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Overview on the Technological Development and Particularities of Industry Services Development

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Abstract
The role of technological development in sustaining the competitive advantage, as also the effect of the technical progress in developing the demand of services for undertakings manufacturing products are underlined in the concepts of technological development and industry services development. Technological development assumes reducing production costs, differentiating the services and increasing the quality and it influences the provider's pricing policy. It is shown that a technological change will not automatically lead to a competitive advantage unless it meets opportunity conditions in relation with sustaining the competitive advantage.
Other matters refers to the development of commercial services due to the expansion of modern technologies on operation automation, the computer treatment of the data and communications development, such as: the development of the provider's communications with the customers, the introduction of individualized marketing, increasing the number of served customers, increasing the quality of delivered products, improving the efficiency of the contact personnel and others.

Keywords: competitive advantage, differentiation, technology, technical progress, benchmarking research.

JEL classification: O330.

1. Introduction

In the developed economies, the third sector of services presents the most accelerated development and represents the context in which a new branch of economy is defined – service economy.
The differentiation of services and costs represent important factors of the competitive advantage. The reduction of costs on the value chain allows to set out an attractive price, and the differentiation allows a good adequacy of the service in relation to the customer's expectations. (Porter, 2001)
The technology is involved in these two factors, the technological developments being able to lead to the reduction (rationalization) of costs and to the diversification of products and services starting with the express and implied expectations of the customers.

2. Overview on technology and the competitive advantage

Technology influences the competitive advantage if it holds a significant role in determining the relative position of cost or bidder's differentiation. In order to have an effect upon costs, the technology will have to influence the cost components within the value chain or to provide uniqueness to certain activities in such chain. On the other hand, technology influences the competitive advantage by over-ranked factors, such as: scale economy and new interdependence relations with synergist effects. These factors will influence, on their turn, on other ways, the cost and uniqueness. (Kotler, 1998)
Because the technology of an organisation is often placed in a relation of interdependence with the technology of a company's buyers, the technological change made by the buyer may influence the competitive advantage as well as the technological change produced inside the organisation. (Cojocaru, Cheikh, 2007)

3. The main conditions of opportunity of a technological change

The technological change initiated by an organisation providing services will lead to a sustainable competitive advantage under the following main conditions:

- the technological change by itself will reduce the cost or amplify the differentiation, and the company's competitive advantage will be sustainable;
- the technological change moves the driving forces of cost or uniqueness in the favour of the organisation;
- obtaining "first innovator" advantages asides the ones inherent to the introduced technology;
- the technological change improves the overall structure of the branch;
- the technological change will have to be protected, as possible, from imitation.

The technological changes not confirming such conditions will not lead to an improvement in the organisation's competitive position, even if it might represent a remarkable technological achievement. (Cojocaru, Cheikh, 2007)

4. Particularities on the technical progress and industry services

One of the trends leading to the emergence of services consists in the technological development of production, in increasing the automation in parallel with diversifying the sorts of products. Such a trend is sustained by: (a) the new possibilities to automate the production, based on the emergence of programmable machines with digital command and (b) the miniaturization trend.

The second trend (b) is represented by the progress of communication technology accompanied by the progress in miniaturizing the systems of transducers (sensors) and command elements. These progresses also lead to some new possibilities of mechanization and automation of some support activities, other than the ones of transforming the so-called raw material and end products, activities such as handling, inter-phase storage and logistics (transfer and positioning transport). (Sundbo, 2006)

At least two main causes leading to the emergence and automation of service activities in industry are identified, if we only refer to the effective structures, the manufacturing one, i.e.: increasing the structural complexity of the manufacturing installations, accompanied by increasing the output of such installations; increasing the requirements of assortment flexibility of the output, due to increasing the product demand (production volume) simultaneously with increasing the product diversification (the number of sort-dimensions of the products). (Ozawa, 2010)

5. Simple technology, advanced technology and the emergence of certain support services

The way that various types of services accompanying the manufacturing (production) are generated when it it based on advanced technologies can be explained by comparing two production scenarios, one based on a simple (basic) technology and the other based on advanced technologies. Such scenarios allow us to highlight the activities required by production, work division, leaving from the necessary knowledge to render the activity, as also the necessary knowledge to execute partial activities. The scenario of simple (basic) production is shown in figure 1, and figure 2 shows the scenario of advanced production.

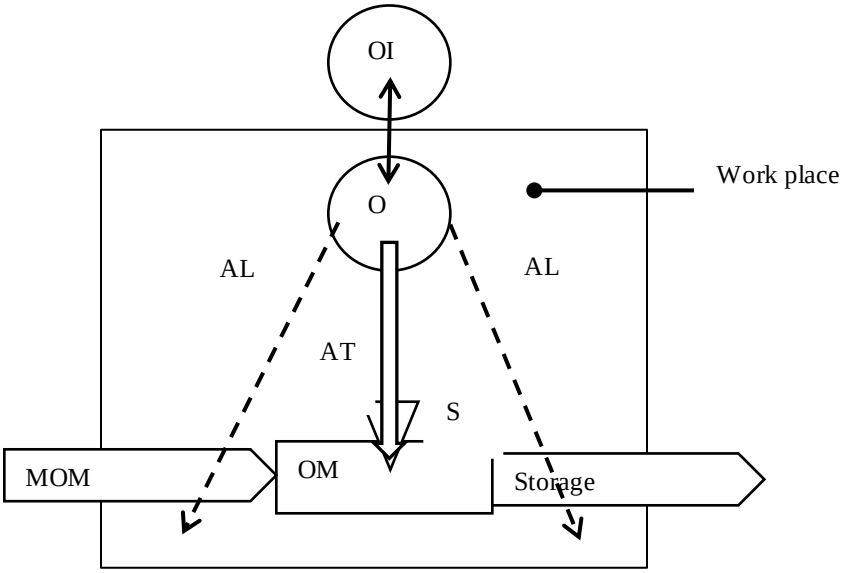

Figure . Operator's activities in the manual production scenario
Source: Cojocaru and Cheikh, 2007, p. 54
Legend: OI - hierarchic operator; O - execution operator; OM - work subject; S - tool; AL - logistic activities; AT - transformation activities; MOM - the assembly of work subjects.

a) The operator's activities in case of simple production
In this scenario, the operator (O) renders the following main activities: it receives the assignment and the necessary information to fulfil it as a drawing or model; it identifies the work subject (PL); it positions the material for first operation; it chooses the tool and prepares it for work; it achieves the first operation as a live drive (it uses its own power to change the shape); it checks (assesses, measures) the performance of the first operation; it changes the position of the work subject for the second operation; it handles fixing devices (as applicable); it renders the second operation; it continues to render the operations and the measurements; it fulfils the last operation; it measures the end result; it removes the processed work subject from the post; it removes the waste; it puts the used tools in the related location; it reports that the assignment is done.
The operator is capable of rendering the full range of basic operations based on its qualification and experience. None of the operations it performs is usually exceeding its level of knowledge (engineering competence). In some cases, it can refer to the hierarchic superior to obtain additional information.
b) Necessary activities to achieve production in the advanced-technology scenario
In this scenario, there is an advanced technological installation between the operators and the work subject, with a high level of automation and increased technological flexibility. Usually, such an installation contains:

- A man-machine communication model set out as a control panel which allows: to programme the installation for various assignments; to find the condition of certain parameters; to troubleshoot some malfunction conditions; to show the malfunctioning causes; to obtain reports on the fulfilment of the assignment.
- An automatic command module for reconfiguring the machine. This module, by leaving from the information about the job, selects and connects the modules of the installation to be involved in the assignment.
- A command module for the work processes per each module. This module controls the

movement of the tools and their working speed.

- A module ensuring the control of the transforming accuracy.
- A module rendering intra-process logistic operations, such as positioning the work subject in posts, handling the work subject between posts, disposing the waste from each post.
- A module in charge with tool logistics. This module allows to extract the tools from the tool storage, to change the tools in the working modules.
- A power module to supply utilities to all the work modules. This module ensures the distribution of electricity, air and hydraulic power to all the work modules from the installation.

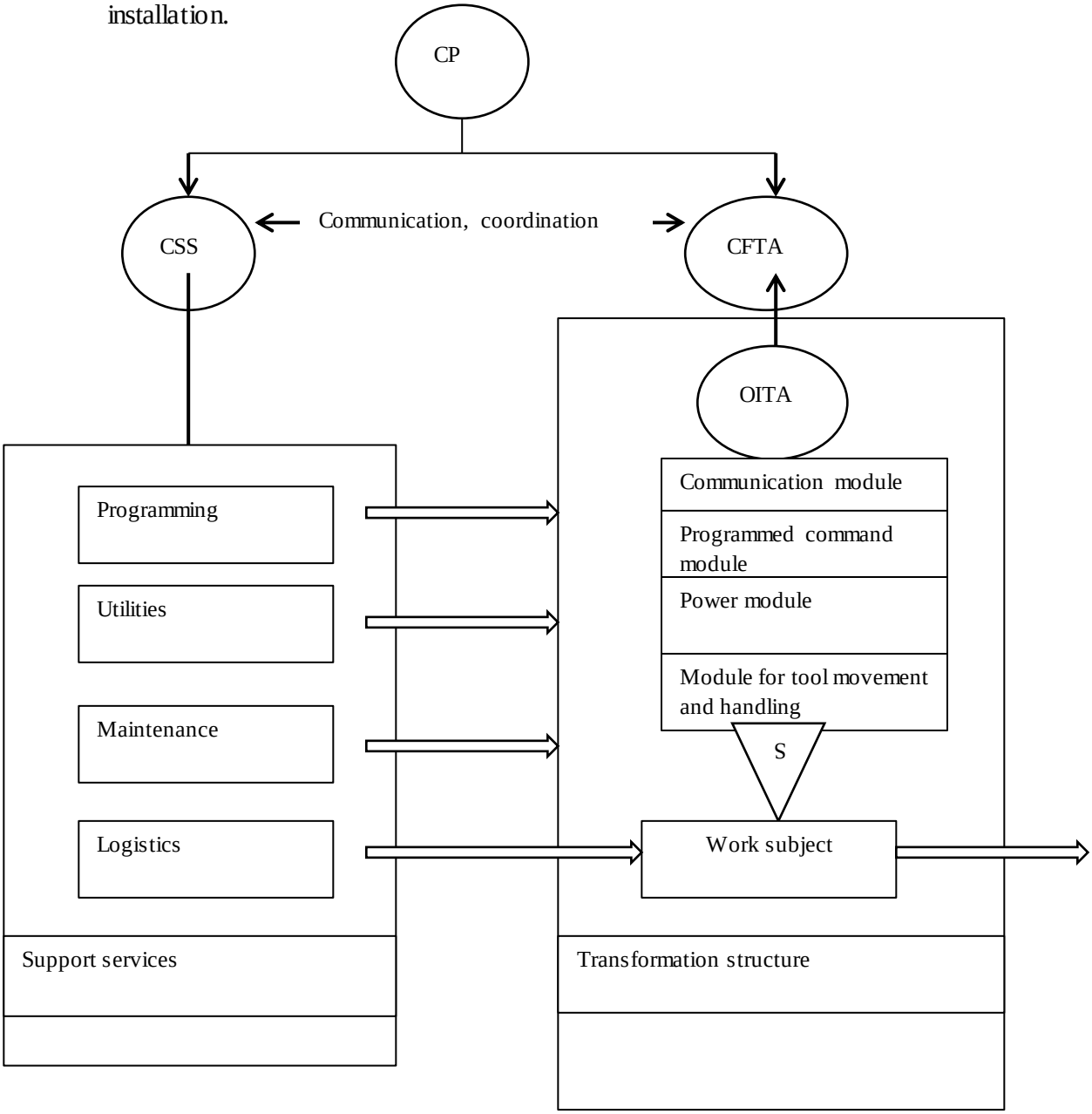

Figure 2. The emergence of support services in the manufacturing scenario with advanced technology
Source: Cojocaru and Cheikh, 2007, p. 57
Legend: CP - production management; CSS = support services coordinator; CFTA - coordinator of advanced-technology manufacturing; OITA - operator of advanced-technology plant; MLA - automated working machine; S - tool.

b1) Scenario's features

- The necessary information to process the work subjects is drafted outside the plant and is not related with the operator handling the plant. It is developed on specialised components of the organisation (research-development units) and are transformed in digital command programmes of the plant (engineering software).
- The necessary energy to fulfil the assignment is obtained from outside the job, it being ensured by special components of the organisation.
- The supply with work subjects is made from outside the work place by a special logistic structure existing in organisations.
- The plant maintenance is provided by special units of the organisation's structure from outside the work place.

b2) The tasks of the advanced-technology plant operator (OITA)

Unlike the case of the operator from the simple production scenario, in this scenario the operator may not have all the necessary knowledge to ensure the operation and availability of the plant it operates.

The scenario allows a clear presence of dichotomy between the execution operations undertaken by the operator and the plant and the support operations making possible the execution without participating directly in the transformation of the work subject. The support activities are "services" for the basic activity (execution). The model shows the inter-conditioning between the execution and the support activities. (Lall, 1992)

The high capacity, in qualitative and quantitative terms, of a technologically-advanced plant, can only be valued provided that the delivery of the support services meets a series of requirements, such as the ones related to quality and promptness. The deficiencies of the support services lead to reducing the availability of the technological plant, with serious economic effects, considering the important costs of such a plant. (Maxwell, 2006)

c) The expansion of the functions and content of the services for special manufacturing firms

The previous analysis was centred on the way that the support services are generated within the manufacturing structure (execution). This analysis allows us to highlight only a part of the necessary services for an organisation under the modern economy. A widened systematization of the services, currently adopted in an undertaking, is shown in table 1.

It. no.	Production stage	Services used
1	Before production	• research-development • grounding and financing investments • personnel recruitment and selection • training and improvement • supply
2	During production	• financing • resource management • quality control • occupational security • plant maintenance
3	Selling the production	• studying the purchase behaviour • advertising and promotion • business strategies • logistics • distribution channels

It. no.	Production stage	Services used
4	When using the products	• installation • beneficiary's training • advice • leasing • maintenance (servicing)
5	After using the products	• measuring the satisfaction • recycling, waste management

Table 1. Services used by undertakings
Source: Cojocaru and Cheikh, 2007, p. 59

At the organisation's level, from total of production costs, the service costs may represent 70-80%, them becoming dominant costs. The increase of the importance of services in undertakings is also proven by the increase in share of service occupations in the structure of employments, irrespective if the organisation operates in the primary, secondary or tertiary sector.

6. New services due to the expansion of modern technologies

The new technologies were used on a large scale in traditional production activities: they represented the essence of industrialization and of the increase in output, due to automation and standardization. (Ioncica, 2008)
Furthermore, they sustained the new missions of production: product quality, fastness in delivery and the flexibility - by adapting to the increasing customization of the offer and by aligning to the diversity of customer demands. In the context of the current economy's evolution, the automation, robotics, the computer treatment of the data can be used in any production activity, both in the industrial and service sector. (Nollet, Haywood-Farmer, 1992)
The main advantages that the new technologies can provide, contributing to improving the results in the service sector, refer to:

- the possibility to focus the organisation's communications with the customers and to practice an individualised marketing;
- the increase of the number of served customers;
- the increase of service quality;
- improvement of the efficacy of the contact personnel;
- increasing the efficacy of the performing personnel (distribution) and co-production (cooperation) with the customer. (Plumb, Ionescu, 2008)

7. Benchmarking research on the features of the manufacturing and service delivery activities

7.1. The bases of the benchmarking analysis between the manufacturing and the service delivery activity

The management of manufacturing activities on tangible products has a solid theoretical base built in time and it has proven its utility. In this context, models were developed to structure the production organisations for the management functions and roles and the assembly of related activities (processes) and operations were identified and characterized.
A benchmark analysis on the manufacturing activity and on the service delivery activity is a way to know, understand and characterize the service delivery activity, if it goes from a series of parameters frequently used to characterize the manufacturing activity.
The research was designed by benchmarking analysis, using 12 typical parameters to define

the organisations of two groups: the group of organisations specialising in manufacturing tangible products and the group of service provider organisations.

7.2. Setting out and selecting the comparison criteria

For the group of service provider organisations, there have been selected organisations for maintenance services, which usually render the service and the beneficiary's place. Such organisations may belong either to the equipment supplier or can be established as independent organisations specialising in industrial services. As far as the parameters used as comparison criteria are concerned, the 12 parameters were selected from a list with 22 basic parameters:

a) the importance factor granted by the organisations' management;
b) the opinions of some researchers;
c) the special literature.

The method. For each parameter, the specific content related to the manufacturing and to the service delivery situation was identified.

The differentiation between the manufacture and the maintenance service delivery activity appears as a specific content for each featuring parameter.

The parameters. For benchmarking, the following 12 parameters were used: (1) structural organisation; (2) general planning of the activity; (3) scheduling the operations; (4) assignment performance duration; (5) duration of the operations within the assignment'; (6) time ranges per operations and working plans; (7) operative surveillance and control; (8) job nature; (9) assessment of individual and group performances; (10) professional development opportunities; (11) participation; (12) retribution.

7.3. The results of the benchmarking research

Table 2 shows the results of the comparative characterization of the activity in an organisation manufacturing products and an organisation providing maintenance services, usually, at the beneficiary's place.

Item No.	Parameter	Product manufacture	Service delivery
1	Structural organisation	• It depends on the series character of the production; • structure under pyramid form	• It depends on the organisation's specialisation on products or groups of similar products; • Structure of "reverse pyramid": - the personnel in contact with the beneficiary represents the first structural level; - all the other functional groups and the management use such personnel
2	The general planning of the activity	• It takes place based on contracts and based on statistics	• It is made based on "service" agreements and statistically based on the analysis of time series corrected with forecast items
3	Scheduling the operations	• Analytical and rigorous, based on technically-grounded regulations	• Analytical and relatively rigorous for deliveries as "servicing" • As a guidance based on the similarity and statistical data for random orders during the annual exercise
4	Assignment performance duration	• It depends on the product complexity and size of the order • Large and very large, for complex products achieved based on order; • medium and small for products made on stock	• It depends on the complexity of the plant to be repair and the failure level; • small and very small for "service" operations • medium and small for repair operations

Item No.	Parameter	Product manufacture	Service delivery
5	The duration of the operation within the assignment	• It depends on the technical level of the working installations and the operator's qualification; • usually small and very small for plants with high level of automation and small or medium for operations made by hand by special personnel	• It particularly depends on the provider's qualification, the material preparation of the repair assignment and the endowment with mechanized work means; • Small, medium
6	Time ranges per operations and working plans	• Determined analytically, in detail and rigorously	• Globally determined, on analytical and statistical bases for repair assignments
7	Surveillance and operative control	• The final conformity control is made by special personnel	• The final control is made by beneficiary, who confirms that the assignment is fulfilled
8	Job nature	• The work of execution under regulated conditions • monotonous, relatively poor in content	• diversified, each intervention having own specifics, requiring adaptive reasoning • the contact with the beneficiary's representative is seen as a possibility to socialize
9	Assessment of individual and group performances	• The performances can be rigorously measures in quantitative and qualitative terms • The progress in achieving the production and quality plans expresses the performance; • Disciplinary evaluation indicators	• Parameters such as: the satisfaction perceived by the beneficiary regarding the quality of the repair and the provider's behaviour; compliance with the time range allocated to the assignment; complying with the costs planned for the assignment; the number of complaints or observations made by the beneficiary; the quality of planning and preparing the assignment
10	Professional development opportunities	• Largely depend on the organisation's policy against the human resource • it requires an organised and planned system for performance development; • usually, the opportunities are low, them occurring when important changes take place in the organisation'; • in some cases, the professional development targets the flexibility of the work force by multiple qualifications	• opportunities of professional development due to the diversity of assignments and to team work; • multiple qualification constitutes an objective of professional development; • the teams see the importance of a good preparation of the assignment and of a good intra-group communication; • the organisation should be concerned with training and improving the personnel in knowing the structure and operation of the plants to be repaired, as also for team work and the behaviour against the beneficiary; • good or medium professional development opportunities
11	Participation	• It depends on the organisation's management style and the opportunities created to stimulate the proposals; • under manufacturing conditions, the execution operators have a relatively limited vision on the other activities • the supervisors and unit managers have a wider vision and if they are motivated,	• the performance of different repair assignments by the same team allows to see some improvement possibilities in the activity by experience transfer, from one case to the other; • after each mission, it is required a mission to highlight the various issues able to improve the performances; • the organisation should stimulate the procurement of improvement proposals and after their analysis, it should be transformed in working procedures • medium and/ or high participation for activity improvement

Item No.	Parameter	Product manufacture	Service delivery
		they can make important proposals • generally low or medium participation	
12	Retribution	• The retribution is made based on results, under the form of individual or global agreement; • For support services, retribution can be made centrally, corrected with the way that the tasks are met or related with the results of the service units	• The team's retribution can be made: - based on the number of assignments and their complexity; - with a percentage from collections; - in accordance with the number of rendered hours and considering the fulfilment of the quality requirements and the costs; - centrally, based on the rate retribution adjusted in addition or by reduction in relation with the individual's contribution brought to the team results

Table 2. The results of the benchmarking research upon the activity of product manufacture and the activity of maintenance services
Source: Author

7.4. Research conclusions

The main conclusions of the research are as follows:

During the achievement of the products, the structural organisation is centred on the work division and the manufacturing processes of the tangible product, and in the case of service delivery, on sustaining the "front" personnel - in contact with the beneficiary from the classic pyramid form (organisations for tangible products) passes to the "reverse pyramid" form (service organisations);

Activity planning and operation scheduling is more rigorously formulated in organisations manufacturing tangible products, than service provider organisations, because they have a higher number of time ranges and work plans, scientifically determined;

In both cases, the assignment performance duration depends on the complexity. Usually, it is higher in manufacturing, which also depends on the batch size. In the case of service delivery, the assignment duration is, usually, small and very small;

Surveillance and operative control are rigorously staged in manufacturing; in such cases, a differentiation applies between the execution personnel and the control personnel. For service delivery, an important role is taken by self-control and final control directly provided by the beneficiary;

The nature of the job is monotonous, repetitive and relatively poor in content for the majority of the personnel in manufacturing organisations and diversified and rich in contacts and content in the case of service deliveries.

The assessment of the performances is achieved by the extent that the production and quality plans are reached, as also by disciplinary indicators in the case of manufacturing and by the satisfaction perceived by beneficiary in regards of service quality and the operators' behaviour in the case of service delivery;

The professional development opportunities are relatively low in the case of manufacturing and high in the case of services due to the different situations concerning the interventions and the contact with the beneficiary's personnel;

The participation of the personnel in the improvement of the activity is relatively low in case of manufacture and it depends on the organisation's management style. In the case of service delivery, the different cases of the assignments allows to obtain suggestions of activity improvement, and in this case the use of such suggestions depends on the management's style;

As far as retribution is concerned, in the case of service deliveries, there is a larger variety of methods than in case of manufacture, and a higher average level of retribution.

8. Conclusions

The management of the organisations providing services should seek the trends leading to the emergence of new services for undertakings as a result of the technological development of production, based on: (a) the new possibilities of automation of the production; (b) the miniaturization trend; (c) the development of process informatics; (d) the emergence of some new types of devices, such as industrial robots. Such trends allow forecasting the occurrence of some new types and combination of services demanded in the scenarios of manufacture with advanced technology. At least four groups of enterprise services will be developed and diversified, namely: (a) services of computer services in assisting manufacture; (b) utility supply services; (c) maintenance services; (d) logistic services.

The benchmarking analysis aimed at determining the particularities of service management in relation with the management of material production.

By this benchmarking research, the general characterization of the activities of the service provider companies was achieved by using 12 parameters with the intent of providing a managerial instrument to guide the service provider organisations. For each parameter, the service provider activity was characterized in comparison with the tangible-product manufacture activity. Among the used parameters, the structural organisation, the general planning of the activity, operation scheduling, assignment duration, time ranges and work plans, the nature of the job, the professional development opportunities, the motivation and others were found.

The benchmarking analysis was a fundamental research leading a significant contribution to a multi-criteria knowledge and understanding upon the service delivery activity.

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