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# Operations management body of knowledge and its relevance to manufacturing and service organizations

Operations  
management  
body of  
knowledge

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## Abstract

**Purpose** – The purpose of this paper is to assess the differences in importance assigned by manufacturing or service organizations to topics related to operations management and its attendant body of knowledge.

**Design/methodology/approach** – The authors did this by cataloguing and analyzing vacancy announcements related to operations management, presented by manufacturing and services companies in major Brazilian human resources websites.

**Findings** – The results show that manufacturing companies primarily hire personnel with skills in routine process management, quality management, lean manufacturing, ergonomics and work organization. Service companies generally seek professionals with knowledge and experience in logistics, supply chain management and project management.

**Research limitations/implications** – This study presents some limitations that reduce the power of its conclusions. There is some degree of subjectivity in the interpretation of the contents of the analyzed ads. In order to reduce this problem, the authors who did the tabulation of data marked the situations for which there were some doubts about the classification, discussing them with the other author, until they reached a consensus on the best way to classify each one.

**Originality/value** – The discussion about the importance assigned by manufacturing and service companies to the topics of operations management is crucial for not only the results obtained, but also to stimulate the debate on topics that comprise or should comprise the body of knowledge of operations management, and the way they are incorporated into business practice. This provides an additional opportunity to reflect on the potential of operations management in supporting business managers now and in the future.

**Keywords** Services, Operations management, Manufacturing, Job ads

**Paper type** Research paper

## 1. Introduction

There has been a lot of discussion over the last few decades about the growth of the services sector—in terms of nations' GDP and people's occupations—compared to the manufacturing sector, which had dominated the business scenario since craftsmen gave way to the factories of the industrial revolution.

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Operations management is a discipline that originated to solve management problems in a factory environment, but since the mid-twentieth century researchers, lecturers and practitioners have begun to adapt the knowledge of the field to also support service operations.

This paper seeks to identify and distinguish, according to the sector (manufacturing or services), the operations management themes most valued by companies for hiring professionals. We did this by cataloguing and analyzing vacancy announcements related to operations management, presented by manufacturing and services companies in major Brazilian human resources websites. It is worth noting that there is a limitation to using open job vacancies as a proxy for the knowledge valued by organizations, since there may be no open positions due to them being filled. In this case, the proposed methodology would not capture the value of such knowledge for the organization. Nevertheless, all the qualifications demanded in job announcements reflect the type of knowledge that companies value. In addition, the use of a relatively large sample contributes to biases canceling each other, allowing a viable result from this survey.

From a theoretical perspective, the present study is justified by the possibility of increasing knowledge about the importance of specific topics, from operations management to organizational practice, which could guide new efforts by researchers to deepen the theoretical knowledge informing operations management teaching and practice. From a practical point of view, the identification and dissemination of topics in operations management that are more valued by companies, depending on the sector of activity, can help business administration researchers, lecturers and executives to understand what companies need most, contributing to the alignment of their efforts to make a difference in everyday business practice.

In the following sections, we present a brief discussion about the increasing importance of operations management in the service sector, showing that there is already concern in the literature about suitably adapting knowledge originally developed for the management of manufacturing operations to services operations management. Next, we discuss the methodology used in data collection and analysis, followed by the presentation and discussion of the results obtained. The paper closes with some final considerations, which include possible future studies and the limitations of the research undertaken here.

## 2. The growth of the service sector

In the last few decades, companies in the tertiary sector of the economy, i.e. the service sector, have increased their relative share in job creation and economic importance.

Gallie (1991) showed that prior to the First World War, about 80 percent of the employed population were manual workers, but by 1987 non-manual labor accounted for half of all jobs. With the increasing importance of service delivery, service operations management has become important in organizations' practice, and a relevant research topic within the broader field (Smith *et al.*, 2007). According to Ricci and Rachid (2013), from 1994 to 2000 service sector employment grew by 141.3 percent, concurrent with a slowdown in the manufacturing industry. In 2007, according to the same authors, 31.7 percent of formal jobs were in the service sector. Heineke and Davis (2007) state that the service sector grew significantly in the late twentieth century, to the extent that 80 percent of jobs in the USA were offered by service companies. This rapid growth was caused by several factors, such as change in the population's lifestyle, deregulation and availability of better infrastructure, based on new information and communication technologies. As also pointed out by Heineke and Davis (2007), once the service sector surpassed 50 percent of the economy, which happened in the 1950s, researchers—especially economists—began to examine the characteristics of services and to adapt and apply concepts to them that had originally been developed to deal with manufacturing operations.

An outsourcing wave further fueled movement in this direction, with manufacturing companies beginning to hire services from specialized companies at lower cost and better

quality than if performed internally. Activities such as property security, cleaning, building maintenance, industrial canteens and logistics services were transferred to external suppliers (Fitzsimmons and Fitzsimmons, 2010). Almeida (2004) had earlier identified this trend, stating that from 1977 to 2000 there was an increase of more than 15 percent in the services sector in Europe and Japan, and a similar growth in the USA. The increase in service activity was accompanied by a 20 percent reduction of the manufacturing sector in Europe and the USA, and 11 percent in Japan. Mechanization, automation and standardization also contributed to the increased relevance of service provision (Almeida, 2004).

Investigative studies that address the transition from an industrial society to a service society have been available for decades. Sullivan (1982) highlighted the challenges and demands of research in service operations management in light of some distinctive characteristics of services, such as intangibility, inseparability, heterogeneity and perishability. Machuca *et al.* (2007) performed a detailed survey of studies about service operations in the main operations management journals: *International Journal of Operations & Production Management*; *International Journal of Production Economics*; *International Journal of Production Research*; *Journal of Operations Management (JOM)*; *Production and Inventory Management*; and *Production and Operation Management Journal (POM)*. They concluded that 7.5 percent of papers published were linked to service operations management. At the same time, Smith *et al.* (2007) conducted an empirical evaluation of the productivity of researchers and institutions in service operations management in papers published in five important scientific journals: *Manufacturing and Service Operations Management*; *Management Science*; *Operations Research*; *JOM*; and *POM*. They mapped 463 papers published between 1990 and 2006, and found that the percentage of papers about service operations management rises from 7.0 percent in 1990 to 17.2 percent in 2006.

Chase and Apte (2007) discussed the role of services in national economies and the importance of scientific research on the topic, highlighting the importance of teaching operations management in universities to address service operations. Recently, Jung *et al.* (2015) developed a theoretical study involving socially responsible service operations management (SRSOM), which can be defined as the managerial activities of service operations concerning social responsibility and legal, ethical and environmental issues. The authors also referred to other studies published in the last 20 years that discuss SRSOM, demonstrating that interest in the topic increased exponentially over the analyzed period.

### 3. Shared knowledge of manufacturing operations and service operations management

A definition of services offered by Gadrey *et al.* (1995) treats service as an operation performed by a provider which aims at changing the customer's status, at the moment that the customer needs and with the customer's collaboration. According to these authors, the process ends up linking the result to the provider's knowledge structure. As it involves a transformation operation, the production of services can use tools, planning, and quality and control procedures originally devised and applied to manufacturing and industrial processes (Gadrey *et al.*, 1995). As services are also produced through processes, their achievement can benefit from the know-how developed by manufacturing companies on the subject (Freire, 1998). The automation of processes ensures that, like manufacturers, service companies standardize what they deliver to the market, which is valued in several situations. According to Gallie (1991), there is a clear trend toward the standardization of non-manual work, which was formerly typical for manufacturing processes only. Service operations professionals are learning to think more and more about their processes in the same way as their counterparts in manufacturing operations.

According to Kon (2007), services are also part of the manufacturing process itself, often essential for the versatility of the production process. Areas such as logistics and quality

management are examples of services that are crucial in manufacturing, as they add value to products and are key to manufacturers' ability to meet varied market requirements. In a previous study, Kon (1996) attributed versatility in production to manufacturers' ability to reduce the internalization of different stages of production, mainly service-related activities, by assigning part of their processes to third parties for economic and control reasons. According to the author, the standardization of industrial operations generates opportunities for companies that specialize in services that were previously carried out within the factories, providing them with more customers, reducing costs and improving related processes.

Bowen and Youngdahl (1998) considered that the philosophy of waste reduction and lean operations applied to industrial processes, as well as the constant search for efficiency in production, can be adapted and successfully used in processes in the services sector. As example, theories initially focused on lean manufacturing can be applied to service and office operations, resulting in concepts such as the lean office and lean healthcare. Gadrey *et al.* (1995) go even further, arguing that knowledge from the manufacturing and service areas can be adapted and applied to one another, and that knowledge does not need to flow from manufacturing to services only, although most operations theory was developed for manufacturing because of the demands of the industrial revolution. For these authors, the reduction of trade-offs, mapping of value flow, increase in employees' capacity and organization of work teams focused on improvements are examples of important objectives for both manufacturing and service activities.

The concern with service operations management has rightly increased in academic circles, reflecting the migration of a large number of manufacturing jobs to the service area. Paiva and Brito (2013) identified that the topics supply chain management and operations strategy occupy the first positions among the topics of interest of the operations management academic community in Brazil, possibly because these topics interface with other areas of business administration. The topic service operations appears as the fourth most discussed in the national scientific journals they assessed. The authors argue that the growth of the service sector in the world economy in recent decades is the main justification for service operations to attract increased attention from researchers.

Although the study by Paiva and Brito (2013) found a significant reduction in recent interest in quality management, its extensive discussion throughout the 1990s may have contributed to the shift of operations management research to "softer" themes. "Harder" topics, more related to engineering and manufacturing—a characteristic identified by Corrêa *et al.* (2010)—have gradually given way to concerns that are more related to management, its declared purpose since it was still known as production administration; and finally, to service operations topics. According to Arkader (2003), quality management entered the research agenda in North America and Europe in the 1980s, due to its success in Japan, where the use of quality tools and continuous improvement techniques helped recover the country's economy after the Second World War. American industry had focused on the technological structure, giving little emphasis to people, but it became necessary to rethink the relevance of topics studied by the operations management area. According to Arkader's (2003) survey, traditional Brazilian academic journals tended to publish papers more concerned with issues related to materials and inventory management. It was only in the late 1980s that quality management issues began to appear in national journals, influenced by the global trend that was already established. The author also points out that lean philosophy only gained relevance in the market and in academic studies after the economic events of the 1990s, with the opening of the Brazilian market and the more favorable financial situation of the country.

In an assessment of more recent papers published in *Gestão e Produção*, one of Brazil's leading operations management journals, Bortolossi and Sampaio (2012) found that

although about 70 percent of the papers published in the previous decade were still about manufacturing, the topics being discussed in manufacturing and service operations papers were getting closer. According to the authors, this result shows a trend leading to the development of more research on service operations management, attesting its relevance to the area of operations management as a whole. With the objective of discussing the challenges and opportunities for the area of service operations, Johnston (2005) assessed around 250 papers published in three international journals. The study revealed that service operations' professionals are expected to have the knowledge and skills to answer basic questions related to three issues: quality, productivity and efficiency of operations. The author further states that, although the development of service operations management has its roots in manufacturing operations, it is acknowledged that service operations are different from manufacturing operations, and that concepts must be refined, redefined or developed from scratch to meet the specific requirements of the area.

#### 4. Methodological procedures

This study seeks to raise the practical importance for Brazilian manufacturing and service companies of the various operations management themes, trying to identify differences in their needs, based on the requirements described in job vacancy ads. Similar methodology has been applied by other researchers in other areas. Faria *et al.* (2015) collected information on professional placement websites in order to identify the market requirements for logistics professionals. Peleias *et al.* (2008) carried out the identification and analysis of the professional profile required by the labor market for Accounting Professionals in São Paulo, based on their evaluation of 2,560 job ads published in local newspapers. Azevedo and Gomes (2006) studied the labor market for information management professionals in the context of Brazilian companies in the country's North, Northeast and Midwest, by analyzing 578 job advertisements on the Catho website ([www.catho.com.br](http://www.catho.com.br)). At the international level, Rieucan (2015) compared recruitment practices adopted by retailers in France and the UK, based on the analysis of the content of vacancy ads on websites. The sample consisted of 454 French company announcements and 329 advertisements from UK companies. Glazer and Hassin (2010) studied the effectiveness of job posting ads on websites. Choi and Rasmussen (2009) assessed the most important qualifications and skills required for the position of digital librarian by analyzing 363 job postings.

As can be seen, collecting data from job posting ads published by online agencies have become a data source option for researchers working in diverse areas. Job posting sites have revolutionized the way companies connect with individuals seeking employment. According to Silveira (2004), the internet has become an important means of advertising job offers, because it functions as a mass communication media, like the press, radio and television, which employers have always widely used to disseminate job vacancies. However, the internet is much more effective than these other approaches, as they do not allow for the same degree of interaction among the parties. Another factor that contributes to the use of the internet by both prospective employees and employers is the volume of information provided and shared, free of charge, which is infinitely higher than that possible through traditional communication channels (Silveira, 2004).

##### 4.1 Choice of recruitment websites to be assessed

In order to analyze the vacancies offered, we chose companies specializing in recruitment and selection services, which disseminate job vacancies through web classifieds. We only considered websites that operated at the national level, offering job placements in the different regions of the country, as we sought to understand the phenomenon in Brazil as a whole and not in a specific sub-region. The fact that the internet does not impose geographical barriers does not necessarily mean that a company operates in a broad

geographic area. We chose companies that were well known in the Brazilian professional market and published job ads for all regions of the country. Other criteria were the features of each website for searching and selecting the required information. These included the possibility of using search terms (production, operations, services, processes, quality, projects, industrial, factory and logistics), the clear disclosure of the requirements of each specific vacancy and a unique code to avoid having the same vacancy be considered more than once in the data collection and analysis for the survey. At the end of the process, six companies were selected, as shown in Table I.

The content of the job offers presented in the selected sites was submitted to content analysis as prescribed by Bardin (2009, p. 44). The author content analysis as a “set of techniques for analyzing communications, aiming to obtain indicators (quantitative or non-quantitative), through systematic and objective procedures that allow the inference of knowledge regarding the conditions of production/reception of the analyzed messages.” McDaniel (2004, p. 170) also stressed concern for the objectivity and systematization of content analysis, claiming it to be “a technique used to analyze written materials by dismembering them into meaningful units using carefully applied rules.”

The content analysis allowed the topics of operations management in demand by the companies to be extracted from the published ads. The frequency of appearance of each topic (significant unit) per vacancy was used as a proxy for the importance attributed to it. If a topic was referred to at least once in a specific job ad it was accounted for. This way, the maximum number of times a topic could appear in the study was limited to the total number of analyzed vacancy ads.

While certain topics may not appear in the ads because the corresponding roles are already filled, new ads for vacancies represent an adequate proxy for the importance given to the different topics that comprise the operations management body of knowledge. Because many companies post ads, potential deviations in one direction are offset by deviations in the opposite direction, based on the principle of statistical centrality. Some bias may indeed exist, if specific topics are acquiring greater importance today than they had in the past, requiring companies to hire people with specific expertise previously nonexistent in their workforce. However, this bias, even if impossible to detect with the procedures adopted in the present study, contributes to highlighting topics that are increasingly demanded. This aligns with the objective of our research into the perceived needs of companies with respect to operations management knowledge and skills, which they are trying to meet by hiring new employees.

4.2 Selection of research analysis units (vacancy ads in classifieds)

The task of collecting and selecting the job postings in the area of operations management for inclusion in the study was initially performed using a set of keyword searches carried out on the chosen websites. The keywords used were: “production,” “operations,” “services,” “processes,” “quality,” “projects,” “industrial,” “factory” and “logistics.”

Company	Searched web page
Catho	<a href="http://v.catho.com.br/buscar/empregos/">http://v.catho.com.br/buscar/empregos/</a>
Manager	<a href="http://www.manager.com.br/empregos">www.manager.com.br/empregos</a>
Curriculum	<a href="http://www.curriculum.com.br/vagas-emprego">www.curriculum.com.br/vagas-emprego</a>
Elancers	<a href="http://www.elancers.net">www.elancers.net</a>
Michael Page	<a href="http://www.michaelpage.com.br">www.michaelpage.com.br</a>
Robert Half	<a href="http://www.roberthalf.com.br/vagas-de-emprego">www.roberthalf.com.br/vagas-de-emprego</a>

Source: Elaborated by the authors

Table I.  
Companies selected to form the research corpus

The second phase of selecting the job vacancies to comprise the corpus of analysis consisted of reading the job descriptions and required activities, eliminating those that did not refer to operations management. All vacancies selected for this study required (complete or in progress) college training in business administration or production engineering.

The study included all the vacancies offered during one month, in classified ads published in the six websites (see Table I). During the data collection period, each site was checked once a week. Each advertised vacancy bid was considered only once, regardless of how long it was posted.

#### *4.3 Thematic classification of job vacancies*

After selecting the vacancy ads considered pertinent to the area of operations management, we performed a thorough analysis of their content. As we analyzed excerpts from the text (phrase, sentence, paragraph section or whole paragraph), their content was associated with one or more of the 36 topics proposed in the consolidated mapping of operations management topics, as per Peinado and Graeml (2013).

For example, the text excerpt: “coordinate the entire process of product manufacturing, aiming at meeting the quality and productivity goals established by the company” was associated with the topic production management. On several occasions, a single piece of text could be associated with more than one theme. Thus, the text: “coordinating projects related to the area, aiming to increase productivity, realign goals and monitor plant performance through KPIs” was associated to the following themes: project management (coordinating projects related to the area); and measurement of performance and productivity (monitoring plant performance).

#### *4.4 Identification of the company's sector of activity*

The companies offering the vacancies were also classified according to their industry. The two possibilities were manufacturing companies and service providers. For each vacancy offer we analyzed, the company's industry was considered, regardless of the job description. Thus, for example, a vacancy for a logistics supervisor, which is a service activity, could be classified as “manufacturing” when offered by a manufacturing company, or as “services” when offered by a service provider.

#### *4.5 Identification of required academic background*

As previously mentioned, all job vacancies we selected for inclusion in the corpus of analysis of this study required complete or ongoing college education in the area of business administration or production engineering, or some related field. A secondary objective of this study was to better understand the degree of interdisciplinarity in operations management, whose professionals often have different backgrounds. Three possible categories of required academic training were established: training in business administration; training in production engineering; and training in administration or engineering generally. The cases in which the vacancy listing only mentioned the need for college education, without a specific description of the area, were counted as belonging to this third category, provided that it was clear they were vacancies in the operations management area. Otherwise, they were discarded.

#### *4.6 Expressions that designate leadership positions*

We sought to determine if the position offered involved management and leadership activities, and assess the extent to which companies hired operations management staff to occupy managerial positions (command and responsibility for subordinates). Procedures for choosing people for management positions have been changing over the

years: according to Bergamini (1994), the analysis of Brazilian organizations shows a notorious shortage of qualified professionals to act as leaders, even among those that develop activities requiring leadership.

The demands of the market on executives have evolved past simply controlling the work of others, who are expected to obey orders. Executives today need skills to foster team collaboration, delegate various thinking tasks to employees and act at the various levels of the organization (Ancona *et al.*, 2007).

The analysis of the selected job vacancies for this study allowed us to distinguish between those referring to managerial positions and those concerning more operational activities. The classification of the position was made through careful reading of the title and description of the activities of each announced vacancy. We looked for expressions that associated words like “management,” “supervision,” “command,” “development,” “leadership,” “coordination” and “motivation” with words such as: “team,” “people” and “employees.” Among the assignments of a leader is the ability to awaken greater engagement in the people involved in the processes. The presence of these expressions, in the appropriate context, allowed for the classification of a position as being a leadership role or an operational role.

#### *4.7 Identification of English language knowledge as a requirement for a position*

We also assessed if the offered position required mastery of the English language to carry out the activities related to operations management. Although a foreign language is not usually part of the compulsory curriculum of business administration or engineering courses, according to Rocha (2010), knowledge of the English language has become a determining factor in the selection of candidates for job openings. Rocha (2010) even claimed that salaries offered are related to knowledge of the English language, and are significantly higher when the candidate is proficient. Taking into account, the fact that the analyzed vacancies contain expressions that suggest leadership positions, the requirement for better-qualified candidates may involve good knowledge of the English language. According to a study by Crystal (2006), the number of people who are fluent in English, or at least have the ability to use it to communicate, reached 25 percent of the world’s population. The fact that 1.5bn people can express themselves in that language attests to its importance in the current globalized labor market.

The analysis of the job vacancies allowed us to establish four possible categories regarding English language requirement: not required, basic level, advanced level and requirement of another foreign language, besides English.

#### *4.8 Data analysis procedures*

We collected data from advertisements by companies dedicated to the hiring of professionals in the labor market, working throughout Brazil. Once the data were collected, we then performed statistical analysis according to the following steps, with the help of the Statistical Package for the Social Sciences software. First, a descriptive frequency analysis of the following variables was carried out: the company responsible for the classified advertisement; the geographic locale of the vacancy; English language requirement; sector of activity of the company; type of academic background required; and role involving management or leadership activities.

The above-mentioned analysis allowed us to characterize the sample in a more detailed way. Then, in order to explore the characteristics of different strata of the sample, we created several sets of crosstabs. Pearson’s  $\chi^2$  significance tests, and  $\phi$  and Cramer’s  $V$  tests were used to analyze the degree of correlation among variables, as recommended by Dancy and Reidy (2006) and Field (2009).

## 5. Analysis of the results

The process of collecting and selecting job vacancies was performed according to the criteria already described in item 4.2 and resulted in obtaining 394 job vacancy ads for the five Brazilian regions, as shown in Table II.

An *ad hoc* evaluator who had access to this work during its preparation observed that job vacancies in manufacturing organizations appeared in much larger numbers than those for service companies, and questioned whether this could not influence, in some way, the results obtained. It should be noted that we considered every ad posted by all companies that offered vacancies through the six job posting websites in the analysis, conditioned to meeting the criteria defined in item 4.2. As none of the six websites presents itself as specialized in a specific sector, e.g. manufacturing or services, the discrepancy between the number of vacancies offered may be due to:

- (1) The existence of greater demand for operations management professionals in manufacturing, which is a reasonable conjecture, considering that manufacturing operations tend to be more complex, as discussed in a previous section, and therefore requiring greater sophistication in management.
- (2) The fact that some vacancies for service companies, which could eventually be classified as operations management vacancies by someone who knows the discipline, may have been presented in the ads using terminology that is not specific to the operations management area. This would have prevented them from being detected based on the keywords used to select the ads considered in the study (see Section 4.2). However, if this is the case it would also mean that operations management is not a field of knowledge that is considered important (or even known) by those who are placing the job offer. Reasons for this may be related to the discussion offered in Section 3.

### 5.1 Analysis of required background education

When an ad for an operations management vacancy is posted, who is it aimed at? Do companies plan to hire someone with a background in business administration or production engineering? Is the candidate's formal education an issue? To answer those questions, Table III shows the results obtained, separated by the activity sector of the organizations offering the vacancies. The last column in Table III shows that 336 (85.3 percent) of the 394 vacancies analyzed were offered by manufacturing organizations, and 58 vacancies (14.7 percent) by service organizations.

Analysis of Table III shows that, of the 394 vacancies in the operations management area, only 4.8 percent of the vacancies demanded education in business administration, against 36.8 percent of vacancies that required education in production engineering. Despite this preference in recruiting engineers for vacancies in the area of operations management, 58.4 percent of all analyzed ads accepted candidates with either a business administration or

Region	Michael Page	Elancers	Curriculum	Manager	Robert Half	Catho	Total	%
North	0	0	1	0	0	4	5	1.3
Northeast	3	0	6	6	0	21	36	9.1
Midwest	0	2	3	2	0	17	24	6.1
Southeast	27	8	29	40	37	115	256	65.0
South	11	5	14	10	0	33	73	18.5
Total	41	15	53	58	37	190	394	100.0

**Source:** Elaborated by the authors

**Table II.**  
Sample data separated  
by recruiting  
company and  
Brazilian region

engineering background. The influence of the company's sector on the definition of the required formal training of candidates has shown to be significant, when adopting Pearson's  $\chi^2$  test or Cramer's *V*. Service companies are less inclined to demand training in engineering than are manufacturing companies. This is not surprising, since the manufacturing sector has a strong engineering tradition and has historically had engineers as managers since the dawn of scientific administration.

5.2 *English language requirement for the job*

We then analyzed the organizations' requirements for English language knowledge for vacancies related to operations management activities. Table IV shows the results obtained, separated by sector. Approximately 70 percent of the analyzed vacancies do not require foreign language knowledge. On the other hand, almost 25 percent of the positions require fluency in English, or knowledge of a second foreign language. The  $\chi^2$ -test did not show statistical significance for any differences between manufacturing and service companies in that respect.

5.3 *Management and leadership activities expected*

Next, we analyzed whether ads were for vacancies that required candidates to exercise leadership activities, if hired for the role. Table V shows the results obtained, separated according to the industry/sector of the organizations offering positions.

**Table III.**  
Education background required based on company activity sector

Activity sector	Education background required			Total
	Business administration	Engineering	Business adm. or engineering	
Manufacturing	11 (3.3%)	137 (40.7%)	188 (56.0%)	336 (100.0%)
Services	8 (13.8%)	8 (13.8%)	42 (72.4%)	58 (100.0%)
Total	19 (4.8%)	145 (36.8%)	230 (58.4%)	394 (100.0%)

**Notes:** Pearson  $\chi^2$ : 23.34 sig. < 0.001;  $\phi$  and Cramer's *V*: 0.244 sig. < 0.001

**Source:** Elaborated by the authors

**Table IV.**  
English requirement based on industry

Industry	Not required	Basic	English language		Total
			Fluent	Other language	
Manufacturing	238 (70.8%)	19 (5.7%)	64 (19.0%)	15 (4.5%)	336 (100.0%)
Services	37 (63.8%)	5 (8.6%)	11 (19.0%)	5 (8.6%)	58 (100.0%)
Total	275 (69.8%)	24 (6.1%)	75 (19.0%)	20 (5.1%)	394 (100.0%)

**Note:** Pearson's  $\chi^2$ : sig. > 0.05 (no significance)

**Source:** Elaborated by the authors

**Table V.**  
Expectation of performance of leadership activities

Industry	Not required	Leadership activity		Total
		Not required	Required	
Manufacturing	23 (6.8%)	313 (93.2%)	336 (100.0%)	
Services	6 (10.3%)	52 (89.7%)	58 (100.0%)	
Total	29 (7.4%)	365 (92.6%)	394 (100.0%)	

**Note:** Pearson's  $\chi^2$ : sig. > 0.05 (no significance)

**Source:** Elaborated by the authors

More than 90 percent of the vacancies analyzed include activities related to command and leadership as part of the job descriptions. This result shows that the vast majority of vacancies in the field of operations management relate to management activities. They are primarily not vacancies for workers at the base of the organizational pyramid, which is in line with the requirement of higher education (college) that was included as a selection criterion for the ads to be analyzed in the study. In this case, the Pearson's  $\chi^2$ -test did not present statistical significance, so it is not possible to say that there are differences between the expectations of companies in the manufacturing sector and those in the service sector that those hired for operations management jobs will be involved in command and leadership activities.

#### 5.4 *The most valued practices in operations management*

We sought to measure the practical value assigned by the hiring companies to each of the 394 job vacancies analyzed, based on their demand for people with the related skills and knowledge, by identifying and classifying the topics covered in each post. The number of times each topic was mentioned in the announced vacancies was counted. Table VI presents the result of this analysis, showing the number of mentions for the topics found in the content analysis of the job descriptions. The data were separated according to industry (manufacturing or service), as shown in the second and third columns, respectively. The fourth column shows the total count, without any stratification, and the last column indicates if there was statistical significance based on Pearson's  $\chi^2$ -test (\*\*\*) for sig. < 0.001; and the level of correlation of  $\phi$  and Cramer's  $V$ , in cases where there was statistical significance. Results were normalized and presented as percentages, by means of the quotient between the number of mentions of an individual topic and the total number of vacancies, as informed in the last line of Table VI. These normalized results are shown in parentheses.

The results we present in Table VI show that, of the 36 topics considered, nine presented statistical significance for differing frequency of occurrence for manufacturing and service companies. Figure 1 illustrates the difference in the valuation of these nine topics, according to the company's sector of activity.

Figure 1 shows that six topics, related to routine management (2.1 and 2.2), quality management (4.1 and 4.3), ergonomics and work organization (6.1) and lean manufacturing (3.1) are demanded more by companies in the manufacturing sector than in services. The remaining three topics, related to logistics and supply chain (5.1 and 5.7), and project management (8.1), are demanded more by service companies. These differences were reasonably foreseeable: the routine of manufacturing operations tends to be more complex than that of services, which would justify a greater concern with routine management by manufacturing companies. These companies, by virtue of the way their productive processes are organized and the historical development of the sector, also have a strong connection with topics related to quality management and work organization, including lean manufacturing, which challenges previous paradigms of manufacturing. On the other hand, logistics, supply chain management and even project management are service activities, regardless of whether they are performed by manufacturing or service companies. It is therefore not surprising that they attract more attention from companies that are already configured as service providers.

Regarding the other topics, it is not possible to infer a distinction between the manufacturing and service companies' perspectives, since there was no statistical significance in the percentage differences obtained (see Table VI).

To further explore the obtained results, we prepared a ranking of items that appeared in more than 10 percent of the analyzed ads, as shown in Table VII. This table presents the ranking, in terms of relative importance (higher frequency in ads), of the operations management topics, both for manufacturing and services.

Topic	Industry		Total	$\phi$ and Cramer's $V$
	Manufacturing	Services		
<i>1. Operations strategy</i>				
1.1 Production strategies and policies	48 (14.3%)	5 (8.6%)	53 (13.5%)	no sig.
1.2 Global operations management	4 (1.2%)	0 (0.0%)	4 (1.0%)	no sig.
<i>2. Routine operations management</i>				
2.1 Production and process management	257 (76.5%)	19 (32.8%)	276 (70.1%)	0.338***
2.2 Planning, scheduling, and operations control	98 (29.2%)	6 (10.3%)	104 (26.4%)	0.151***
2.3 Measuring performance and productivity	103 (30.7%)	13 (22.4%)	116 (29.4%)	No sig.
2.4 Capacity planning and analysis	17 (5.1%)	1 (1.7%)	18 (4.6%)	No sig.
2.5 Cost accounting for operations management	47 (14.0%)	4 (6.9%)	51 (12.9%)	No sig.
2.6 Operations information management	52 (15.5%)	5 (8.6%)	57 (14.5%)	No sig.
2.7 Location of plants, design and layout	22 (6.5%)	3 (5.2%)	25 (6.3%)	No sig.
<i>3. JIT—lean manufacturing</i>				
3.1 Lean production systems	58 (17.3%)	2 (3.4%)	60 (15.2%)	0.136***
3.2 Flexible manufacturing systems	1 (0.3%)	0 (0.0%)	1 (0.3%)	No sig.
3.3 Automation CIM—CAD/CAM	14 (4.2%)	0 (0.0%)	14 (3.6%)	No sig.
<i>4. Quality management</i>				
4.1 Quality management	120 (35.7%)	6 (10.3%)	126 (32.0%)	0.193***
4.2 Total quality management	26 (7.7%)	0 (0.0%)	26 (6.6%)	No sig.
4.3 Standardization and certification for quality	57 (17.0%)	1 (1.7%)	57 (14.7%)	0.152***
<i>5. Logistics and supply chain</i>				
5.1 Logistics, transportation, and distribution	20 (6.0%)	25 (43.1%)	45 (11.4%)	0.414***
5.2 Materials and inventory management	44 (13.1%)	15 (25.9%)	59 (15.0%)	No sig.
5.3 Purchasing and procurement systems	20 (6.0%)	9 (15.5%)	29 (7.4%)	No sig.
5.4 Supply chain management	15 (4.5%)	7 (12.1%)	22 (5.6%)	No sig.
5.5 Demand management	6 (1.8%)	2 (3.4%)	8 (2.0%)	No sig.
5.6 International logistics and global sourcing	7 (2.1%)	7 (12.1%)	14 (3.6%)	No sig.
5.7 Strategies and logistic practices	23 (6.8%)	15 (25.9%)	38 (9.6%)	0.228***
<i>6. Ergonomics and work organization</i>				
6.1 Design, measurement, and improvement of work	64 (19.0%)	1 (1.7%)	65 (16.5%)	0.165***
6.2 Human resources management in operations	61 (18.2%)	6 (10.3%)	67 (17.0%)	No sig.
<i>7. Environmental sustainability of operations</i>				
7.1 Regulatory and environmental issues in operations	25 (7.4%)	3 (5.2%)	28 (7.1%)	No sig.
7.2 The role of operations in sustainability	8 (2.4%)	0 (0.0%)	8 (2.0%)	No sig.
7.3 Sustainable business strategy	1 (0.3%)	0 (0.0%)	1 (0.3%)	No sig.
7.4 Sustainable supply chains and reverse logistics	0 (0.0%)	1 (1.7%)	1 (0.3%)	No sig.
<i>8. Project management and product development</i>				
8.1 Project management	18 (5.4%)	10 (17.2%)	28 (7.1%)	0.164***
	Activity sector			
Topic	Industry	Services	Total	$\phi$ and Cramer's $V$
8.2 Design and product development	24 (7.1%)	1 (1.7%)	25 (6.3%)	No sig.
8.3 Manufacturing project	18 (5.4%)	1 (1.7%)	3 (0.8%)	No sig.

**Table VI.**  
Number of mentions  
of topics in analyzed  
job ads

(continued)

<i>9. Innovation and technology management</i>				
9.1 Technology management for operations	2 (0.6%)	1 (1.7%)	3 (0.8%)	No sig.
9.2 Group technology	0 (0.0%)	0 (0.0%)	0 (0.0%)	No sig.
9.3 Technology management organizational change	0 (0.0%)	0 (0.0%)	0 (0.0%)	No sig.
9.4 E-business and operations	0 (0.0%)	0 (0.0%)	0 (0.0%)	No sig.
9.5 Technologic innovation	16 (4.8%)	2 (3.4%)	18 (4.6%)	No sig.
Total analyzed	336	58	394 (100%)	

Note: \*\*\*Sig. < 0.001

Source: Elaborated by the authors

Table VI.



Source: Elaborated by the authors

Figure 1. Topics for which there is significant difference in value for manufacturing and service companies

As can be seen, only three of the nine topics for which there was statistical difference between manufacturing and service companies (highlighted cells) are among the top 12 most relevant topics for both manufacturing and service enterprises (2.1 production and process management, 4.1 quality management and 2.2 planning, scheduling and operations control). Three of them (6.1 design, measurement, and improvement of work; 3.1 lean production systems; and 4.3 standardization and quality certification) are among the most important for manufacturing, but not for service companies. Three others (5.1 logistics, transport and distribution; 5.7 logistics strategies and practices; and 8.1 project management) appear in the list of most frequent topics in service company advertisements, being less frequent among manufacturing companies.

## 6. Conclusions

Starting with the objective of verifying the practical importance attributed to the themes of operations management by its practitioners, and seeking to understand how manufacturing and service organizations differ in this, we collected and analyzed 394 job postings by manufacturing and service companies.

We found that 58.4 percent of companies do not have any preference for business administrators or production engineers when hiring someone to perform operations

Pos.	Industry	%	Services	%
1	2.1 Production and process management	76.5	5.1 Logistics, transportation and distribution	43.1
2	4.1 Quality management	35.7	2.1 Production and process management	32.8
3	2.3 Measuring performance and productivity	30.7	5.2 Materials and Inventory Management	25.9
4	2.2 Planning, scheduling, and operations control	29.2	5.7 Strategies and logistic practices	25.9
5	6.1 Design, measurement, and improvement of work	19.0	2.3 Measuring performance and productivity	22.4
6	6.2 Human resources management in operations	18.2	8.1 Project management	17.2
7	3.1 Lean production systems	17.3	5.3 Purchasing and procurement systems	15.5
8	4.3 Standardization and certification for quality	17.0	5.4 Supply chain management	12.1
9	2.6 Operations information management	15.5	5.6 International logistics and global sourcing	12.1
10	1.1 Production strategies and policies	14.3	2.2 Planning, scheduling and operations control	10.3
11	2.5 Cost accounting for operations management	14.0	4.1 Quality management	10.3
12	5.2 Materials and inventory management	13.1	6.2 Human resources management in operations	10.3

**Table VII.**  
Most important  
(demanded) topics for  
manufacturing and  
service companies

**Source:** Elaborated by the authors

management activities. However, manufacturing companies still tend to opt for engineers more frequently (40.7 percent) than service companies (13.8 percent).

We also found that 69.8 percent of the vacancies do not require advanced knowledge of English, which could be a reflection of the low degree of integration in global supply chains by many Brazilian companies. Considering that the study represented a “snapshot” of a particular moment, it is not possible to know if the demand for English-speaking professionals is increasing, and at what pace. Nevertheless, 25.1 percent of companies require good knowledge of English, or value candidates that are familiar with a second foreign language.

Both manufacturing and service companies are hiring professionals in the area of operations management with the expectation that they will be engaged with leadership activities in the organization. This was expected, considering that all ads we analyzed were for positions that required college education.

For about 25 percent of the listed operations management topics, a statistically significant difference was observed in the relative frequency they were demanded in the advertisements of manufacturing and services companies. This is in accordance with our expectations: manufacturing companies have shown more concern with production and process management, and with systems that support such activities. They are also more interested than service companies are in managing quality, standardizing processes and measuring work improvement. As they deal with inventories, they are also more concerned with the implementation of lean production. Service companies, in turn, have shown greater interest in logistics and distribution practices, as well as in project management.

As service operations are increasingly in demand, it is reasonable for managers—and the schools that provide their formal education—to reflect on the emphasis they give to the operations management topics that are more important to service companies. The need for training in these areas will continue to grow together with the trend of an increasing percentage of work migrating to the service sector.

Despite the revealing results, this study presents some limitations that reduce the power of its conclusions. There is some degree of subjectivity in the interpretation of the contents

of the analyzed ads. In order to reduce this problem, the authors who did the tabulation of data marked the situations for which there were some doubts about the classification, discussing them with the other author, until they reached a consensus on the best way to classify each one. Fortunately, there were very few cases where this was necessary. Another limitation is the use of vacancy offers in ads (current demand) as a proxy for the activities and knowledge valued by organizations. While this is certainly true for the short term, there is no guarantee that it will extend over time, especially if companies are experiencing some adjustment due to changes in the business or technological environment. In these situations, knowledge and skills associated with activities not affected by the adjustment, and which are already available in the organization, are momentarily demanded in different amounts than those which are not available, so that their valuation would not be captured by the methodology here employed. Although this may happen, it is understood that the knowledge and skills demanded in the job posting announcements reflect what companies need, otherwise they would not seek professionals that have them. As mentioned earlier, the use of a relatively large sample size allows an unbiased result to be obtained. Interviewing executives, recruiters, job seekers and newly employed professionals could represent a natural way to further the present research, contributing to deepening the discussion on the importance of the operations management themes to organizations in the field.

The discussion about the importance assigned by manufacturing and service companies to the topics of operations management is crucial for not only the results obtained, but also to stimulate the debate on topics that comprise or should comprise the body of knowledge of operations management, and the way they are incorporated into business practice. This provides an additional opportunity to reflect on the potential of operations management in supporting business managers now and in the future.

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