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Operations research/management science tools for integrating people with disabilities into employment. A study on Valencia's Sheltered Work Centres for Disabled

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Abstract

People with disabilities have a right to a full life in every sense and one of those fundamental rights is the possibility to work. In this paper, the importance of social employment integration of disabled people is highlighted as one of the stakeholders to be satisfied by companies in the new framework that corporate social responsibility is constructing. The objective of the paper is to revise the benefits of some well-known operations research/management science tools that, if applied correctly, have a double positive impact on work accessibility and improved productivity. The responses collected from managers of Valencia's Sheltered Work Centres for Disabled by means of a structured questionnaire are used to analyse the level of implementation of these tools and their impact depending on the type of centre, the kind of disability and other structural variables.

Keywords: corporate social responsibility; operations management; disabled workers

1. Introduction

In recent years, the concept of corporate social responsibility (CSR) has extended its scope and consistency. Thus, international references such as Michael E. Porter and Mark Kramer (2002, 2006) propose that there is a convergence point between pure philanthropy and pure business where all interests coincide positively in both social and economic terms. In this sense, CSR has to move away from philanthropy, towards the integration of the social and environmental concerns into company management strategies and models.

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Within operations research, where Decision Theory has traditionally been developed, various researchers are starting to propose Multicriteria Decision approaches where the function to optimize focuses not only on business *profits* but also on the objectives of other *stakeholders* (see, among others, Wenstøp, 2005; Rauschmayer, 2005).

In this sense, Schneeweiss (2000) attributes to operations research, as an applied science devoted to the resolution of decision problems, the responsibility to introduce moral norms into decision-making strategies, either at the company level or at the consultant/analysis level. For Gallo (2004), responsibility means "considering the effects of what one is doing, whether in the short or in the long term, whether geographically near or far, whether on people or on nature; it also means considering and respecting the dignity and the value of all people whose lives are or might be affected by one's actions and decisions". This "principle of responsibility" suggests that in our role as decision makers, not only should the specifications of the client be taken into account but also those of the other stakeholders, that is, all those who might be affected, either directly or indirectly, by the results of our decisions.

This last consideration, clearly synthesized in Gallo's definition, obviously introduces more complexity in the managers' task because, according to this, a solution to a business problem should now not only involve maximizing profit but also finding the best tradeoff that globally satisfies all stakeholders involved in the process.

In this paper, we focus on one of the stakeholders who need more attention within the scope of CSR: disabled workers and their social–employment integration. There are many ways to be socially responsible and, without any doubt, one of them is to help disabled people have equal working opportunities. But for this, companies need to adopt certain CSR practices that should be defined, and whose potential is not always clearly understood by many managers.

1.1. Objectives and structure of the article

With this in mind, the objective of this paper is to revise the benefits of some well-known operations research/management science (OR/MS) tools that, if applied correctly, have a positive impact on accessibility to work and improvement of productivity. This analysis proposes management strategies that help to achieve social–employment integration in the most efficient manner possible, thus allowing the incorporation of CSR practices in companies.

The structure of the article is as follows: in the next section, institutional progress on social–employment integration of the disabled is described, and then we detail the reasons why we consider the integration of the disabled as a key component of CSR. Once this is done, we summarize the important role played by *Sheltered Work Centres for Disabled* (henceforth, SWD) in Spain in the last decades. Some important comments about SWDs' integration model and their philosophy are presented, in order to understand the environment in which our empirical survey has been carried out.

Section 4 highlights the main findings of the survey, whose aim is to measure the level of implementation of some well-known OR/MS tools and their real impact on SWD management models and strategies. The survey is based on responses collected from SWD managers using a structured questionnaire, and the more significant results are analysed and compared with the OR/MS tools under study, previously explaining the methodology used. The results are discussed in Section 5 and, finally, in Section 6, general conclusions are drawn and further research lines are proposed.

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2. Social–employment integration of disabled workers

2.1. Institutional progress in CSR

From the point of view of employment, the term "disabled person" refers to those people whose possibilities to obtain and maintain a suitable job and to progress within that job are remarkably lower due to a mental or a physical deficiency (Lopez Pino and Seco Martín, 2005).

In the last decades, the legal frameworks and regulations for the disabled have been significantly modified. Many governments have implemented policies aimed at promoting the right of the disabled to integrate as fully as possible in society. In this sense, social and employment integration of the disabled has received special attention in most international regulations, e.g. the Universal Declaration of Human Rights, the Charter for the 1980s from Rehabilitation International, the Program for Worldwide Action from the UN in 1988 or the European Social Charter in 1981.

Since 1990, social responsibility has found increasing interest in the literature. Although in certain forums there are doubts as to whether this boom is just a passing trend, certain indicators reveal that we are facing a real change of paradigm in which companies are seen as responsible for something more than merely obtaining maximum profit (Guthey et al., 2006).

In the field of disability, the second global report 2007 about Discrimination, presented as part of the International Labour Organization (ILO) Declaration relative to the fundamental workplace principles and rights (ILO, 2007), suggests that governments and companies adopt non-legislative regulations (not as social well-being policies, but as a question of human rights and social integration). Additionally, it proposes that active policies, actions and programmes about labour markets should combat discrimination against workers with disabilities in three ways: (1) via the formulation of policies and regulations against discrimination in the workplace; (2) via an increase in the opportunities for people liable of being discriminated to find a job; and (3) via an improvement of the hiring procedures in public and private sectors.

But despite the considerable legislative efforts made by multiple national and international institutions, total social–employment integration of people with disabilities still seems far away. This fact confirms the perception that the solution has to come not only from legal regulations via governmental measures but also by overcoming the prejudices about the capabilities of the disabled, and by the genuine commitment of companies to include integration programmes in their operation strategies and models. Furthermore, the incorporation of disabled people into many productive activities generates added value to a company, as well as to society as a whole.

2.2. Why should the integration of the disabled be a key component of CSR?

Together with the possible strategic advantages, we also have to consider the ethical demands, that is, those reasons not based on increased economic benefits that push us towards a responsible management model: (1) People work in a company and their dignity should be respected. Respect of people's dignity and the avoidance of instrumentalization or manipulation is an unconditional ethical requirement. (2) The impact that the company has on many people's lives is high, and cannot be taken lightly. In the same way as we as people have a moral responsibility for our actions and have to

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respond to the damage we can potentially do, companies must also be responsible for the consequences of their actions (Goodpaster and Matthews, 1982). (3) The company is a very important social agent. Placing company against society is a mistake. The company should not be positioned against society; it exists within it, and as a social institution it plays a role in the solution of social problems. We must demand from all social institutions a greater contribution towards a fairer society (Cortina, 1994; UN, 2008; Sen, 2003).

As has been well systemized by Porter and Kramer (2006), there are four main lines of argument for the development of CSR: moral obligation, sustainability, license to operate and reputation. All these considerations are well contrasted, but in our opinion, what is lacking is a rigorous discussion on the question of whether one responsibility is more legitimate than another; that is, whether we can decide which CSR strategies should be placed over the others. Our justification to consider the integration of the disabled as a key element of CSR comes from the supposition that priority should be given to the requirements of justice over those of strategic convenience. In our opinion, there are two fundamental arguments for considering the insertion of the disabled as a key element of CSR:

- Expansion of capabilities: Nobel Prizewinner for Economics, A. Sen, affirmed that genuine freedom demands the expansion of people's capabilities to live a life they have reason to value (Sen, 1985; Terzi, 2005), and this has a clear and close relation to this topic. If we want to increase people's freedom, we have to expand their capabilities; this is particularly important in the context of disadvantaged people, in which social–employment integration is of paramount importance.
- Importance of the topic of disability for the quality of life of millions of people: authentic CSR has to put people in the first place, and its effects on the quality of life of those affected. Without falling into a utilitarian interpretation, it seems obvious that the number of people whose quality of life would be directly or indirectly improved if companies developed good integration practices for the disabled could be many millions worldwide.

These considerations, together with those mentioned earlier, illustrate the great importance of social–employment integration of the disabled in the new CSR framework, and as active *stakeholders*, companies should also take this into consideration.

Once clarified *why* social–employment integration of the disabled should be a priority as a stakeholder of companies, we will analyse *how* this integration should be tackled. Thus, the following paragraphs will describe through an empirical study which integration strategies have been implemented so far and their weak points, and we propose tools that, when correctly applied, allow us to meet these stakeholder needs with no loss of efficiency. But before this, it is necessary to describe the scenario of our study: the Sheltered Work Centres for disabled.

3. The Sheltered Work Centres for Disabled in Spain

3.1. Introduction

According to the Survey on Disability, Impairments and Health Status of INE (INE, 1999), in Spain about 9% of the population has some form of disability, with much higher unemployment

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rates than the rest of the population. In this scenario, SWDs represent a protected employment formula that has contributed significantly towards reducing the unemployment rates among disabled workers in Spain.

Although these centres receive institutional support, the basic objectives of SWDs do not considerably differ from the objectives of a conventional company. The singularity of sheltered work lies in the fact that it is specifically addressed to those people who, due to their particular characteristics and market possibilities, find difficulties in integrating into the workplace, although their ultimate goal is that the disabled gain sufficient abilities to make their integration in a conventional company possible. Thus, SWDs have a double function: on the one hand, that of allowing the disabled to work on a temporary or regular basis, depending on the type of disability, and full integration and, on the other hand, that of serving as a platform so that the maximum number of workers acquire sufficient skills and abilities to integrate into a normalized work framework.

In recent years, there has been a notable development of this type of centre. In 1995, there were only 137 SWDs in Spain. Today, the number of SWD centres has increased to 1700, with 43,000 disabled people working in them. The reason for this is quite simple: in Spain there is a quota of 2% jobs reserved for people with disabilities, like in other countries. But not only did the majority of companies fail to fulfil this quota, but so too did most public administrations. In view of this relative disaster, in the year 2000, some "alternative measures" were taken, e.g. companies that did not integrate this 2% could: (1) sign a supply or service contract with an SWD or with a self-employed disabled worker and (2) make donations and sponsor integration actions.

The implementation of these measures showed the lack of awareness from companies of how necessary the integration of these workers is, and also the disinformation about the facilities available to facilitate integration. A positive side effect has been the spectacular growth of these centres all over Spain, successfully integrating people with physical, mental and/or sensory disabilities, significantly contributing towards reducing the unemployment rates. Despite this fact, this boom has not received due attention by, among others, the academic community.

3.2. *Model and philosophy of the SWDs*

In our opinion, it is in conventional companies where the true social–employment integration of the disabled should take place, because the SWDs effectively provide work to these people, but do not contribute so much to societal normalization. In this sense, to fully integrate disabled workers in conventional companies would doubly contribute to this normalization: on the one hand, those who are integrated as part of the staff of the company, with the subsequent benefits for them, and on the other, the fact that the workers without disabilities perceive as normal a heterogeneous working environment where all workers, with or without some form of disability, undertake the most appropriate tasks according to their abilities and capacities. With this, we do not intend to defeat the considerable contribution of the SWDs, but if the efforts to provide work to these people come only from these centres, the gap between normal workers and those with a disability becomes greater, relegating the latter to work centres.

On the other hand, the underlying philosophy of the SWDs is far from the traditional stereotype that considers those with disabilities as "*incapable*" of developing a permanent

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professional work. In fact, many of these disabled workers can adapt perfectly well to the working day and timetable of a conventional company and tend to show a high motivation due to their great desire to demonstrate their worth, because on many occasions from an early age they suffer tacit marginalization that limits their evolution. In fact, due to their great desire to exceed expectation, their work efficiency increases with the passage of time, on occasion surpassing that of workers without disability (CSREurope, 2007 – *DuPont* case). In the case of workers with mental disabilities, the prejudice is even more marked. However, these workers can perform professional tasks that do not require complex intellectual knowledge, a high level of abstraction or complex instructions. This last point fits well with the division of simple tasks typical of assembly lines, these being one of the tools whose potential is analysed in the next section.

In summary, it can be said that SWDs are institutions that compete in real labour markets and therefore: (1) need to be efficient and competitive, not only for their survival but also to be able to grow (thus promoting new jobs) and (2) these centres need to ensure social–employment integration for the people who work there, taking into account their limitations and aiming to achieve a positive evolution in their capabilities and capacities. The combination of both objectives demands some efficient management tools based on multicriteria approaches, within the stakeholder philosophy mentioned in the Introduction.

4. Empirical research

4.1. Introduction

Our survey analyses the SWDs of the Valencian Region. In Spain the role of the SWDs is not easy, but in the case of Valencia's SWDs there is an additional factor: they are small and medium enterprises, working primarily as subcontractors or suppliers of conventional companies. This is why their goals focus on reducing costs and increasing productivity in order to provide a quick response to their customers within the stipulated quality parameters. To survive in a competitive market, this is the only way to achieve the main goal of the SWDs: to grow and promote the integration of a greater number of people with disabilities into quality jobs.

It is therefore necessary to develop and implement *best practice* in the strategies of the SWDs, that is, the manufacture of products with an excellent assembly quality and the lowest possible cost and with an efficient delivery time. To achieve this in a conventional business is not simple, but in the scenario under study, the high heterogeneity of the workers makes this task even more complicated, and therefore requires new management models and approaches.

In recent years, there has been an initial academic interest (Chi, 1999; Hasegawa and Katayama, 2000; Colella, 2001; Katayama, 2001; Katayama et al., 2001; Katayama and Hwang, 2008) in analysing the most suitable management techniques in environments with people with disabilities. In this sense, our research work analyses the OR/MS tools that have been shown to be most efficient and how these tools can help improve work accessibility in SWDs, based on the fulfilment of CSR; that is, efficient employment integration of disabled workers in SWDs or even in those companies that could operate as direct employers.

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4.2. Objectives

After almost a decade working with Valencia's SWDs, the authors have implemented a number of innovative proposals, based on intuition about which decision tools could be more efficient for this double purpose of enhancing productivity and improving accessibility to work, having obtained some good results (see Miralles et al., 2003a, 2005, 2007, 2008 or Canos and Miralles, 2007).

At this point of the research, we thought it would be appropriate to carry out a rigorous analysis of the current status of the Valencian SWDs, so as to gain an objective view of the real impact of the decision tools. The research covers most of Valencia's SWD centres, and analyses the level of implementation of OR/MS tools and their impact through conventional parameters relative to production efficiency and specific parameters relative to work accessibility. The main objectives can be summarized as follows:

- To promote *best practice* in the management strategies used with employees, equipment and materials.
- To reflect on the situation of the SWDs and possible ways of improvement.
- To have a useful list of *best practices* for production management and human resources (HR) in SWDs.
- To look for the correlations among the characteristics of the enterprises and the best use of the OR/MS tools, especially focusing on *lean production* tools.

4.3. Methodology

The survey was conducted in the form of personal interviews, as there were some questions that required further clarification. This also allowed us to explain the importance of the research to the centre managers. At each SWD, the questionnaire was passed, at least, to either the manager or the production officer. In some cases, the questionnaire was answered by two managers, then taking the average value of the answers.

4.3.1. Sample and measures

In this study, we analysed 48 of Valencia's SWDs (>40% of the total SWD centres in the Valencian Region), including companies that work in different industrial sectors and deliver products and/or services. The fieldwork was carried out during the year 2007 using a questionnaire comprising 192 questions divided into four groups:

1. Control variables: data about the company, its structure and its industrial sector.
2. OR/MS tools and their level of implementation in the company.
3. Competing priorities of the company.
4. Results obtained through certain indicators.

The answers were then used to draw the most significant correlations and identify the type of OR/MS tool that best suits each company depending on the type of business, disability and/or priority. Because of space constraints, this paper will only describe the first two groups (control

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variables and tools), whereas the relationship between competing priorities and the results obtained by the SWDs will be analysed in future works.

4.3.2. Control variables

When analysing the relationship between the type of business (characterized by the so-called control variables) and the use of OR/MS tools, the companies had to be grouped into the smallest possible number of statistically valid sets. For this, the responses of the control variables were assigned values 0 or 1. Table 1 illustrates some examples.

4.3.3. Analysis of tools

For the tools group, the answers relative to the same topic were aggregated into a single variable. In such a way, more reliable information on the degree of knowledge and implementation of each tool is obtained. A total of 18 tools were analysed (Table 2).

4.4. Results of the survey: control variables vs. OR/MS tools

This section presents the most relevant findings about the relation between the control variables and the OR/MS tools obtained from the ANOVA analysis. The use of the tools is rated on a scale from 0 (not used) to 5 (widely used), while the control variables use a 0–1 scale. This allows detecting more easily whether the item analysed relates to a greater or a lesser use of the OR/MS tool.

Table 1
Examples of control variables aggregated to 0–1

Technology used	0	Less advanced	Decision making structure	0	Decentralized
	1	More advanced		1	Centralized
Demand variability	0	Unpredictable	Workers salary	0	SWD agreement
	1	Predictable		1	Higher than agreement
Productive capacity use	0	Low	Number of workers with a fixed	0	Low
	1	High	contract	1	High
Products innovations frequency	0	Low	Intensity of competitive rivalry	0	Low
	1	High		1	High

Table 2
Tools analysed

Production programming	Line balancing	TQM – Total Quality Management
Design for manufacturing	JIDOKA	Knowledge management
Operations technology	TPM – total productive maintenance	Human resources in manufacturing
Kanban	Standardized operations	Management of the supply chain
SMED	Five S	Salary (variable)
Work cells	Visual factory	Staff training

SMED, single minute exchange of die; JIDOKA, automation with a human touch.

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4.4.1. Production scheduling

From the 48 companies surveyed, 28 have a production scheduling tool for determining the allocation of resources and quantity of goods to produce. The use of techniques associated with production scheduling has a value of 2.607 out of 5. This means that, in general, these tools are known and moderately used, although there is still room for improvement. For example, the companies that programme their production do it on a regular basis and on all products (3.661 out of 5). However, production levelling is less widely used (1.732 out of 5), with a huge potential for improvement.

There are two general statistically significant conclusions obtained from the ANOVA analysis related to the number of workers and the type of disability of the employees (Table 3).

The first conclusion is logical because the higher the number of workers, the more complex the management tasks and, therefore, the more necessary the use of standard programming tools. Regarding the type of major disability of the employees, the only possible explanation is that the companies with workers with mental disabilities are mostly devoted to repetitive jobs. For this reason, Production Scheduling is more widely used than in other cases.

4.4.2. DFM – design for manufacturing

Only 10 companies from all SWDs surveyed design the products or services they offer. The efficiency of the design process in these companies has been valued 2.263 out of 5. Only the following correlations are significant (see Table 4).

Larger companies obtain better design values than smaller ones. This may be due to company size, as large companies require increased efficiency in all procedures to avoid management problems, while small companies tend to be more informal, which do not affect them in their daily work.

Table 3
Results of ANOVA for "production scheduling"

	Number of workers		Major disability of employees		
	Few	Many	Physical	Psychiatric	Others
Scheduling					
N	12	16	15	12	1
Average	2.014	3.052	2.256	3.264	0

Table 4
Results of ANOVA for "DFM"

	Number of workers		Do you manufacture?		% new products	
	Few	Many	No	Yes	Low	High
Design						
N	7	3	3	7	3	7
Average	1.821	3.292	1.250	2.696	3.292	1.821

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Generally, companies that design and also manufacture obtain better results, probably due to a better knowledge of the products. Also, young firms or companies that frequently change the products they offer obtain worse results in product design. This may be related to the lack of experience in some cases and to the typical rush process in others.

4.4.3. Operations technology

The use of technology in production is particularly low in Valencia's SWDs, with an average of 0.652 points out of 5. In addition, the use of technology is not particularly high in any specific area: production, storage or management (ERP or MRP). This is mainly due to the fact that most SWDs tend to have manual rather than automated tasks that require many workers, and where investing in technology sometimes means reducing human resources, which is not desirable.

In fact, this assumption is reinforced by the only significant correlation in this section: the percentage of workers with fixed contracts is lower in those companies that use more technology.

4.4.4. Manufacturing control through Kanban

Kanban cards are hardly used in Valencia's SWDs. It has obtained an average score of 0.891 out of 5. A deeper analysis shows that the managers of these companies are aware of the benefits of flexible manufacturing (2.172 points). However, the technique of Kanban cards is unknown by most SWD managers as a method of controlling production and materials.

4.4.5. Preparation of machines: single minute exchange of die (SMED) techniques

Among the companies that manufacture or assemble, the concern to reduce setup times is considerable (2.422 points out of 5). Nevertheless, they do not know and do not apply the SMED techniques (1.266). The most significant relationships from the ANOVA analysis are shown in Table 5. Companies that manufacture standard products, and do not offer services, and that schedule production, are those where SMED techniques are more often applied.

4.4.6. Work cells

The cluster of machines by products in order to reduce the displacement of materials is a very general action in Valencia's SWDs (3.234 points out of 5), indicating a single meaningful relationship: the companies with the largest number of product sets are more concerned with the grouping of machinery into work cells.

4.4.7. Line balancing

The concern to balance well the workload among those SWDs dedicated to manufacturing/assembling is high, because the average is 2.586 points. Furthermore, according to the ANOVA analysis, this concern is particularly significant in firms with a certificate of quality. Furthermore, as shown in Table 6, line balancing is more often used in those companies with many employees

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Table 5
Results of ANOVA for "SMED"

	Do you schedule production?		Products customization		Do you offer services?	
	No	Yes	Standard	Customize	No	Yes
SMED						
N	9	23	15	17	20	12
Average	1.544	2.765	2.933	1.971	2.830	1.742

SMED, single minute exchange of die.

Table 6
Results of ANOVA for "line balancing"

	Do you offer services?		Number of workers		Do you schedule production?	
	No	Yes	Few	Many	No	Yes
Line balancing						
N	20	12	16	16	9	23
Average	3.025	1.854	1.734	3.438	1.306	3.087

(more concerned about having balanced work loads), which do not offer services (and therefore are focused on production), and that schedule their production.

Concerning the assembly lines, job rotation in SWD is almost mandatory so that workers learn different skills progressively. But in this heterogeneous environment job rotation is more complex as each job change generates an imbalance. In this sense, approaches like that reported in Costa and Miralles (2009) can be very useful.

4.4.8. Automatic defect JIDOKA

Detecting errors as they occur is one of the approaches less widely used in the studied SWDs (1.469 points out of 5), and this fact should be improved. Note that only the larger companies that assemble, but do not export, sometimes use these techniques.

4.4.9. TPM – total productive maintenance

Machine maintenance is generally contracted outside in Valencia's SWDs. The global score for this variable was 2.083, which is not very high. Maintenance is never delegated to the operators who handle them, independent of the type of disability.

This fact, together with those described in section 4.4.14, confirms the perception that there is a lack of confidence in the disabled workers, and it is not usual to delegate complex tasks to them.

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4.4.10. Standardized operations

There is a moderate concern on standardized operations. From the three questions related to this issue, only the one related to the participation of operators in the standardization process (1.958 points) gets a low score.

The ANOVA analysis indicates certain relationships: work is more standardized in companies that schedule the production and have a high number of employees with fixed contracts, and obviously in companies that offer standard products (Table 7).

4.4.11. "Five S" and visual factory

The importance of tidiness and cleanliness is very high (3.740 out of 5). This confirms the evidences that the authors found in some previous experiences with Valencia's SWDs (Miralles et al., 2003b). In a more detailed analysis, 5S is more frequently used in companies assembling products, not exporting, and with customized products.

However, Visual Factory techniques, very similar to 5S, are hardly applied, with an average score of 0.561 points. In fact, most SWD managers have never heard of these techniques.

4.4.12. TQM – total quality management

The questions about "Total Quality Management" were divided into three areas: involvement of the management staff; involvement of the operators; and use of statistical control for processes. The scores in the first two areas are high: 3.563 and 3.349 points, respectively. However, the use of statistical control is low. This may be due to the lack of statistical knowledge and training of most SWD managers. In terms of significant interactions, TQM is more widely used in those companies that have certificates of quality, those offering standard products, dealing with unpredictable demand, with many employees, assembling products and scheduling production. Most of these direct relationships are logical.

4.4.13. Knowledge management

Knowledge management techniques are hardly ever used in SWDs (1.302 average out of 5). In SWDs with mentally disabled employees, knowledge management approaches were not possible due to their intellectual limitations. The size of most Valencian SWDs could be another reason for these low figures.

Table 7
Results of ANOVA for the Tool "standardized operations"

	Products customization		Do you schedule production?		Fixed contract employees	
	Standard	Customize	No	Yes	Low	High
Operations standardizing						
N	19	29	20	28	22	24
Average	2.982	2.034	1.733	2.893	2.061	2.750

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4.4.14. Human resources in manufacturing

The answers given to questions related to human resources management in the area of manufacturing have been globally high, with 2.659 points out of 5. In particular, the questions related to direct communication between management and employees have better scores (4.594 points and 4.0625 points).

By contrast, those questions evaluating the responsibility delegated to employees have lower scores (1.490, 1.510 and 0.667). Therefore, we can conclude that there is good communication but the decisions follow a top-down approach in a typically hierarchical atmosphere.

4.4.15. Supply chain management

The answers to questions related to the supply chain have an average of 2.597 out of 5. But when the question refers to whether they establish long-term relationships with customers, the score is 4.219. This is because many of Valencia's SWDs depend on one company, which is often their only customer with a strong dependence.

In this area, the ANOVA showed that companies offering customized products, with mentally handicapped workers, that schedule the production, and those that were founded a long time ago, have a closer relationship with customers and suppliers.

4.4.16. Variable salary

Valencia's SWDs do not usually employ variable salary approaches to reward and motivate their employees. The average score is 1.313 points out of 5.

4.4.17. Staff training

The SWD managers have shown concern for employee and team leader training. The result has been an average of 2.932 points out of 5, those companies with advanced technology being more involved (which is logical, since to handle this technology more qualified and advanced training is required and renewed periodically), and those that produce on demand (employees should be better trained to meet the challenges of the market) (Table 8).

Table 8
Results of ANOVA for "Staff training"

	Technology		Number of workers		Work orders		
	Less advanced	More advanced	Few	Many	On demand	Mass production	Both
Staff training							
N	11	37	24	24	30	9	9
Average	2.227	3.142	2.510	3.354	3.225	1.722	3.167

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In addition, like with other tools, larger companies better know and apply the theoretical knowledge on lean production tools, mainly because they have more funding for training courses.

5. Discussions

For a better understanding of the values shown in the previous section, these data are compared with information from previous studies. In the literature, two studies (Bonavía Martín and Marin-Garcia, 2006; Marin-Garcia et al., 2001) on outstanding industrial sectors in Valencia also address the use of lean manufacturing tools, and use similar statistical scales, so that the results are comparable for certain tools.

On the one hand, Bonavía Martín and Marin-Garcia (2006) analyse the implementation of the most representative lean production practices in the Spanish ceramic tile industry (which has one of the most important clusters worldwide in the north of Valencia, especially in the province of Castellón). The general conclusion is that the use of lean production tools in the tile industry is as low as it is in SWD. We can only highlight a small difference with the use of total productive maintenance (3.93 in the tile industry, and 2.083 points in SWDs).

On the other hand, Marin-Garcia et al. (2001) analyse the use of lean production tools in the Spanish auxiliary automotive industry (using a Likert 1–5 scale similar to our scale). This is the industrial sector where lean production practices are more widespread (Shah and Ward, 2007); therefore, the overall results are better than ours in SWDs. Despite this, we can observe certain similarities in some of the variables. For example, Valencia's SWDs have an average value of 2.597 in supply chain management, which is not bad, considering that the average score in the Spanish automobile industry is 3 out of 5. Also, for variable salary, the average score in SWDs was supposed to be low (1.313), but compared with the automobile industry, only 8% of these companies used variable salary (with a score of 2). Hence, although the overall level of use of OR/MS tools by Valencian SWDs seems to be low, this situation is similar in conventional Spanish small and medium-size enterprises.

Finally, from our interviews with SWDs managers, we perceived some differences among the SWDs. In some SWDs, the managers have almost no knowledge of operations management. Their priorities are exclusively social and could survive only with subsidies from the government. In general, these companies accept any kind of work, usually manual with low added value, and they only compete by offering lower prices. These centres do not seem to have very long life expectations, and their strategy often only focuses on obtaining financial aid.

On the other hand, there are many other SWDs whose managers have a clear aim: the centre should satisfy some specific needs of the market better than their competitors. Their managers often have experience and accept only orders that can be delivered within deadlines and with the appropriate quality. They seek to specialize in a particular field, with the aim of optimizing the working methods and trying to assign the task that best suits the characteristics of every worker. These SWDs often last longer and are very efficient at integrating their employees with disabilities, and simultaneously fulfilling their social aims.

The verification of these perceptions through some specific empirical study is one of our further research lines, which will give us more valid and interesting conclusions.

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6. Conclusions

In this paper, a brief review of CSR has been presented, followed by an analysis of the current status of social–employment integration of workers with disabilities. Then some considerations have been described that support the idea that CSR needs to include, as a priority, those people with disabilities as stakeholders.

After explaining why social–employment integration of the disabled should be a key component of CSR, we show how an appropriate design of the production systems can integrate many people with disabilities, overcoming certain existing prejudices, and thus even increasing productive efficiency by the implementation of OR/MS tools. These tools have been implemented mainly in Sheltered Work Centres for Disabled, but also conventional firms should be aware of their great potential.

These tools can help to achieve the objective of "work models under the concept of Social Responsibility that include in their codes of conduct the fulfilment of initiatives for contracting people with disabilities as well as for their promotion in the posts they obtain" (De Lorenzo, 2004). The survey carried out illustrates how some OR/MS tools can greatly help to achieve this goal.

Our future research will focus on the design of valid global methodologies for the practical application of our philosophy, based on CSR within the scope of disability by efficiently implementing the OR/MS tools with impact on accessibility. Another research line will be to observe the importance of the supply chain as a multiplier of these attitudes in companies, demonstrating the positive benefits brought about by CSR. Finally, it will be necessary to analyse which OR/MS tools are the most appropriate depending on the type of disabilities.

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