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## Identifying Critical Success Factors in continuous improvement Projects in a steel company

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### Abstract

Quality management involves a constant effort of continuous improvement. Since continuous improvement actions are carried out uniquely, it is convenient to manage them as projects. Identifying the Critical Success Factors (CSFs) of continuous improvement projects and how they are perceived by the people directly involved in their management is of vital importance to be able to optimise human and material resources when prioritising actions and to be able to implement measures to ensure the success of these projects. Knowing the presence or absence of these success factors and how they are perceived within the organisation by those who manage them is an analysis tool that can be used by senior management to anticipate the failure of continuous improvement projects and to prioritise those factors perceived as weaker within the organisation. For this purpose, a structured survey was carried out with the managers of the continuous improvement projects to find out their opinion on which factors they believed to be most critical when developing these projects and to find out how often they thought they occurred in the past.

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## 1. Introduction and objectives

Continuous improvement is an essential element in industrial organisations. Whatever the system or methodology on which continuous improvement initiatives are based, they should be developed by a team of people over a certain period to achieve the desired improvement within a product, process, or service. This definition is very close to the definition of a project provided by PMBoK[1]; sharing the concepts of effort, temporality, and creation of a new product, service or result. As in the case of projects, concerning portfolio management, to translate corporate strategy into concrete actions it is necessary to implement continuous improvement projects aligned with the guidelines set out by senior management [2]. The concept of continuous improvement is linked not only to product improvement or work improvement but also requires the implementation of methodologies involving the whole organization or a large section of it, parts that already participate in the processes managed from continuous improvement [3] where excellence is sought [4–6]. Despite the important role that continuous improvement has within the different management methodologies such as Lean Manufacturing, Six Sigma, Balanced Scorecard, or other hybrid systems, some authors [7] argue the lack of a specific theoretical framework acquiring some mentioned characteristic methodologies or others [3,8,9]. To carry out continuous improvement projects properly, an adequate development framework is required. According to some authors [10], there are three types of routines for which the concept of continuous improvement can be internalized throughout the company: those dedicated to maintaining the execution of current processes, those dedicated to improving existing processes, and those for developing new processes [11]. These routines, understood as the way things are done within an organization [12], can be reinforced with a series of actions following a cyclical process, based on the diagnosis provided by the tools used in the behavioural model, visualization of the next steps to be reinforced, implementation of necessary changes and review and repetition of the organizational model [13].

Moreover, the concept of CSF introduced in the early 1960s is defined as “the limited number of areas in which satisfactory results will ensure the successful and competitive performance of an individual, department or organisation” [14]. Other authors define CSFs as “important influences that contribute to the success of a project” [15]. This concept can also be applied to continuous improvement projects, so CSFs are variables or factors that managers should be controlling and prioritizing to achieve the objectives in the different areas of activity [16], or inputs to the management of a project that should lead either directly or indirectly to its success [17]. It is important to know which are the CSFs to increase the chances of achievement of projects, to be able to anticipate the possible effects that these factors could have, and to be able to manage them adequately [18]. In this sense, continuous improvement projects are no exception. Many authors have tried to identify potential CSFs when implementing different continuous improvement methodologies, as shown in [19,20]. Regarding the presence of CSFs in Kaizen projects, in a literature review it was found that 18 authors identified more than 21 activities in the execution of this type of project in the Mexican industry [21].

In addition to the similarities observed in Lean, Six Sigma, and the Lean Six Sigma hybrid system, up to 7 CSFs shared by these methodologies are identified: management commitment, education and training of the people involved in the projects, communication within the team, customer orientation, culture within the organisation, staff participation, and teamwork. However, after reviewing the related bibliography, there is clearly a lack of consensus within the scientific community when defining in detail which CSFs are linked to continuous improvement projects. In this sense, the set of factors considered by each author is very comprehensive and diverse. Some of these factors appear repeatedly and are assessed in various ways. Moreover, the acquired experience of project stakeholders can be the basis for knowing which aspects to consider in the enhancement of continuous improvement management methodologies. Their vision is more subjective than that of the researchers and practitioners and lacks a theoretical structure, but their closeness to the reality of these processes makes their contribution especially valuable. With all this in mind, the objective of this research is to identify the critical factors for success in continuous improvement projects based on the experience of a specific role of stakeholders involved. To ensure a theoretical structure, the process of collecting information is based on the most common factors extracted from the literature review. The set of experts considered will be asked to evaluate their relevance.

This paper is organized as follows: in section 2 we present the methodology: selected CSFs, how they have been grouped to be used in both questionnaires, their importance and frequency and the Likert scale used. In section 3 we present the results of both questionnaires, and finally in section 4 we expose the case study conclusions.

## 2. Methodology

The case study considered corresponds to a multinational company based in the North of Spain, established more than 50 years ago. The company has a quality management system based on the ISO9001 standard with an emphasis on continuous improvement. Continuous improvement activities are developed as projects with an ad-hoc work team in which a member of the Continuous Improvement Department (change agent) is always involved to provide support to project managers throughout the project. These continuous improvement projects start and develop under the guidelines of a methodology that marks how to choose the team members and carry out the work. The improvement actions can originate top-down or bottom-up. Depending on the kind of problem to be solved, the methodology establishes a schedule of activities with a fixed deadline. These projects are short-term, around 12 weeks. This approach to continuous improvement has been in place for more than eight years, so there is a lot of accumulated experience.

Concerning the team, all its members work part-time on the project, including the project manager. In all cases, the project manager receives the support of a change agent to define the scope and objectives, to follow up on the fulfilment of tasks, to meet deadlines, and to manage the different tools, as well as to choose and use the available continuous improvement tools and to train team members to use them. Therefore, project managers have a complete vision of the development of the activity, and are considered the experts who can best assess the CSFs. For this reason, we have extracted information from the expert judgment of the project managers, as opposed to change agents, who have a very partial vision of each project since their focus is on support tasks for project managers or methodological aspects related to continuous improvement, so they do not have an overall perspective. The information was collected using a structured and anonymous survey distributed to all those leading projects during 2019, asking them, based on their prior knowledge and experience, which factors they considered critical to the success of these projects, and how often they believe these factors occur within the organisation on the projects they manage.

To compose the survey, a list of CSFs was selected after a review of the literature. The CSFs chosen were classified into three categories of management for continuous improvement projects:

- **Top Management:** the objective of CSFs in this area is to analyse the projects from a strategic management perspective. It delves into how senior management constantly promotes continuous improvement actions, generating a culture of change (CSF01) reinforced by a policy of reward and recognition for participation in projects (CSF02). Other factors to assess are the commitment to provide these projects with the human, technical and economic resources necessary for their development (CSF03) and how the importance of continuous improvement actions (CSF04) is communicated within the organisation. And finally, a commitment to the implementation of the improvement proposals in this type of projects is essential to maintain the continuous improvement actions over time (CSF05), which must provide leadership in action through awareness and availability of means.
- **Change Agent:** analysis of projects managed under a methodology that sets tasks and deadlines (CSF06) and whose initial analysis is carried out by the department's management or senior management (CSF07). Several tools are used to advance within the different continuous improvement actions developed in the project (CSF08). The methodology sets the actions to achieve the objectives and the execution deadlines (CSF09). In many cases, these continuous improvement tools are new for the project managers and the project team. Therefore, the change agent must train them.
- **Project Team:** this area of management delves into the team itself. Some proposed factors are if it is relevant that the project team is composed of people affected by the problem to target (CSF11) and their commitment to continuous improvement (CSF12). Good communication (CSF13) is also included since many projects aim to solve several departments' problems. Another relevant element is to have team members with the necessary technical skills to appropriately handle the project (CSF14). Finally, having the necessary time to participate in the project is considered (CSF15).

A pair of questions were proposed to project managers for each of the CSFs listed, to assess their importance (Q's) and how often they occurred within the organization (O's). The table below shows the equivalence between each CSF and both group of the questions asked to participants.

Table 1. CSF and interview questions grouped

| Group          | CSF   | Importance questions   | Frequency questions   |
|----------------|---|--|---|
| Top Management | CSF01 Commitment of Top Management to promote continuous improvement                      | Q01 Top Management must provide and activate continuous improvement through constant involvement   | O01 Management has promoted a culture of change   |
|                | CSF02 Recognition and reward policy   | Q02 Participation in the continuous improvement projects should be recognized and rewarded   | O02 Participation in the project has been acknowledged and rewarded                                 |
|                | CSF03 Allocated resources   | Q03 To allocate human, technical, and economic resources   | O03 The necessary human, technical and economic resources have been made available                  |
|                | CSF04 Top Management communication  | Q04 To communicate the results from previous improvement projects to the entire organization   | O04 There has been communication of successes and sharing of best practices                         |
|                | CSF05 Commitment of Top Management to implement best practices for continuous improvement | Q05 Commitment of Top Management to implement the best continuous improvement practices achieved   | O05 There has been a commitment from Top Management to implement improvements practices achieved    |
| Change Agent   | CSF06 Task planning and management  | Q06 Project managers must be able to perform good planning and task management accompanied by the Change Agent                               | O06 The project manager was capable of good planning and task management                            |
|                | CSF07 Defined scope and project objectives  | Q07 The project must have a defined scope and objectives.  | O07 The scope was defined, and the objectives were clear  |
|                | CSF08 Use of the right continuous improvement tools                                       | Q08 Use of the right continuous improvement tools  | O08 The right continuous improvement tools were used to solve the problem                           |
|                | CSF09 Deadlines and deliverables  | Q09 Deadlines and deliverables   | O09 Tasks have been followed up to meet deadlines and objectives                                    |
|                | CSF10 Continuous improvement tools training   | Q10 Receive training in the Continuous Improvement tools used.   | O10 There was training on the continuous improvement tools to be used                               |
| Project Team   | CSF11 Project Team consisting of the personnel affected                                   | Q11 The team must have representation from all stakeholders and be made up of people capable of establishing a suitable working environment. | O11 The Project Team had the right members to solve the problem, capable of working together        |
|                | CSF12 Commitment of the Project Team to continuous improvement                            | Q12 The team must be committed to continuous improvement.  | O12 Project Team committed to continuous improvement  |
|                | CSF13 Interdepartmental communication   | Q13 There must be communication and cooperation with the affected sections or facilities.  | O13 here has been cooperation and communication between the affected sections or facilities.        |
|                | CSF14 Project Team made up of people with the necessary expertise                         | Q14 The team must have the people with the technical expertise to address the problem  | O14 Project Team members with the necessary technical expertise to solve the problem were available |
|                | CSF15 Specific blocked time for the project   | Q15 Specific blocked time should be available for the project to reduce the workload.  | O15 Specific time has been made available for the project, reducing the normal workload.            |

In addition, a block of segmentation questions was introduced in the survey. A Likert scale, graduated in 5 values, was used to know the opinion of the respondents in both blocks of questions, importance of the CSFs and frequency with which they occur in the projects:

Table 2. Likert scale linguistic variables number for alternative

| Linguistic variables / importance / frequency | Not Important at All / Never | Of Little Importance /Rarely | Of Average Importance / Sometimes | Very important / Often | Absolutely Essential / Always |
|---|------------------------------|------------------------------|-----------------------------------|------------------------|-------------------------------|
| Numbers                                       | 1                            | 3                            | 5                                 | 7                      | 9                             |

The anonymously structured survey was then distributed via email to the 89 project managers of the 150 continuous improvement projects carried out throughout 2019, receiving a total of 59 completed questionnaires. It is necessary to point out the homogeneous characteristics of respondents in terms of age, background, and position. All of them usually manage continuous improvement projects and work in a large industrial company with a high degree of maturity in project management.

### 3. Results

Most respondents rated almost all the CSFs proposed as very important or essential, as shown in next table. The result is a distribution totally skewed to the right, towards the highest values of the scale used. Of the total of 59 questionnaires received, the distribution of the answers for each of the blocks is shown below.

Table 3. Distribution of answers

| Linguistic variables | Not Important at All / Never | Of Little Importance / Rarely | Of Average Importance / Sometimes | Very Important / Often | Absolutely Essential / Always | Total |
|----------------------|------------------------------|-------------------------------|-----------------------------------|------------------------|-------------------------------|-------|
| Importance           | 0                            | 18                            | 131                               | 402                    | 334                           | 885   |
| Frequency            | 59                           | 176                           | 280                               | 294                    | 76                            | 885   |

First, we analyse the block of questions whose objective was to determine the importance for the project managers of the CSFs extracted from the literature. It is necessary to highlight the high degree of coincidence of the project managers who participated in the study. None of the CSFs extracted from the bibliography and proposed to the project managers were classified as irrelevant. Very few CSFs were indeed classified as unimportant. Therefore, there is a broad consensus in evaluating the CSFs proposed in the survey as very important or necessary on the part of the project managers.

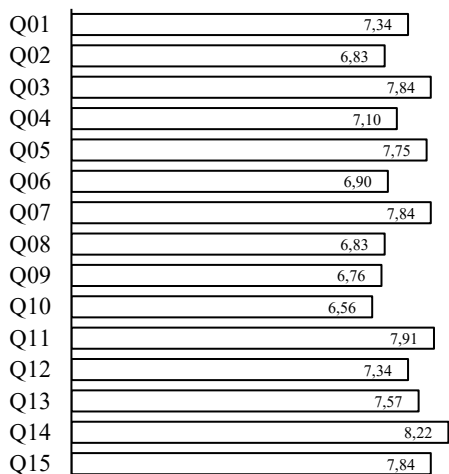


Figure 1 Importance questions mean ranking (Q)

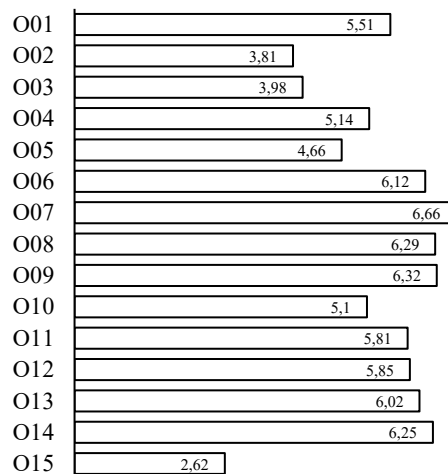


Figure 2. Frequency questions mean ranking (O)

The CSF that receives the highest score is the composition of the team (CSF14); for project managers, being able to count on people with the necessary technical knowledge to address the problem to be studied within the continuous improvement project is the most important of all. On the other extreme, the least valued CSF is that related to training in the use of continuous improvement tools in the development of the project (CSF10).

Next, we analyse the second block of questions, related to the frequency with which these success factors are perceived by project managers. The definition of the scope and objectives of the projects studied (CSF07) is the CSF that receives the highest score. On the other hand, having specific time available for the project (CSF15) receives the lowest score.

Finally, as mentioned above, the CSFs extracted from the literature can be grouped into three management areas. Project managers’ assessment of the different CSFs can be then analysed according to these management areas. Some differences arise by comparing these areas with the blocks of questions related to importance and frequency. The block related to importance shows that project managers consider the CSFs related to team building the most important area. On the other hand, the block related to frequency is the one perceived to be the least frequent for this area. If the analysis is based on the block related to frequency, the results differ. In this case, the project managers believe that the area of CSFs related to change agent involvement is the most frequent. It is necessary to point out how the set of CSFs grouped in this area receive the lowest score in terms of importance and the highest in terms of frequency. It is concluded that there is a contrast between the responses received, depending on whether the CSFs are rated in terms of importance or frequency.

Table 4. Mean by Management Area both groups of question

| Management Area | Mean importance | Mean frequency |
|-----------------|-----------------|----------------|
| Top Management  | 7,3             | 5,3            |
| Change Agent    | 7,0             | 6,1            |
| Project Team    | 7,8             | 4,6            |

#### 4. Conclusions

Despite the limitations of the study, the value of the research lies in turning to the experts who manage continuous improvement projects in order to find out their opinion, delving into what CSFs are essential to them and how often they believe they occur in these types of projects. It can be stated after analysing the results that there is a high degree of agreement among project managers regarding the importance of the CSFs proposed in the survey previously extracted from the literature. On the other hand, the results vary depending on the terms used in the analysis. The CSFs related to the project team are the ones ranked with the highest importance, but, at the same time, they are considered the less frequent to occur. The success factors linked to senior management are perceived as important, although there is potential for improvement according to the perception of the surveyed project leaders. The use of a continuous improvement methodology for several years and the participation of a change agent in the projects to support the project manager seem to influence the perception of project managers. The success factors related to change agents' participation and support are considered by the project managers to be the least important of all. At the same time, they claim these factors to be the most frequent, according to their experience. Given the results, it can be concluded that there is room for enhancement in the management of continuous improvement projects.

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