecture changes

Also, in 2007, concerning the professional trainings (Figure 4) (Taifi, 2008), their efficiency and quality were considered as satisfying and the expertise of the trainers as well. As stated by a dealer: 'When I go to the professional trainings, I learn many new issues I did not know before'. However, the large automotive company keeps restructuring and reorganizing the content, processes of the trainings including the IT-based ones in an incremental or radical manner (Figure 5) and improves even the skills of the trainers according to the incremental or radical changes in the products and after-sales services activities. Here the development of the capacities of the trainers is also one of the most important factors of success of the professional training and for that, the large automotive firm continuously works on understanding and filling the gaps of the trainers' skills to keep an efficient professional training provision.

The professional training and operations management for the after-sales services are thus subject to changes that are either incremental or radical according to the after-sales services themselves in order to pace with the increasing complexity of the environment (Figure 5). These incremental or radical changes also show the concurrent role that the professional training and the operations management plays. Whenever there are incremental changes in the products or after-sales services, there are incremental changes in the operations management and in the professional training, and when there are radical changes in the products or after-sales services, there are radical changes in the professional training and in the operations management (Figure 6). Besides, each radical change lead to the start of new incremental changes in the professional training and operations management and as the complexity of the environment increases as there are more complex products and services and thus more complex incremental and radical changes in the professional training and operations management (Figure 6).
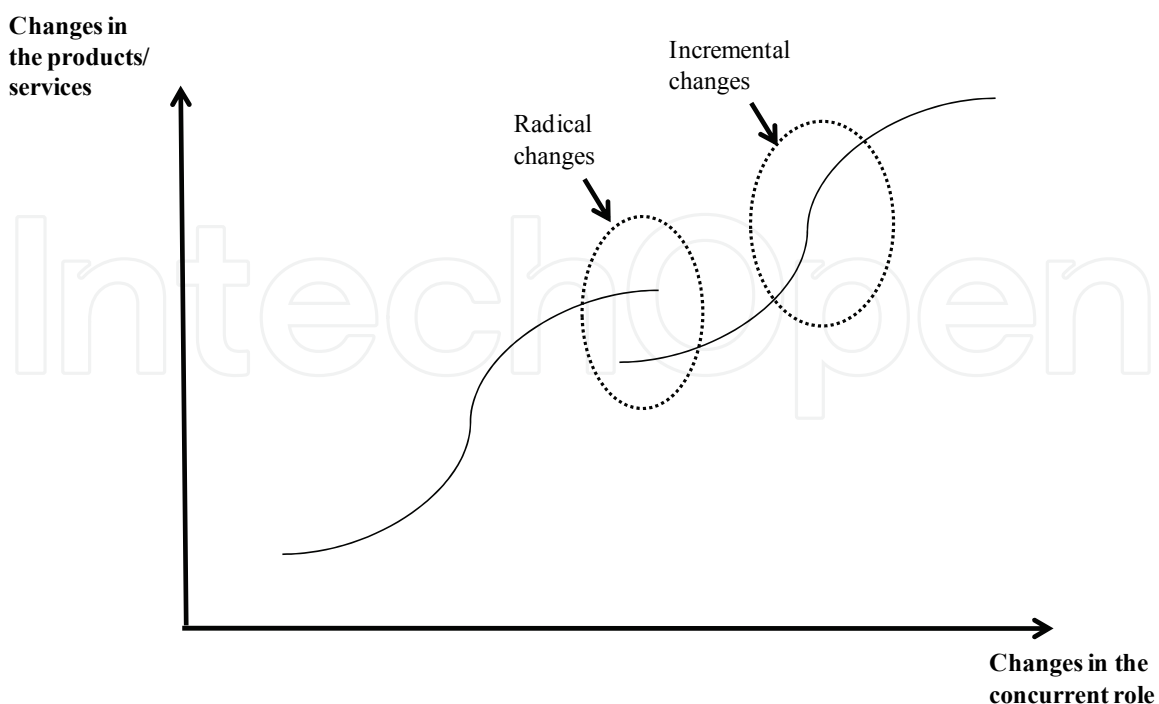

Fig. 6. The types of changes in the concurrent role

7. The concurrent role of professional training and operations management for after-sales services optimization

The processes of interactions taking place among the large automotive firm and the after-sales services organizations are leading to the achievement of the purposes of collaboration. The systems and tools used for the after-sales services and the professional trainings courses regarding the competences of the technicians for the after-sales services and the automotive products are directly connected. As long as there are after-sales services, there are the professional trainings and as long as there is a need for the development of the after-sales services partners competences and capacities, the professional training plays a major role. That is, the more the technological capacities and competences needed to provide the after-sales services, the more likely the professional training will be complex and the less the technological capacities and competences needed to provide the after sales services, the less likely the professional training will be complex. We develop on when and whether the professional training should be complex or simple according to the after-sales services operations management complexity. This shows the concurrent role of professional training and operations management (Figure 7).

		I	II
Professional Training	Complex	- Practical experiments for building competences on products' components - Seminars on the characteristics of the products' components of each brand	- Seminars on technical competences development and on the products' components for the use of the problem-solving tool and system
		IV	III
	Simple	- Seminars on products components and technical competences development - Web-based courses on the problem-solving tool and system	- Seminars on technical competences development and practical experiments on the products' components - Courses and seminars for technical competences development for understanding the e-Manuals and e-Service news
		Simple	Complex
		Operations Management	

Fig. 7. What types of concurrent roles are there among the professional training and the operations management

In order to provide successful professional training to the needed after-sales services, leading to customer satisfaction and high economic performance, there is a need for a complete focus on the technical competences of the technicians and the types of systems and tools used for the after-sales services and the products' components. The more complex the operations management of the after-sales services are, the more complex is the method used for the professional training. Figure 7 shows the simultaneous, concurrent and tight links between operations management and professional training through the methods of professional training used for the operations management.

If the operations management of the after-sales services is simple, the professional training for it ranges from simple to complex contents accordingly. First, in Figure 7, through the development of new products and after-sales services, there is a need for seminars in the different areas whether the technical competences development or the automotive products' components. That is, for example, as soon as there is a new product launched in the market, the technicians are subject to trainings in order to provide the adequate after-sales services or as soon as there is the launch of a new service and its system, the professional training is involved again for the development of the capacities of the technicians on it. When the operations management for the after-sales services is simple, the professional training is simple; Web-based courses and classes are preferred for the diagnosis IT-tool and problem-solving system since they are IT-based and the technicians have the technological capacities to follow the IT-based professional trainings.

Second, when the operations management is simple, the professional training can also be complex and there are two kinds of trainings showing that (cell I of figure 7). That is, for example there can be practical experiments for building competences on product's components in which the technicians can learn practically on products' components. The practical experiments are complex and require major efforts and concentration from both sides since the trainers have to continuously, during the practical experiments, follow the technicians and these latter have to base the practical experiments on the technical knowledge acquired during the seminars. This type of concurrent role of professional training and operations management can be mostly successful if continuously applied as above since both sides are using their knowledge and technical capabilities for the after-sales services. The ones on the characteristics of the products' components of each brand are also complex since they are consisting of more specific and detailed information and knowledge and are related to each product brand. This makes them more complex in comparison to other seminars since they require more precisions and more explanations and preparations for the characteristics are different from one product to the other. These seminars are complementary, necessary and strategic since the technicians in this case have all required knowledge about the products' components and through the seminars acquire new knowledge about the specific characteristics.

In cell II of Figure 7, both the professional training and operations management are complex. Their concurrent role is complex since the links among them are generic and in relation with all the other types of professional training and operations management. For example, the diagnosis IT-tool and problem-solving system are also related to the courses in which the technical competences of the technicians are developed about the products' components. The technicians base their use of the diagnosis IT-tool and problem-solving system on the technical knowledge acquired during the professional training about these tools and systems and about the products' components. The complexity of the concurrent role of professional training and operations management here is that first the technicians are subject to professional training related to products' components and technical competences development. Second, they follow seminars for the optimal use of the IT-based system and tool for the after-sales services. Finally, the integration of the technical competences acquired and the knowledge about the use of the IT-system and tool lead to the building of new capacities and make this cell the most complex type of the concurrent role of the professional training and operations management for the after-sales services.

There is another example about the concurrent role of professional training and operations management for the after-sales services (Cell III of Figure 7) concerning the e-manuals and e-service news used as means and tools for the diffusion of the necessary updated data and information for the after-sales services. These are included in the operations management and are technical support contributing to solving the problems in cars. They are also a support for the professional training or vice versa that is the technicians, in order to understand them, have to follow the courses and practical experiments for the after-sales services and can use them not only for the after-sales services but also as a support for the professional training course. Thus, from here, we can also see the complex concurrent role of the operations management and the professional training.

8. Conclusion and future directions

The goal of this chapter was to explore what the concurrent role of professional training and operations management is. More precisely, to demonstrate it through the presentation of the information system architecture dedicated to the after-sales services. The idea was to connect the professional training and operations management in the automotive industry by presenting the case of this life-long sustainable collaboration among the large automotive company and the after-sales services firms, and their efforts to keep competitive advantage and customer satisfaction within the dynamic and complex environment that this is.

The concurrent role of professional training and operations management have been demonstrated through the presentation of the professional training and operations management separately, the illustration of the information systems architecture that provide an overall more elaborated and clear schema and the derivation of the types of strategic changes in it, and the study of the connections among professional training and operations management through the analysis of the complexity of the different types of links (Figure 8).

Architecture
(Information systems)

Model
(Professional training and
Operations management
types of links)

Definitions
(Professional training and
Operations management)

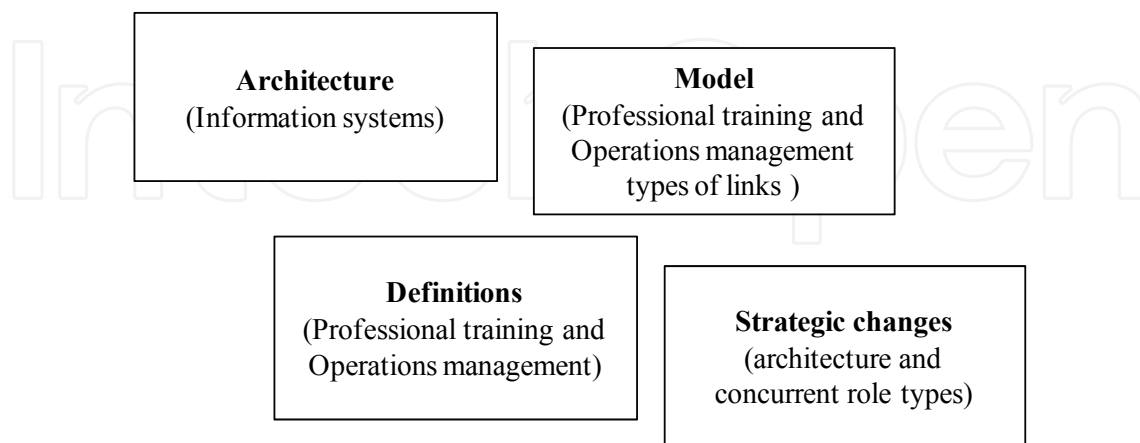**Strategic changes**
(architecture and
concurrent role types)

Fig. 8. Research devise and blocks

Most of the time, information system architectures are not only internal to firms but also inter-organizational and this chapter is providing the information systems architecture among two major players in the product and new product development processes and more precisely in the automotive industry that is a complex and dynamic industry. The information system architecture and the main subject of the chapter that is the concurrent role of the professional training and operations management provide IT-based commands and a new theory contributing to the inter-organizational processes of collaboration, the information systems fields of study, the product development and value chain processes of collaboration.

Besides, the four types of concurrent role of professional training and operations management provided in this chapter shows that the link among them can go from simple to complex and give birth to different types of trainings adapted to the operations management of the after-sales services. The simultaneous role of the professional training and operations management is demonstrated through these types of relationships ranging from simple to complex and do show that these have an intertwined role playing a strategic role for customer satisfaction, high economic performance of both the firm and the after-sales services and thus competitive advantage to them. The model contributes to the integration of different fields of research that are competences management, human resources management, and services operations-more precisely the after-sales services.

Moreover, the strategic changes in the concurrent role of professional training and operations management are directly linked to the fields of research on the business processes re-engineering fields, innovation management and reforming the competences development management since the changes in the concurrent role are depending on the changes in the products and services and on the complexity of the environment firms to be continuously innovative thus create new knowledge for that.

Finally, the after-sales services optimization, that is the main purpose of the concurrent role of professional training and operations management, is leading to the customer satisfaction, high economic performance and contributing to the sustainability of competitive advantage (Figure 9). For that, the concurrent role of the professional training and operations management rely on four main success factors that are the people involved in both the professional training and operations management, the strategy followed to design both of them, the processes and systems used that are mainly high-technological based and the structures created for the organization of the professional training, the operations and their management. These four success factors are strategic and contribute to all the areas in the disciplines of professional training and operations management research.

The concurrent role of professional training and operations management is not limited to the relationships between manufacturing and after-sales services firm, thus this subject can be extended to the relationships among suppliers of products' components, designers and manufacturing firms. Also, the book chapter subject can be investigated in other complex industries for the comparison of the strategies, processes and systems and the structures created or other elements constituting the concurrent role of professional training and operations management. It will be interesting to make research on the information and communication technologies used in other industries on the subject or on the relationships showing the concurrent role among different actors in other industries.
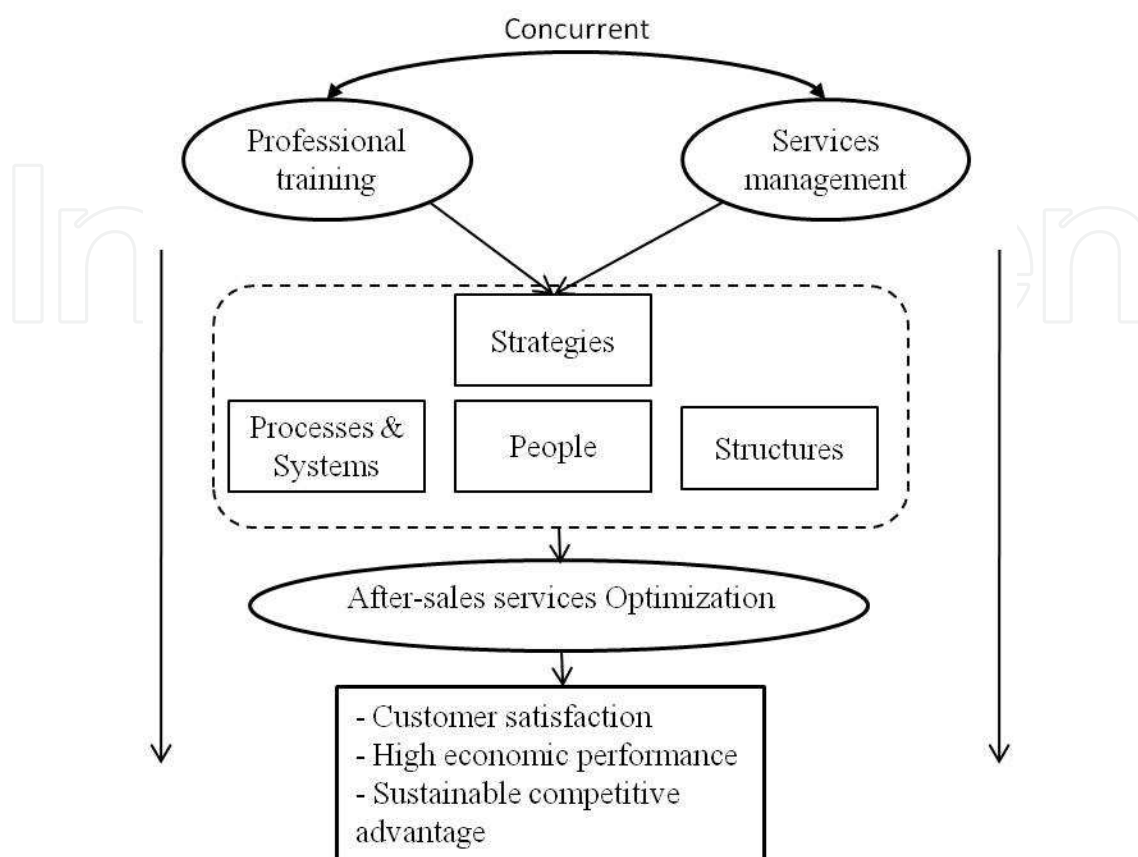
Fig. 9. The concurrent role success factors leading to after-sales services optimization

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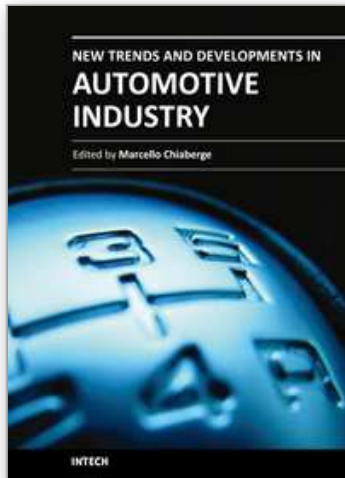
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