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Continuous improvement framework to develop cultural change. Case study, capital goods company

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1 Introduction

The globalisation and democratisation of technologies have introduced numerous changes in industrial sectors. As a result, companies have had to improve their performance by enhancing their effectiveness and efficiency in all possible aspects, such as productivity, operations, processes and quality, production costs and waste management (Bhuiyan et al., 2006; Suarez Barraza et al., 2009). The results of implementing continuous improvement (CI) are well documented in the literature (Bhuiyan et al., 2006; Marin-Garcia et al., 2008; Singh and Singh, 2015). However, one of the major challenges that companies face is the development of a CI organisational culture (Achanga et al., 2006; Bateman and Rich, 2003; Kaye and Anderson, 1999; Näslund, 2013). To remain competitive over time, organisations must develop a CI culture by implementing a continuous improvement process (CIP).

The implementation of CIPs in small and medium-sized enterprises (SMEs) is complex, particularly in those that have done so in small or single production batches, which call for flexible processes (Rymaszewska, 2014). Owing to their size, these companies have limited material and human resources, and they lack knowledge. They also suffer heavily in case of market fluctuations, which, in turn, destabilises production activities and leads to reduced involvement in CI by their leaders and managers.

The purpose of this study is to develop a CIP and apply it to an industrial SME. The aim of the developed CIP is to foster an organisational CI culture and help the organisation advance towards high performance in the domain of CI.

This paper is organised as follows. Section 2 explains the theoretical framework, including CI elements, cultural change and the continuous improvement frame of reference (CIFR). Section 3 presents the research methodology, Section 4 describes the developed CIP and Section 5 presents the case study (CS). The results and discussion are presented in Section 6, and finally, conclusions are drawn in Section 7.

2 Theoretical framework

According to Singh (2015), CI adapts to different organisational developments, such as Lean, total quality management (TQM) and kaizen. These methods use different tools to reinforce the concept of organisational improvement. Näslund (2013) notes that TQM, Lean, just in time, Six Sigma and Lean Six Sigma are CI methods. Alhuraish (2016) describes how the application of Lean and Six Sigma tools, such as DMAIC (define, measure, analyse, improve and control), quality circles, visual control, 5S and SMED (single-minute exchange of die), enhances the performance of organisations. Depending on the needs of the organisation, one or the other operative method may be more appropriate (Carnerud et al., 2018; Dale, 1996). In this sense, it has been noted that developing a CIP that encompasses the use of different operative methods for each case, organisation and CI maturity level is needed (Bessant et al., 2001; Theisens, 2015). This study, like many others (Bessant et al., 2001; Garcia-Sabater et al., 2012; Wu and Chen, 2006), identifies the elements that must be considered when designing a CIP. In the present study, 12 key elements have been identified (E1 to E12) to define the CIFR, as shown in Figure 1.

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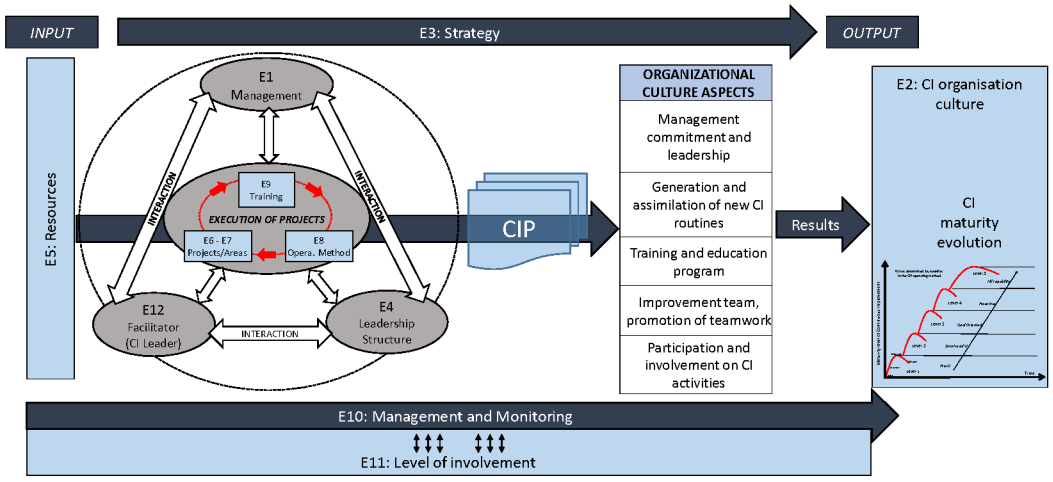

Figure 1. Continuous improvement frame of reference (CIFR) to develop an organisation culture.

The CIFR developed in this study draws on the CI models proposed by Eguren or Wu and Chen (Eguren Egiguren, 2012; Wu and Chen, 2006), who defined the inputs for a process and the outputs resulting from its execution. In the developed model, the outputs are the development and evolution of a CI culture.

Organisational culture (E2) refers to a company's approach. It manifests itself in how problems and opportunities are addressed and how the company manages and adapts to change, which are internalised as routines and behaviours and transmitted to new members as a way of thinking and acting (Alvesson and Sveningsson, 2015). Adopting a CIP, in general, implies a cultural change (Dahlgaard and Dahlgaard-Park, 2006). It mainly influences how ordinary activities are carried out and evaluated. Combining cultural and strategic factors, Kotter (2008) states that when organisational culture is aligned with organisational strategy, improvement projects are more easily implemented and attain levels of excellence with greater ease.

Management support (E1) is one of the main facilitators of CI activities (Albors and Hervás, 2009; Bateman and Rich, 2003; Jorgensen et al., 2003; Kaye and Anderson, 1999). Apart from providing resources for CI, top managers must align projects with the organisational strategy (E3) and establish processes, procedures and policies to start developing a culture of CI (Eguren Egiguren, 2012; Wu and Chen, 2006). Albors and Hervás (2009) emphasise that in order to promote CI and create a CI culture, management must invest time and resources, focus on defining the improvement project objectives and operative methods, and engage the employees in promoting continuous learning. The involvement of employees is essential to achieving long-term improvements (García-Sabater et al., 2012), and for employees to be involved, they should find the participation beneficial; it must have a positive impact on their work. The application of a systematic implementation process and improvement tools helps involve participants (Jurburg et al., 2016).

An organisational culture conducive to implementing CI systems is one based on values, such as customer satisfaction, management commitment, employee participation, training, fact-based decision making and participation in CI activities (Asif et al., 2009; McLean et al., 2017). Successful implementation requires that these values align with the cultural values of the organisation (Tata and Prasad, 1998). The cultural elements of an organisation are evident in (i) the formation of different subcultures within an organisational culture and (ii) the promotion of a learning process within the general organisational culture (Asif et al., 2009). Depending on the organisational structure and culture, different subcultures may exist within an organisation. These subcultures can hamper the development of a strong common culture, which emphasises the values of cooperation and participation (Wilkinson and Dale, 2002). The lack of a common (standardised) organisational culture increases the need for resources and the cost of implementation of CI systems. Training programmes (E9) should serve to socialise new cultural values, linked to a common organisational culture, and allow individuals to attain higher levels of knowledge. In fact, these can be tied to a reward system within the organisation. New skills, abilities and knowledge should be considered in personnel policies during appraisals and promotions (Hyland et al., 2008; Tata and Prasad, 1998).

Ishikawa (1986) places a special emphasis on training and calls for all employees to be trained in skills related to CI to generate improvements in their work environment in a continuous and sustained manner. The Toyota Production System (TPS) believes that cultural change occurs when people are involved in CI to eliminate waste (Liker, 2004). Other scholars suggest that to promote cultural change related to CI in industrial environments, new activities that generate new behaviours and attitudes should be introduced, based on which the level of CI maturity can be measured. When the activities developed increase the level of maturity, cultural change takes place (Bessant et al., 2001; Ljungstrom, 2005; Wu and Chen, 2006). Bessant et al. (2001) propose an evolutionary CI maturity model that promotes the development of an organisational culture enabling the organisation to move towards excellence in CI through the adoption of new routines and skills at the organisational level. This model offers a process of change that drives a new approach to working in which the cultural aspects of an organisation influence and are aligned with the organisational strategy.

It is commonly believed that a CIP should be promoted by top management, and it should be aligned with the company's strategy (E3). To do this, the organisation needs to develop CI-aligned strategic objectives that are deployed and guided by the CIP (Middel et al., 2005). The lack of such an approach tends to lead to reactive management in the face of problems and opportunities, and this constitutes a barrier to the development of systematic CI (Bateman and Rich, 2003). Hyland et al. (2007) and Szeto and Tsang (2005) suggest that in order to unite a CIP with the organisation's strategy, considering the CIP as a strategic element of the operational plan, aligning CI activities with strategic objectives and carrying out CI activities in all areas of the organisation are necessary. For this, the deployment of the CIP must flow from the top to the bottom of the organisational structure (Hyland et al., 2007). In this way, the strategy is focused on the stakeholders who make up the processes (workers, suppliers, external customers).

In relevant literature, researchers are unanimous in their call for an organised structure (E4) to support CIPs and associated activities, integrating workers of different levels and departments on work teams (Fryer et al., 2007; Lodgaard et al., 2016; Wu and Chen, 2006) considering the current organisational structure (Chapman and Hyland, 2000). Kerrin and Oliver (2002) and Jaca (2011) explain that organising CI activities through work teams has numerous advantages because the level of improvement achieved by CI teams is much greater than that achieved individually. Hence, those engaged in a CIP must fully accept and internalise the need for CI and develop an attitude of participation. Involvement of people (E11) is key to the sustainability of CI activities, people should serve not only as executors of the developed improvements but also as a source of ideas for the improvement-generation process (Bateman and Rich, 2003; Garcia-Sabater et al., 2012; Jorgensen et al., 2003).

Wu and Chen (2006) suggest that the organisational structure should allow the development of all activities related to the CIP, such as aligning the organisation with the participants, designing adequate operational methods of improvement, promoting training programmes to include new methods of improvement and examining the effectiveness and efficiency of improvements. The organisational structure for implementing the CIP must have CI teams, effective communication channels and CI facilitators (Middel et al., 2005).

Typically, three roles are identified in CIP implementation: (i) top management, which provides the necessary resources and facilitates the implementation; (ii) middle managers, who lead the CI teams (composed of employees from different departments) through CI activity development and plan and carry out follow-up meetings; and (iii) the CI teams. Many times, middle managers in the organisation are not experts in the development of improvement teams, so the participation of facilitators becomes necessary to execute the projects effectively and efficiently. In SMEs, the CI leader can assume the role of a facilitator (E12), guiding and coaching the promoter and project teams before and during the projects (García-Sabater et al., 2012; Heavey et al., 2014; Gonzalez Aleu and Van Aken, 2015). However, until the CI leader acquires the necessary skills, usually at a low maturity level, the facilitator can be a person from outside the organisation (Garcia-Sabater et al., 2012; Kumar et al., 2009).

The CIP should have the necessary resources (E5) for its activities (Bateman and Rich, 2003; Dale, 1996), and these resources should be accounted for in the management plan to avoid their misuse. These resources must include the time to execute the improvements, the funds for these improvements and the availability of people involved in the improvement teams (Singh and Singh, 2015).

To keep a CIP active, projects should be developed (E6) constantly (Liker, 2004). Projects form the core of improvement activities; cultural changes related to the implementation of a CIP are channelled through them (Bessant et al., 2001). The selection of improvement projects, areas (E7) and operative methods (E8) are key factor for the correct development and evolution of a CIP and the development of a CI culture (Antony and Gupta, 2019; Garcia-Sabater et al., 2012; Kaye and Anderson, 1999; Kumar et al., 2009; Snee, 2010). In selecting its operative methods, projects and areas, organisations should conduct a diagnosis that considers, amongst other concepts, their

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level of CI maturity, organisational capabilities and the scope and objectives of the projects (Antony and Gupta, 2019).

To deploy a CIP, all those involved should have the skills, abilities and knowledge relevant to their roles (Imai, 2001; Snee, 2010). Their training must be aligned with the selected operative method (Antony and Gupta, 2019; Näslund, 2013). Bateman and Rich (2003) note that initially, training team leaders, who will then extend the CIP to others, is crucial. Liker (2004) highlights that one of the pillars of the TPS model is the development of an organisation that learns through CI.

Organisations should analyse their CI activity periodically to understand their weaknesses and introduce corrections. Self-examination is the most effective route to achieving successful CI (Wu and Chen, 2006). Furthermore, a CIP follow-up process must be established to measure two aspects: the efficiency and effectiveness of the improvement projects (Fryer et al., 2007) and the efficiency of the CIP (Bessant et al., 2001; Gonzalez Aleu and Van Aken, 2015). The evaluation system and metrics should be adapted to each level (Wu, 2006).

Institutionalisation (understood as the development and assimilation of an organisational culture) of CI requires designing a specific context that promotes greater acceptance by employees; development of routines and structures that reinforce organisational knowledge; and fostering of a common culture instead of several subcultures (Asif et al., 2009). To drive cultural change, an organisation must focus on the most tangible factor (climate)—changing the practices, policies and procedures that affect the beliefs and values guiding employee actions. Essentially, a cultural change occurs when employees begin to behave differently because of a change in the organisational climate (Schneider et al., 1996). This climate communicates what must be believed and valued, and these beliefs and values constitute the culture of the organisation (Douglas et al., 2017). Thus, the involvement and participation of employees in new activities proposed and driven by management, such as improvement meetings, the collection and management of suggestions for improvement, the development of training plans, the use of new operational methods and the generation and assimilation of new routines and behaviours, can be, amongst others, indicators of cultural change in an organisation.

Any new CI model should focus on a strong organisational culture that supports CI elements, such as CI routines, employee participation and involvement in CI activities, teamwork, an organisational structure adapted to the organisation, training and development, and the commitment and leadership of management (Wilkinson and Dale, 2002). Thus, the evolution of an organisational culture and cultural change can be measured in the following terms: (a) management commitment and leadership (Wilkinson and Dale, 2002), (b) generation and assimilation of new CI routines (Bessant et al., 2001), (c) education and training of employees in new operational methods (Schneider et al., 1996), (d) development of improvement teams and promotion of teamwork (Jaca, 2011) and (e) the participation and involvement of employees in CI activities (Schneider et al., 1996).

3 Methodology

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Numerous studies related to the analysis of the factors affecting the implementation of CI models use quantitative methodologies, such as structural equation modelling (SEM), to model processes and identify the relationships between the factors affecting CI models (Flynn et al., 1994; Lam et al., 2012; Putri et al., 2017; Zhang et al., 2000). Despite this, many authors indicate that SEM has its limitations. A large amount of data is needed (Putri et al., 2017), and their collection must be done with great care, adequately identifying the respondents by considering their knowledge and involvement (Tippins and Sohi, 2003). Questionnaire data collection can lead to personal bias deviations (Phan et al., 2019). Generalising inter-sectorial conclusions is also not possible (Lam et al., 2012). These make it difficult to draw firm conclusions about the causal relationships of factors in the long term, thus making it challenging to obtain solid conclusions from each context or company (Martínez-Costa and Jiménez-Jiménez, 2008). Therefore, several authors argue that more sophisticated qualitative methods can be applied to conduct in-depth studies of individual firms or contexts (Martinez-costa and Jimenez-Jimenez, 2009; Noronha, 2003). Some studies argue that the use of qualitative methodology with a contextual and temporal analysis is a more appropriate method in single case studies than quantitative methodology based on statistical analysis. This is because these studies do not generate a sufficient volume of data to allow appropriate statistical analysis (Meredith, 1998).

In the present investigation, only one company was analysed in-depth, because of this, a qualitative methodology was applied. The researcher participated in the CIP implementation and collected data from different sources of information. Considering the research objective —implementing a CIP to develop a standardised and shared organisational CI culture in an industrial SME— action research (AR) and the hermeneutic phenomenological methodology was used to draw conclusions. According to AR, a researcher is not an independent observer but a participant in the research process (Coughlan and Coghlan, 2002). AR is concerned with creating organisational change and simultaneously studying the processes involved. As a result, members from the organisation under study are expected to actively participate in the process as are the researchers who take an active part in implementing and monitoring projects. This provides for a more holistic perspective on how changes occur within the organisational context (Coughlan and Coghlan, 2002) and helps identify different aspects that improve or promote the processes. Furthermore, given that the aspect to be changed is the culture of the organisation, a hermeneutic phenomenological approach is useful for reinforcing the analysis of the research results through analysis in situ and increased emphasis on interpretation (Gorichanaz, 2017). The phenomenological tradition of research explores the *lived experience* of a phenomenon (Langdrige, 2007). A phenomenological inquiry can use interviews or participants' written or oral self-reports to gather participants' descriptions of their experience. Johnson and Christensen (2019) add that the researcher must spend considerable time collecting information from different viewpoints and gain a deeper understanding of the subject to be investigated. The use of AR in this study confirms the researcher's deep understanding of the subject under investigation and the ability to extract information from different sources (interviews, observation, surveys, etc.).

4 Continuous improvement process

In this study, a CIP is developed and configured in four stages to deploy a CIFR. Figure 2 shows the phases executed in each stage, as well as the key elements that exert a strong influence in each stage.

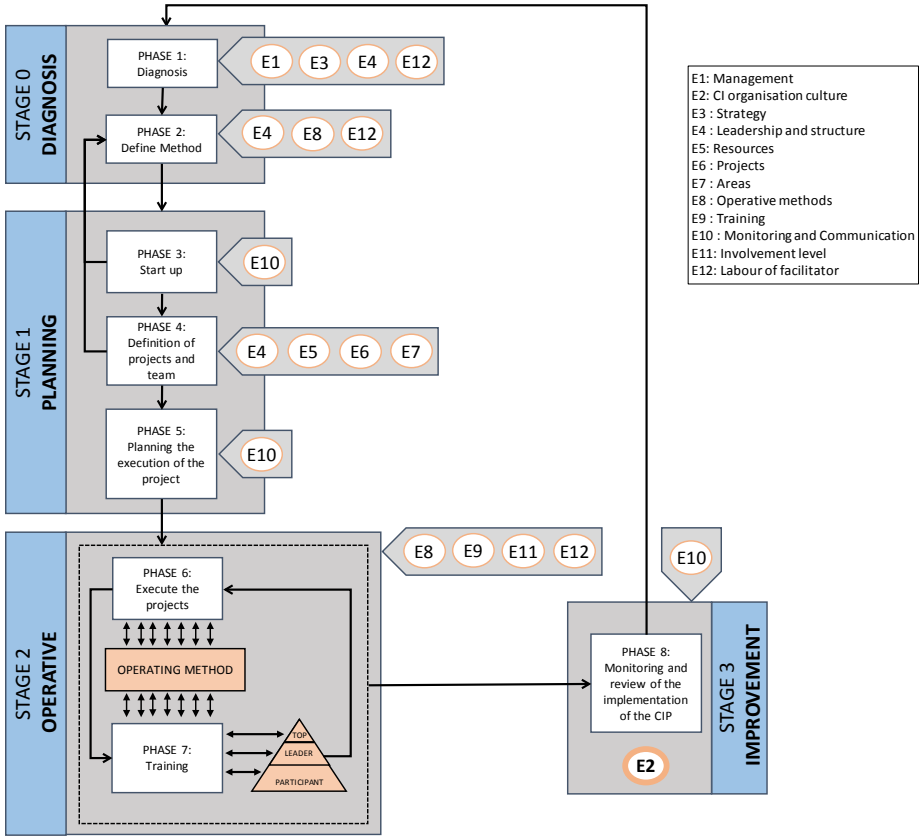

Figure 2. Continuous improvement process (CIP).

STAGE 0: Diagnosis

In stage 0, the management team conducts a diagnosis to determine the organisation's CI level. This diagnostic system is based on the CI maturity levels defined by Bessant et al. (2001) and the study conducted by Theisens (2015), who defined several tools used to develop each level. Table 1 present a summary of the diagnostic system.

Table 1. Continuous improvement (CI) maturity levels and the tools used in each level

CI maturity level (Bessant et al., 2001)	**Tools** **CIMM** (Theisens, 2015)
Level 1 **Pre-CI**	**Creating a solid foundation** Organised work environment (5S) Standardised work (standard operating procedures)

		Quality control and quality assurance
Level 2	**Structured CI**	**Creating a stable structure** Kaizen events Short interval management Work in process (WIP) control
Level 3	**Goal-oriented CI**	**Creating stable and efficient processes** Lean management (value streaming mapping, single exchange die [SMED]) Waste elimination and flow Total productive maintenance (TPM)
Level 4	**Proactive CI**	**Creating capable processes** Six Sigma (DMAIC) Design of experiment (DOE) Reducing variation (statistical control processes) Statistical analysis
Level 5	**Full capability CI**	**Creating reliable products** Product lifecycle management (PLM) Design for Six Sigma (DfSS) Reliability engineering (design failure mode and effect analysis [design FMEA])

STAGE 1: Planning

In this stage, the project teams and the general project plans are defined.

STAGE 2: Operation

This consists of two phases: project execution and the training of participants in the projects. During project execution, the team displays the skills corresponding to the chosen operative method and those related to teamwork. Formal training in the operative method is carried out in parallel. The CI leader, acting as the facilitator, is responsible for designing and executing the formal training for the promoter and project teams, as well as for supporting project leaders in the follow-up phase.

STAGE 3: Improvement

In the improvement stage, the promoter and project teams periodically review and evaluate the achievement of objectives defined in each project (monthly/quarterly). Deviations found are corrected through specific actions and incorporated into the operational plans.

At the same time, management and the promoter team analyse and evaluate the implementation of the CIP and the development and evolution of the organisational culture annually. In the CS, discussed below, this analysis helped identify the strengths

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and weaknesses of the CIP, as well as the improvement actions to be implemented in the next cycle.

5 Case study

This study was carried out in a mature capital goods company, which, over the years, had used different improvement tools but did not succeed in achieving the expected results, in executing a CI process systematically or in institutionalising a CI organisational culture. The middle managers could not extend the CI habits to the workshop staff. However, top management was committed to spreading CI to all staff and was willing to experiment with a new CI methodology.

The company was a cooperative model organisation located in Basque Country, Spain, but it had plants worldwide and three business verticals. The projects relevant to the study were executed in the power transmission equipment business that serves several sectors, including automotive, aeronautics, maintenance, packaging, manufacturing and elevation. Considered an SME, the company had annual sales figures of over 13–15 million euros and employed approximately 50 direct workers and 25 indirect workers. The company was certified according to standards of quality, environment and occupational safety; it utilised preventive maintenance for its assets. The plant had several operational areas: production, assembly and warehouse logistics, quality control, production, design, planning and maintenance, to name a few. The technological solutions it developed, manufactured and marketed were products with high added value and developed through unit production or in small batches; the standardisation level of the products was from low to medium. Workers' technical knowledge was high, and a long apprenticeship was required. The machines and manufacturing processes were very flexible, requiring a significant amount of tooling and detailed technical knowledge.

Defined by management and the research team, the general objective, which aligned with the company strategy, was to increase the organisation's CI level by implementing a CIP to consolidate the organisation at the first level of maturity and prepare it to reach the second level in a period of two years. The CIP was implemented at the case organisation between October 2017 and June 2018.

The diagnosis showed that the organisation had not institutionalised a CI organisational culture. The organisation only had control over production and logistics, and it used the tacit knowledge of its employees to develop work and solve problems. It had some operating standards and relied on autonomous maintenance. Management and the research team recognised the need for a system that would foster CI throughout the organisation and lay the foundation of an organisational CI culture.

Adapting the existing structure to the desired CI organisational structure was necessary to build the CIP. The proposed structure had three levels. The first level was the management team, composed of top management, the CI leader and the managers of several departments, such as quality control, logistics and production. The management team was responsible for defining the strategic goals. The second level was called the promoter team and was composed of the CI leader and the leaders of improvement projects. This team was responsible for defining CI objectives and responsibilities and

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for managing budgets. The third level was the project teams and consisted of the project leader and workers. Figure 3 shows the CI organisational structure developed for this case.

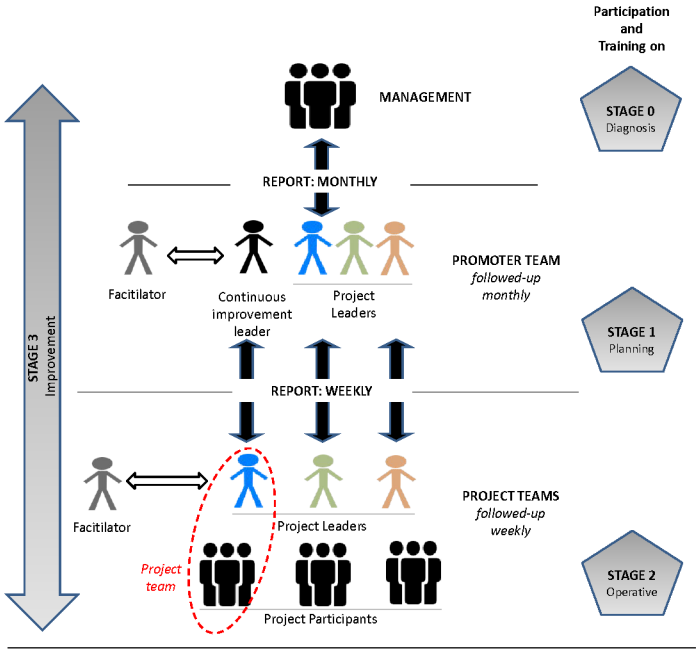

Figure 3. Continuous improvement (CI) organisational structure developed for the case.

Acknowledging the need to reinforce teamwork (Bhuiyan et al., 2006), management and the research team wanted to apply basic CI tools to increase the level of involvement through a common project, standardise the workplace and create an improvement forum. The 5S technique, which facilitates the creation of natural teams, was chosen for this purpose.

The 5S technique is a work philosophy promoting habits that facilitate working in an organised, orderly, clean and safe way. It is a methodology of operational application that translates into benefits, such as space availability, decreased loss of tools and materials, better visual control of the work area, easier defect identification, decreased errors and reduced search time for materials, tools and information. These benefits, in turn, lead to general improvements in productivity, quality, costs, level of service, security, image of the organisation, participation of people and overall morale. The term 5S comes from five Japanese words: *seiri* (organisation), *seiton* (order), *seiso* (cleanliness), *seiketsu* (standardisation) and *sitsuke* (discipline) (Randhawa and Ahuja, 2018).

In the case organisation, the promoter team secured the commitment of top management to define the executed project and obtain the necessary resources (mainly sufficient participant time to invest in the improvement activities). The CI leader, through existing

internal channels, communicated the characteristics and benefits of the CIP to all personnel. After communicating the general objectives to the entire organisation, the promoter team selected critical areas, defined projects and established the teams. Furthermore, each project leader communicated the characteristics of the projects to be executed to the project team members. A total of 21 employees participated in the following selected areas (unit of analysis [UA]), including the workers of the affected area, middle managers and directors:

UA1, Horizontal late: A complex machine that requires great technical knowledge to programme and that manufactures pieces of medium–large dimension in medium–low series

UA2, Machining centre: A complex machine that requires great technical knowledge to programme and that manufactures parts. It manufactures a great variety of pieces in unit production or low series and uses many mooring types.

UA3, Milling machine multi-table: A complex machine that requires great technical knowledge to programme and that manufactures parts. Operating the machine is a laborious task, as it uses 10 mooring tables simultaneously.

UA4, Assembly area: An area composed of six individual assembly tables (shared by several workers) and four common storage areas

The management team and the research team defined the general plan, the evaluation system for the CIP and the communication channels (via information panels and several meetings). Moreover, each team leader defined the plan for each project. These plans were developed in parallel over several meetings in which the promoter and project teams were helped by the research team. The plan considered the operative method, the necessary training and the resources required.

The training on the CIP was divided into three levels. Table 2 shows the training details for each level.

Table 2. Developed training summary

Level	Participants	Content	Observations

Top Management	- CEO
	- Industrial director
	- Quality director
		- Awareness talk about CI
		- General structure in depth:
		  - CI levels
		  - CIFR
		  - CIP
		- General planning
		- Leadership and teamwork
			Formations are based on several meetings. After the presentation of the CIP, a diagnosis was made, and the CI leader (management representative) and the general CI structure were defined. Training was

			delivered to them before and during the diagnosis stage.
Middle management	- Quality director (management representative) - Several department managers: - Production - Planning - Process engineering - Quality - Purchasing and logistics - Commercial - Maintenance	- Awareness talk about CI - CI levels - CIFR - CIP - General planning - Leadership and teamwork - Brief training on the selected methodology (5s)	Several department managers participated in the formal CI structure as project leaders. Training was delivered to them during the planning stage.
Project team members	- Quality director - Project leaders - Project team members	- Formal training on the selected method in depth: - Awareness - Technical	Each project team was trained before and during the project in the operative stage.

During the execution, the project team focused on 5S skills, whereas the promoter and project leaders focused on skills related to teamwork and leadership.

The CIP implementation results were analysed based on the information collected about the CI elements and the five organisational culture aspects. Data on these aspects were collected by the researcher in line with a phenomenological approach in a study diary and quantified in terms of several indicators. Data were collected by (i) observing the work done, (ii) conducting interviews on weekly follow-up meetings and (iii) gathering information via surveys. At the end of the implementation, a questionnaire was sent to 45 people in the organisation, of which 21 had participated in improvement projects (the rest had not participated). The survey aimed to see if the improvement projects had generated behaviour changes in the selected areas. The response rate in the project-based areas was 87%, whereas in the other areas, it was 40%. The first part of the survey focused on employee characteristics, such as length of employment at the company, area of work and previous experience in applying improvement tools. The second part sought employees' opinions on CI activities and was divided into three sections: (i) operational, (ii) feelings about the execution of the methodology and (iii)

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behaviour during and after the execution of the methodology. The questionnaire design was based on the works of Jurburg et al. (2016), Khanna and Gupta (2014) and Viles et al. (2015). The reliability of the questionnaire, based on its internal consistency, was validated through Cronbach α coefficients (Viles et al., 2015). The metrics for each analysed aspect are shown in Table 3.

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Table 3. Aspects of the CI organisational culture

CI organisational culture aspects		
Aspect	**Description**	**Metrics**
Management commitment and leadership	Management must show commitment towards CI and lead the implementation of the CIP. Management must manage the resources, define the implementation strategy of the CIP, including the operative method, and develop the general plan. Management must define the CI organisational structure, defining a CI leader and the promoter team (management team, promoter team, project leaders and participants of each project).	- Economic resources provided - Time dedicated to CIP follow-up - Number of meetings between management and project leaders - Attendance at formal training sessions - Attendance at meetings of improvement teams
Generation and assimilation of new CI routines	Management must reinforce the assimilation of CI routines by developing an appropriate culture and climate through an organic structure and flexibility-oriented leadership.	**Routines** (Bessant et al., 2001): - R1. Understanding CI: the ability to articulate the basic values of CI - R2. Getting the CI habit – the ability to generate sustained involvement in CI - R3. Focusing CI – the ability to link CI activities to the strategic goals of the company - R4. Leading the way – the ability to lead, direct and support the creation and sustaining of CI behaviours - R5. Aligning CI – the ability to create consistency

		between CI values and behaviour and the organisational context (structures, procedures, etc.) - R6. Shared problem solving – the ability to move CI activity across organisational boundaries - R7. Continuous improvement of continuous improvement – the ability to strategically manage the development of CI - R8. The learning organisation – generating the ability to enable learning to take place and be captured at all levels
Training and education programme	The CI leader, supported by management, must develop and manage an appropriate training plan. The training should be oriented to each level of the organisational structure. The training must encourage *learning by doing*.	- Number of training levels - Number of training sessions provided - Number of employees trained - Satisfaction of the trained employees - Number of operators who have applied the training in their real work environment - Level of attendance at the training provided
Improvement teams, promotion of teamwork	Management and the promoter team must define the necessary improvement teams. For each project, they must establish a team and a project team leader. For the team to evolve, the team must apply the training it received in its work area. Management must support teamwork, providing enough time and organising periodic meetings.	- Number of teams defined - Team size, number of participants/team - Evolution of each team - Number of meetings/month

Participation and involvement in CI activities	Involvement of project team participants Involvement of project leaders Feeling of the team whilst applying the CIP	- Number of improvement suggestions/employee - Number of improvement suggestions executed - Response time on improvement suggestions - Attendance at periodic improvement meetings - Attendance at formal training sessions

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6 Results and discussion

The effects of the CIP, analysed in terms of organisational culture (Table 3), were evident in form of cultural changes in the case organisation, although unevenly distributed across areas and improvement teams.

The quantitative results are shown in Figure 4 to Figure 8, and qualitative analyses were reinforced via the hermeneutic phenomenological approach. Qualitative information was collected through a survey and through interviews with management, department directors, middle managers, area supervisors and employees. The results are grouped by CI aspects (below) and are presented along with quantitative data and key narratives.

a) Management commitment and leadership

Figure 4 shows the commitment and leadership capacity of management and the promoter team, specifically the leadership exercised by the project leaders. Differences were observed in the performance of the four UAs, with UA4 showing 80% compliance. UA4 was an assembly area where a team of several employees worked simultaneously with a leader who was focused on area management. Of the narratives collected in UA4, the following stand out:

> *Through the CIP implementation project, we have managed to conduct team meetings weekly, with a clear agenda, in which we analyse the weekly incidents and the work of the following week, in addition to the results of the audits carried out by the team, and suggestions for improvement and the evolution of the improvements raised in previous meetings. The weekly meetings have managed to unite the team.* (Leader of the assembly area)

> *The implemented project has facilitated communication between our leader and us. In particular, meetings on Fridays for one hour allow us to present and discuss our proposals. Communication between us (the team) is much more fluid now that we know how we can help one another.* (Employees of the assembly area)

However, in UA3, the performance metrics did not exceed 50% because of the limited time devoted to monitoring the CIP and the fewer periodic meetings. The following excerpts highlight the issues in UA3:

> *Our leader (area supervisor and CI team leader) performs the role of line supervisor in production planning, but the CI sets it aside. We do not usually hold many meetings to discuss possible improvements in the area.* (UA3 employee)

> *The area is very saturated with work. We know that we must improve, but the workers do not get involved enough. When we have improvement meetings (once a month), workers do not contribute new ideas for improvement. In addition, my team has undergone several personnel changes, which has made it difficult to track the improvements.* (UA3 leader)

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In UA1 and UA2, the level of compliance was moderate, ranging between 30% and 80%. Although the project team held periodic meetings, the time spent by the leader on follow-up meetings with management was identified as a main weakness.

> *It has cost us to implement the new way of working, but the CIP has allowed us to establish weekly meetings in which we deal with the incidents of the week, the plan for the following week, propose improvements etc. Monitoring the efficiency of the area (OEE) has been a considerable improvement; this is a point on the agenda of the weekly improvement meetings. This has allowed us to share and deal with problems amongst peers. I think that now the team is more cohesive.*(UA2 employee)

These narratives confirm that team members need a strong leader who manages the CI system and promotes meetings and communication.

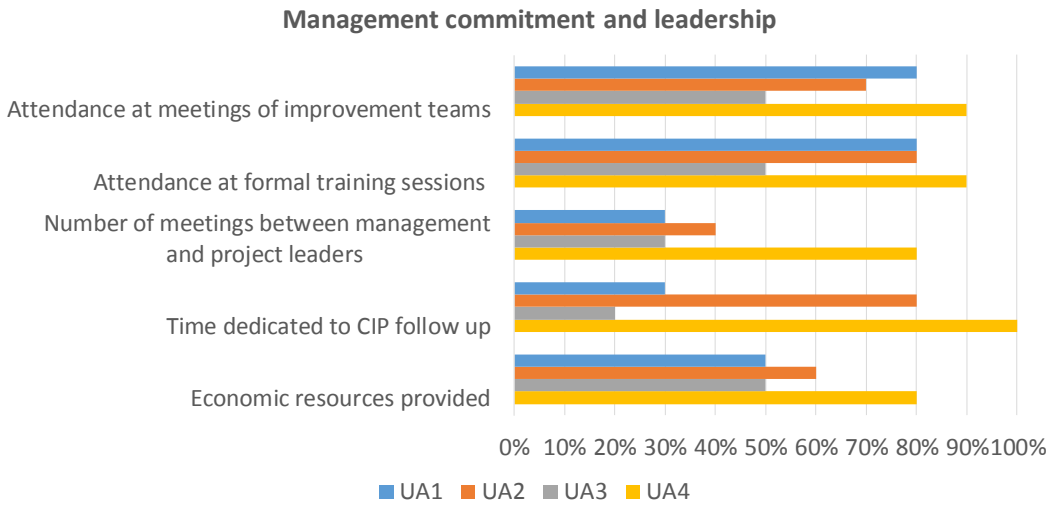

Figure 4. Management commitment and leadership.

Constant CIP follow-up by management in the case organisation not only helped identify problems and organisational structure changes but also helped redefine the training plan and leaders' supervisory and follow-up tasks. These efforts attest to the involvement of management in tracking the CIP.

b) Generation and assimilation of new CI routines

The second aspect analysed was the generation and assimilation of eight improvement routines (defined by Bessant et al. (2001)) amongst the participants, leading to a change in their attitude and behaviour (Figure 5).

The case organisation fared well in the development of routines, as the CIP objective mainly focused on developing routines R1 and R2 (Garcia-Sabater et al., 2012), which correspond to CI level 1 in the Bessant maturity model. Except for UA3, all other units achieved medium to high (50% to 100%) levels of compliance in routines R1 and R2. Furthermore, the results pointed to some positive development of routines R3, R4, R5

and R6, which are associated with advanced maturity levels. Of the narratives collected on this aspect, a team leader highlighted the following:

> *It has been very positive – the definition of teams in which personnel from different departments participate (quality, maintenance or process engineering) and the use of suggestion panels, which makes it easier for employees to make suggestion, and for my (leader) to answer them quickly and simply.*

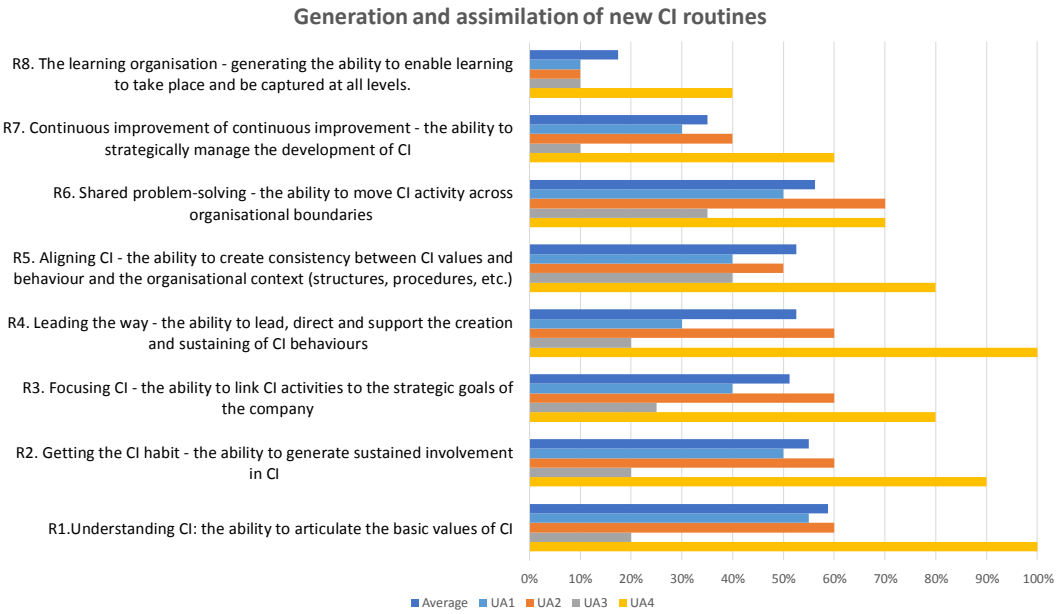

Figure 5. Generation and assimilation of new routines.

c) Training and education programme

Figure 6 shows the results of the metrics assessing the aspect of training and education. Overall, the results exceeded the 70% level of compliance. Training is an ongoing activity, and the results confirmed that 70% of employees at all levels of the organisational structure were trained—from top management to workers—with an average satisfaction level of 75%.

Management viewed this as a positive and important aspect to promote an organisational CI culture, and a similar sentiment was expressed by the CI leader.

> *Despite efforts and the dedication of resources, it is observed that training is important to promote an organisational culture and a dynamic of sustainable CI over time. In fact, in the areas in which not all people have been trained, it is observed that the level of compliance with the standards is lower.*

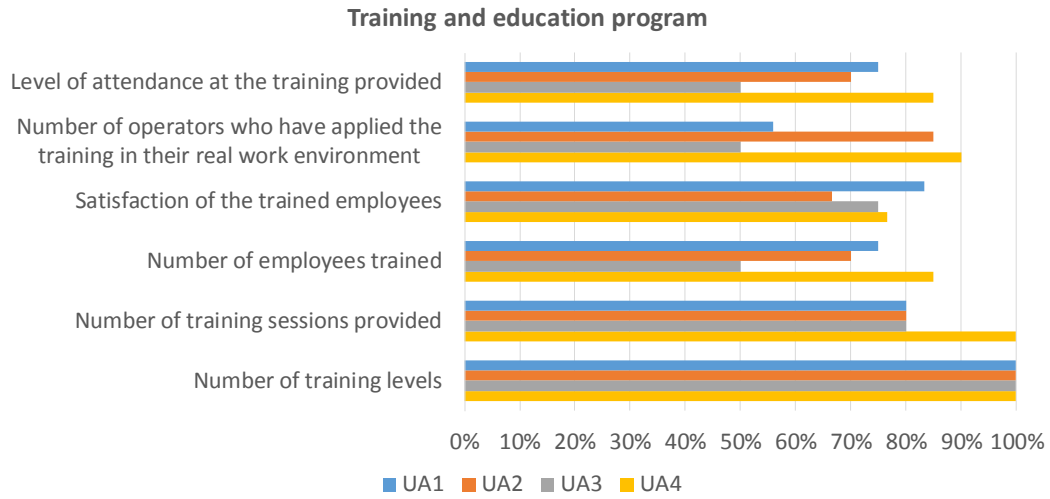

Figure 6. Training and education programme.

d) Improvement teams, promotion of teamwork

Figure 7 shows the results of the metrics assessing 'improvement teams and promotion of teamwork', which refer to management's ability to promote and develop improvement teams and their leaders through the CIP. This was one of the most difficult aspects to implement in the case organisation. Only a moderate level of compliance was achieved in these metrics, and the levels varied greatly amongst the different UAs. Mid-sized stable teams, without much internal rotation, with harmony between their team members and with strong leadership performed better in this aspect. UA4 satisfied all these criteria. The moderate level of overall compliance in UA2 could be attributed to team size. The following explanation was offered by a UA3 operator to justify why high compliance levels were not achieved in the concerned areas (UA1 and UA3).

> *The workload we have makes it difficult for us to attend team meetings. We don't have time to deal with proposals for improvement; we don't have time to deal with the problems in the team. Improvement meetings are not well defined; I think the leader should define a clear agenda (of improvement meetings).*

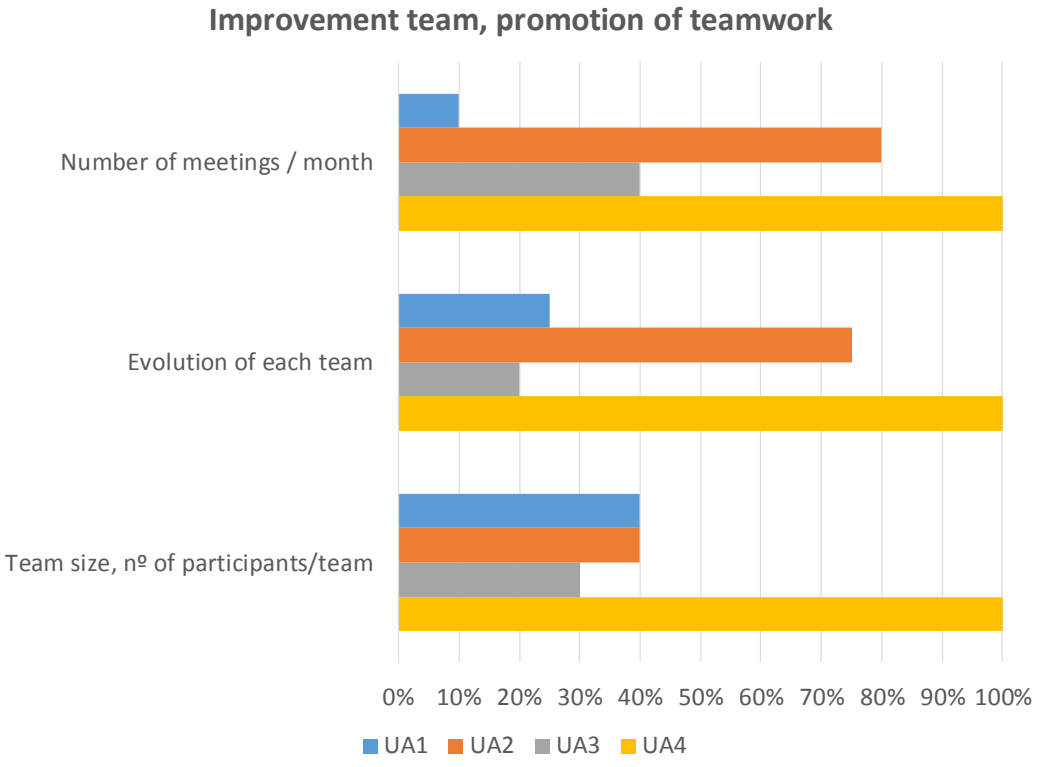

Figure 7. Improvement teams, promotion of teamwork.

e) Participation and involvement in CI activities

Figure 8 shows the results of the metrics associated with the aspect of 'participation and involvement in CI activities'. The overall level of compliance was 72%. The R1 routine (understanding CI) was developed on the basis of the participants' suggestions. Many suggestions for improvement were proposed by employees across UAs, with UA4 accounting for 41% of the total suggestions per employee. Leaders and management also showed good involvement, as the level of response and execution of suggestions exceeded 75%. However, the metric related to meeting attendance showed a moderate level of compliance, with UA3 performing the worst. A UA4 operator highlighted the positive outcomes of collecting suggestions in an interview.

> *I think that the dynamics of collecting suggestions on a blackboard located in the meeting area are good to make improvements in the area. In addition, this dynamic enhances our responsibility to be proactive in responding to improvement proposals.*

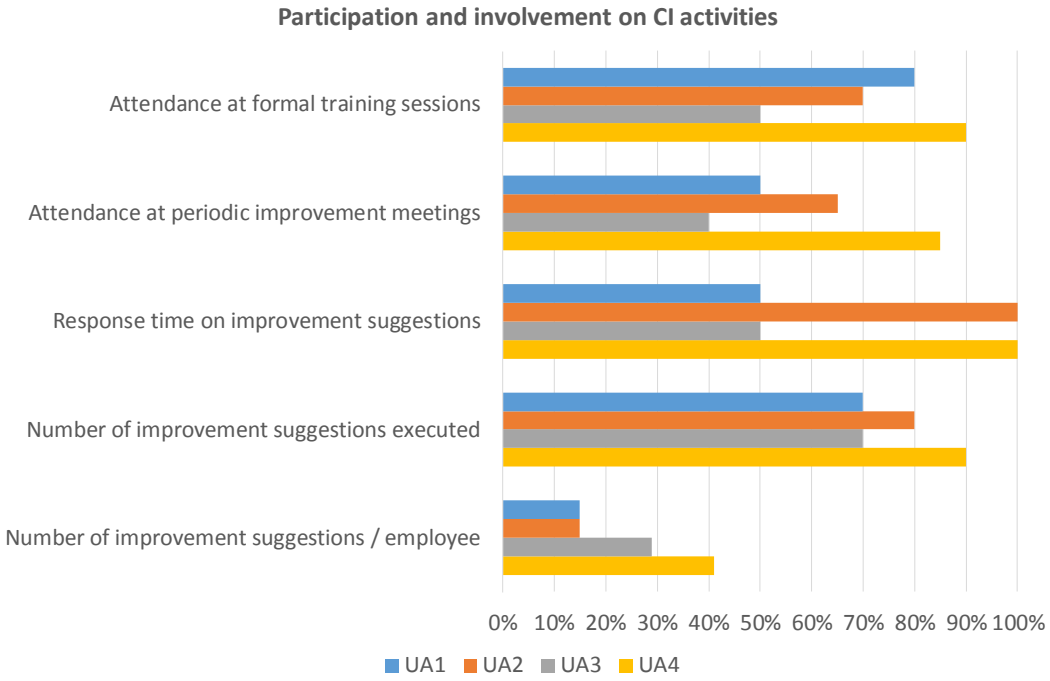

Figure 8. Participation and involvement in CI activities.

Activities carried out in the planning (project planning, communication with all personnel, etc.) and operative stages (execution of the operative method, weekly follow-up meetings, training at different levels, etc.) promoted participation and involvement. A cross-indicator of the participants' involvement is the number of responses obtained in the survey. In the case organisation, 87% of the employees who participated in the projects responded to the survey, whereas only 40% of non-project employees completed the survey.

Figure 9 summarises the results of the study. Overall compliance in aspects of the organisational CI culture averaged a moderate level of approximately 63%. The aspects that showed high compliance were the involvement and participation of improvement teams and training at all levels of the organisational structure. The aspects with the lowest compliance levels were those related to teamwork (55% compliance level) and the generation of new routines (47% compliance level).

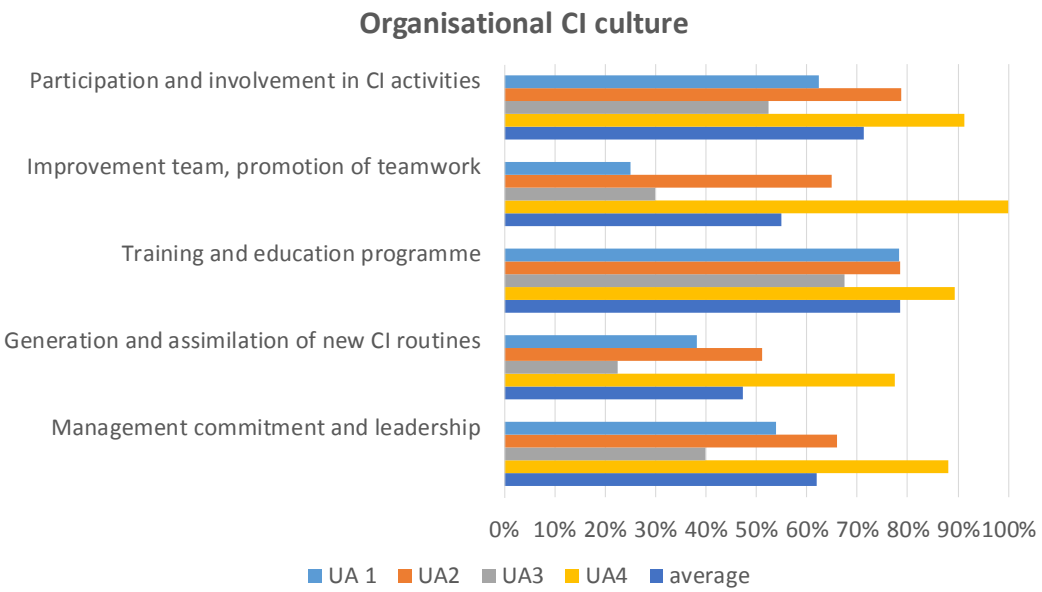

Figure 9. Summary of the aspects analysed related to an organisational CI culture.

Corrective measures were proposed to address aspects in which the levels desired by management (greater than 70%) were not achieved. These measures will be considered by management when deploying the model in other production lines.

Promotion of teamwork: This barrier was mainly linked to the small size of the teams; the absence of a critical mass affected the development of teamwork adversely. To overcome this barrier, the case organisation has agreed to merge small and homogeneous production lines that face similar problems. This will increase the critical mass and allow teams to undertake the tasks of CI collaboratively.

Assimilation of new CI routines: The lack of resources and employee saturation were responsible for the reluctance to develop and assimilate new routines. To address this, management has decided to promote an employee in order to support the areas and advise on CI activities.

Management commitment and leadership: Staff rotation in the teams made it difficult to conduct routine follow-up meetings. Merging small production lines and building teams with a certain critical mass are likely to lower the impact of staff rotation and allow for the routinised scheduling of team meetings.

Finally, to motivate the personnel involved in improvement activities, the case organisation has established an incentive and internal promotion system. Employees who show positive attitudes and abilities towards CI activities are promoted to positions of greater responsibility. Such promotions implicitly entail economic rewards.

7 Conclusions

The results from the case organisation suggest that the CIP increases the CI level, albeit slowly. Moreover, they indicate that the implementation of CI requires not only the application of improvement tools but also the involvement of people. Commitment from management is necessary to ensure this involvement—the organisational structure should be recognised by all, leaders should promote improvement activities through teamwork and the assimilation of new CI routines should be promoted through a training plan tailored to the level of the organisation. Over the course of implementation, adapting the CIP to the organisation with the help of management and the promoter team is important so that the company assumes ownership of the process. In the CS, the applied operative method (5s) allowed the organisation to define the basis of CI. Systematic application of the CIP helps identify the need to apply other tools, such as supply Kanban, management and production panels, collection of process data (OEE) and the implementation of suggestion panels.

This study confirms that the five aspects analysed are appropriate to track the level of CI achieved and evaluate the organisational culture of CI, as the CS showed that acting on the different aspects affected the evolution of CI. In the case organisation, the barriers to the development of cultural change related to CI were the lack of teamwork and the poor assimilation of new CI routines.

In this study, an AR methodology combined with the hermeneutical phenomenological approach helped reinforce the analysis of the results and derived more robust conclusions, which made it possible to define more specific improvement actions for adapting the CIP properly to the case organisation. AR allows researchers to act directly in the process of change, and the phenomenological approach complements AR by introducing information about the feelings and attitudes of those involved in the process. The methodology may be useful for analysing other industrial organisations, especially SMEs, in which the researcher can be in constant contact with the people involved.

The model developed and the process implemented are appropriate for generating changes in the organisational culture of the case organisation. This is reflected in the positive attitude of the respondents towards CI activities. Management has internalised the developed CIP and will apply it to other production lines after accounting for the barriers and limitations identified in the present work.

8 Limitations and implication

Some limitations of the study should be pointed out. The single CS methodology provides an in-depth picture of the studied case, but it is specific to the context of action and does not aim to create universal knowledge, therefore the conclusions cannot be generalised. However, it is important to understand the implications of the findings so they can be applied in other contexts (Coughlan and Coghlan, 2002). Even though the study focused on a single case, other organizations might be able to learn from this experience, and the process followed to adapt and implement the model could be applied within other organisations (Ford et al., 2000).

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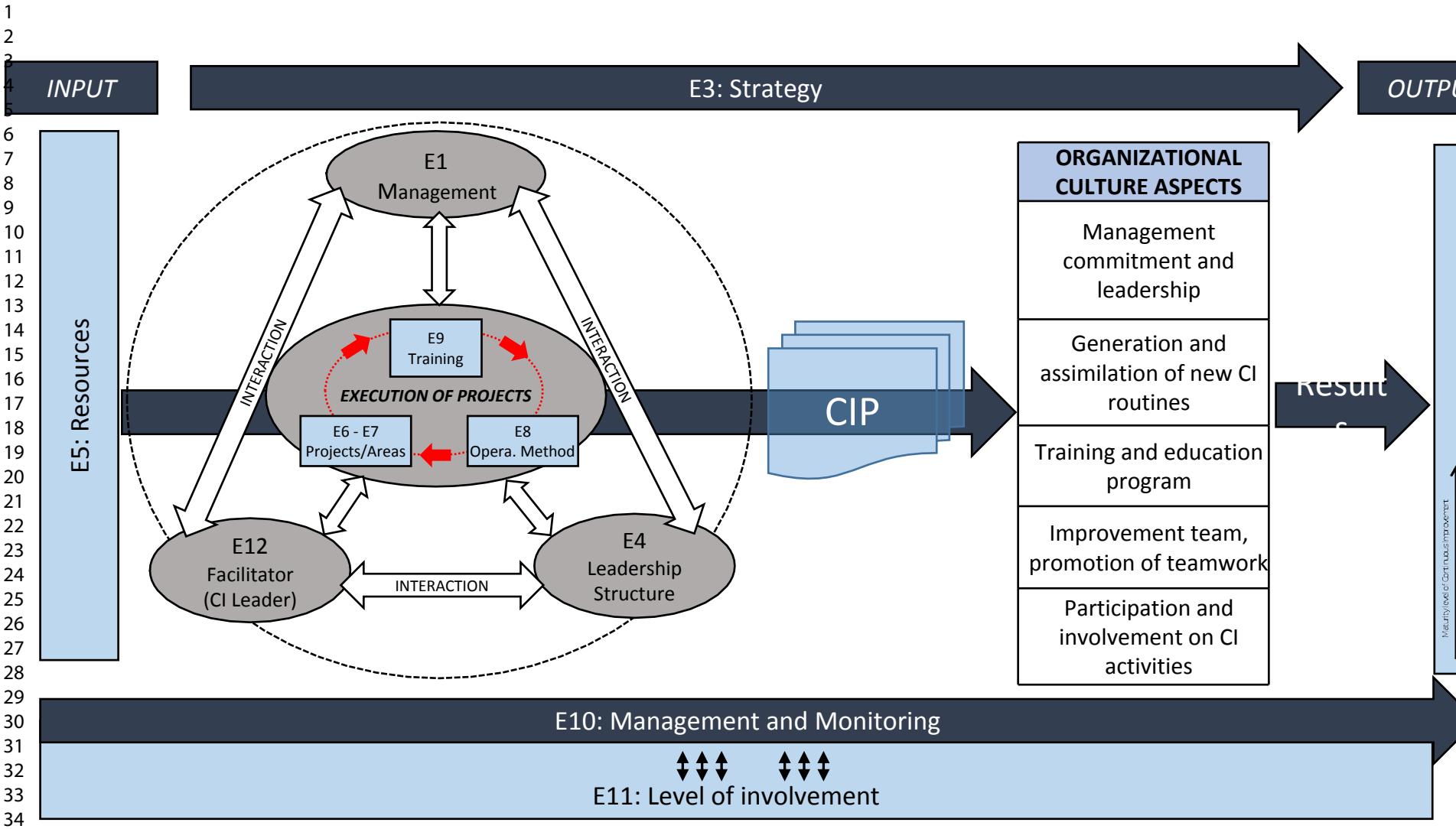
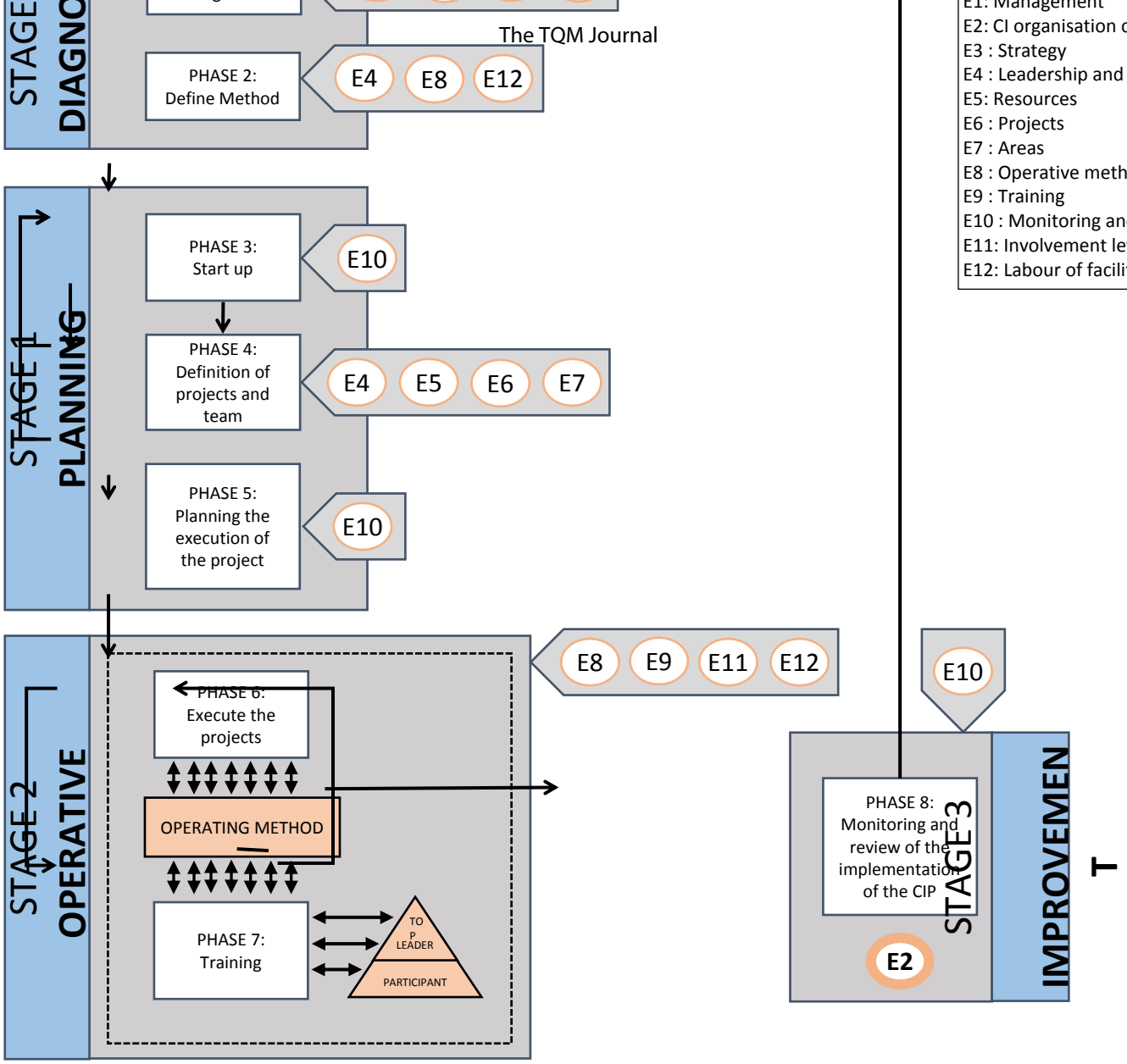

INPUT
E3: Strategy
OUTPU
E5: Resources
E1
Management
INTERACTION
INTERACTION
E9
Training
EXECUTION OF PROJECTS
E6 - E7
Projects/Areas
E8
Opera. Method
E12
Facilitator
(CI Leader)
INTERACTION
E4
Leadership
Structure
CIP
ORGANIZATIONAL CULTURE ASPECTS
Management commitment and leadership
Generation and assimilation of new CI routines
Training and education program
Improvement team, promotion of teamwork
Participation and involvement on CI activities
Result
Maturity level of Continuous improvement
E10: Management and Monitoring
E11: Level of involvement


STAGE 1 DIAGNO
PHASE 2: Define Method
E4
E8
E12
STAGE 1 PLANNING
PHASE 3: Start up
E10
PHASE 4: Definition of projects and team
E4
E5
E6
E7
PHASE 5: Planning the execution of the project
E10
STAGE 2 OPERATIVE
E8
E9
E11
E12
PHASE 6: Execute the projects
OPERATING METHOD
PHASE 7: Training
TO P LEADER
PARTICIPANT
E10
PHASE 8: Monitoring and review of the implementation of the CIP
STAGE 3
E2
IMPROVEMEN
T
E1: Management
E2: CI organisation culture
E3 : Strategy
E4 : Leadership and structure
E5: Resources
E6 : Projects
E7 : Areas
E8 : Operative methods
E9 : Training
E10 : Monitoring and Communication
E11: Involvement level
E12: Labour of facilitator

CI maturity level (Bessant et al., 2001)		**Tools** **CIMM** (Theisens, 2015)
Level 1	**Pre-CI**	**Creating a solid foundation** Organised work environment (5S) Standardised work (standard operating procedures) Quality control and quality assurance
Level 2	**Structured CI**	**Creating a stable structure** Kaizen events Short interval management Work in process (WIP) control
Level 3	**Goal-oriented CI**	**Creating stable and efficient processes** Lean management (value streaming mapping, single exchange die [SMED]) Waste elimination and flow Total productive maintenance (TPM)
Level 4	**Proactive CI**	**Creating capable processes** Six Sigma (DMAIC) Design of experiment (DOE) Reducing variation (statistical control processes) Statistical analysis
Level 5	**Full CI capability**	**Creating reliable products** Product lifecycle management (PLM) Design for Six Sigma (DfSS) Reliability engineering (design failure mode and effect analysis [design FMEA])

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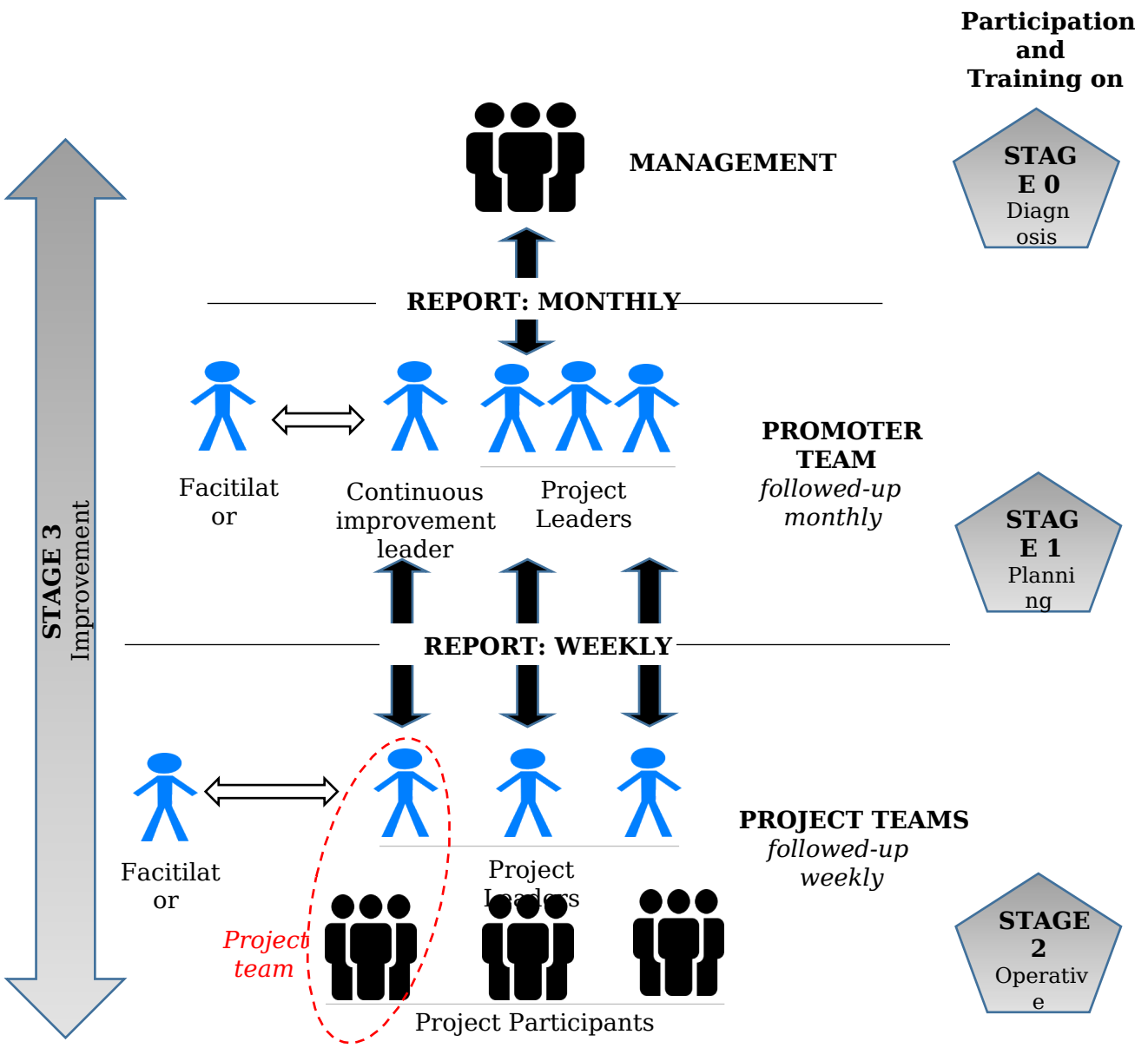
Participation and Training on
MANAGEMENT
STAGE 0 Diagnosis
REPORT: MONTHLY
Facilitator
Continuous improvement leader
Project Leaders
PROMOTER TEAM
followed-up monthly
STAGE 1 Planning
REPORT: WEEKLY
STAGE 3 Improvement
Facilitator
Project Leaders
PROJECT TEAMS
followed-up weekly
Project team
Project Participants
STAGE 2 Operative

Level	Participants	Content	Observations

Top Management	- CEO
	- Industrial director
	- Quality director
		- Awareness talk about CI
		- General structure in depth:
		  - CI levels
		  - CIFR
		  - CIP
		- General planning
		- Leadership and teamwork
			Formations are based on several meetings. After the presentation of the CIP, a diagnosis was made, and the CI leader (management representative) and the general CI structure were defined. Training was delivered to them before and during the diagnosis stage.

Middle management	- Quality director (management representative)
	- Several department managers:
	  - Production
	  - Planning
	  - Process engineering
	  - Quality
	  - Purchasing and logistics
	  - Commercial
	  - Maintenance
		- Awareness talk about CI
		- CI levels
		- CIFR
		- CIP
		- General planning
		- Leadership and teamwork
		- Brief training on the selected methodology (5s)
			Several department managers participated in the formal CI structure as project leaders. Training was delivered to them during the planning stage.

Project team members	- Quality director
	- Project leaders
	- Project team members
		- Formal training on the selected method in depth:
		  - Awareness
		  - Technical
			Each project team was trained before and during the project in the operative stage.

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CI organisational culture aspects		
Aspect	**Description**	**Metrics**
Management commitment and leadership	Management must show commitment towards CI and lead the implementation of the CIP. Management must manage the resources, define the implementation strategy of the CIP, including the operative method, and develop the general plan. Management must define the CI organisational structure, defining a CI leader and the promoter team (management team, promoter team, project leaders and participants of each project).	- Economic resources provided - Time dedicated to CIP follow-up - Number of meetings between management and project leaders - Attendance at formal training sessions - Attendance at meetings of improvement teams
Generation and assimilation of new CI routines	Management must reinforce the assimilation of CI routines by developing an appropriate culture and climate through an organic structure and flexibility-oriented leadership.	**Routines** (Bessant et al., 2001): - R1. Understanding CI: the ability to articulate the basic values of CI - R2. Getting the CI habit – the ability to generate sustained involvement in CI - R3. Focusing CI – the ability to link CI activities to the strategic goals of the company - R4. Leading the way – the ability to lead, direct and support the creation and sustaining of CI behaviours - R5. Aligning CI – the ability to create consistency between CI values and behaviour and the organisational context (structures, procedures, etc.)

		- R6. Shared problem solving – the ability to move CI activity across organisational boundaries - R7. Continuous improvement of continuous improvement – the ability to strategically manage the development of CI - R8. The learning organisation – generating the ability to enable learning to take place and be captured at all levels
Training and education programme	The CI leader, supported by management, must develop and manage an appropriate training plan. The training should be oriented to each level of the organisational structure. The training must encourage *learning by doing*.	- Number of training levels - Number of training sessions provided - Number of employees trained - Satisfaction of the trained employees - Number of operators who have applied the training in their real work environment - Level of attendance at the training provided
Improvement teams, promotion of teamwork	Management and the promoter team must define the necessary improvement teams. For each project, they must establish a team and a project team leader. For the team to evolve, the team must apply the training it received in its work area. Management must support teamwork, providing enough time and organising periodic meetings.	- Number of teams defined - Team size, number of participants/team - Evolution of each team - Number of meetings/month
Participation and involvement in CI activities	Involvement of project team participants Involvement of project leaders Feeling of the team whilst applying the CIP	- Number of improvement suggestions/employee - Number of improvement suggestions executed - Response time on improvement suggestions

- Attendance at periodic improvement meetings - Attendance at formal training sessions

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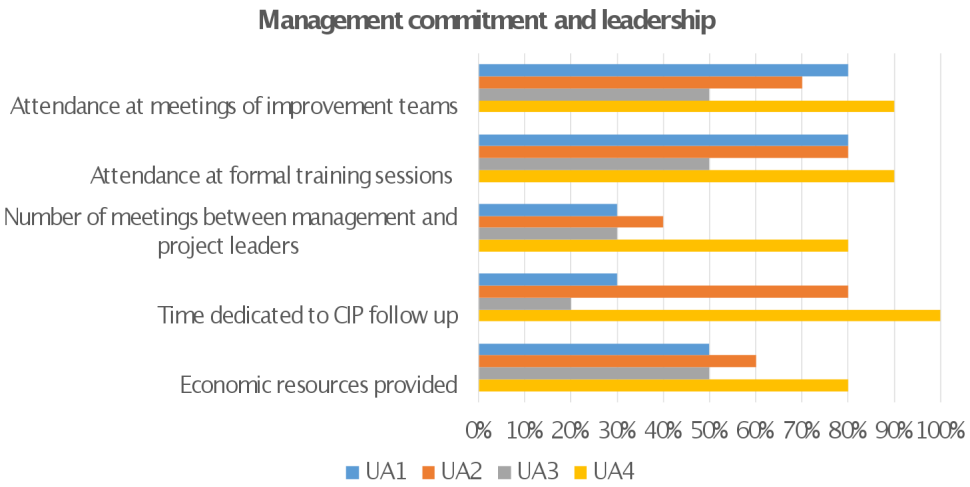
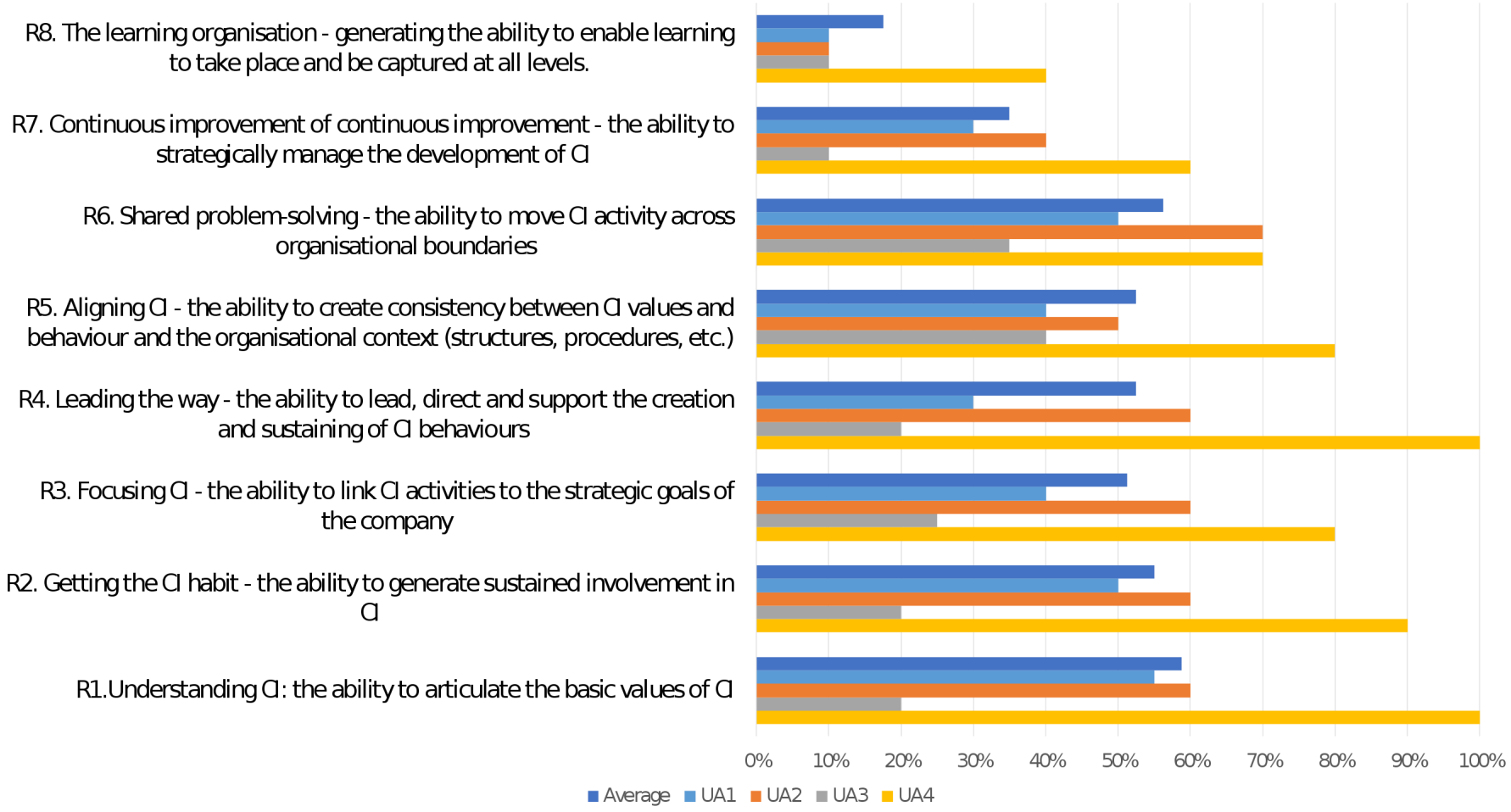
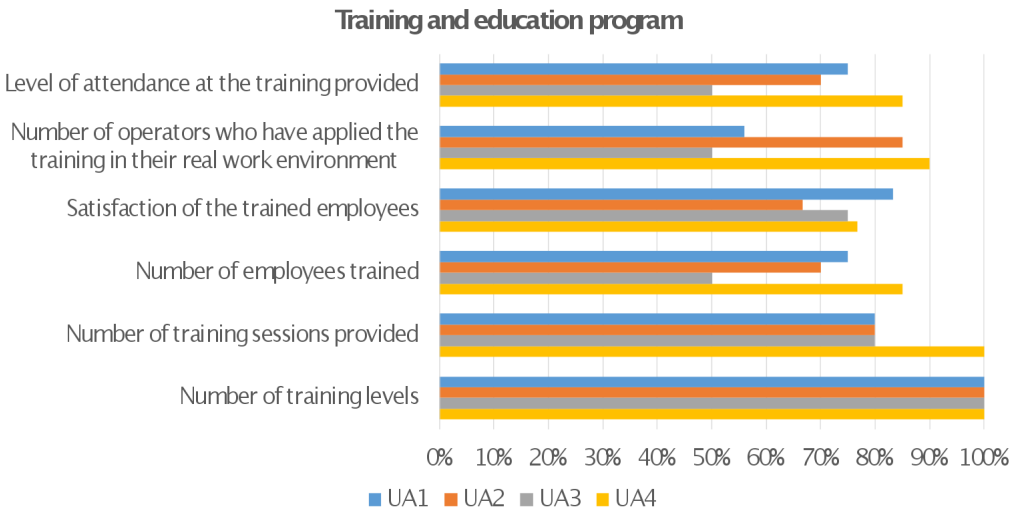
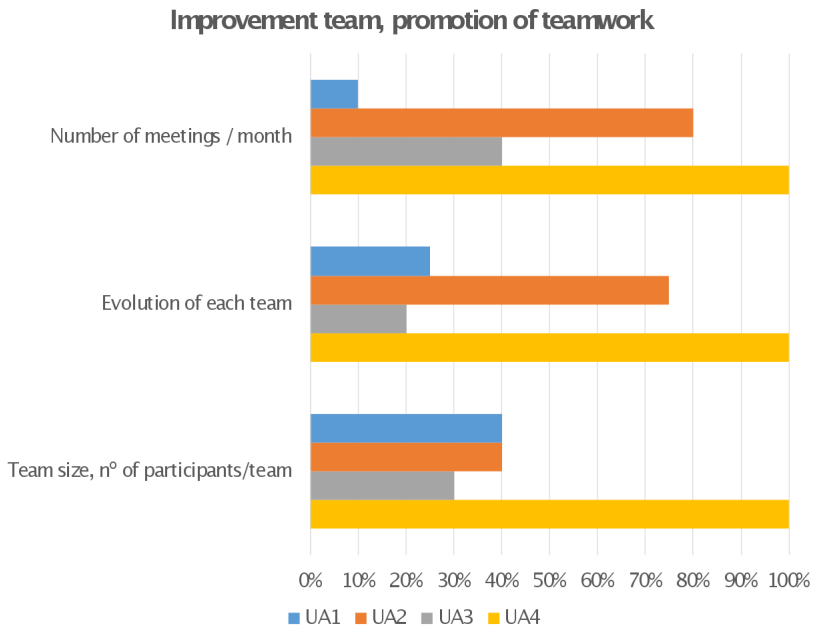
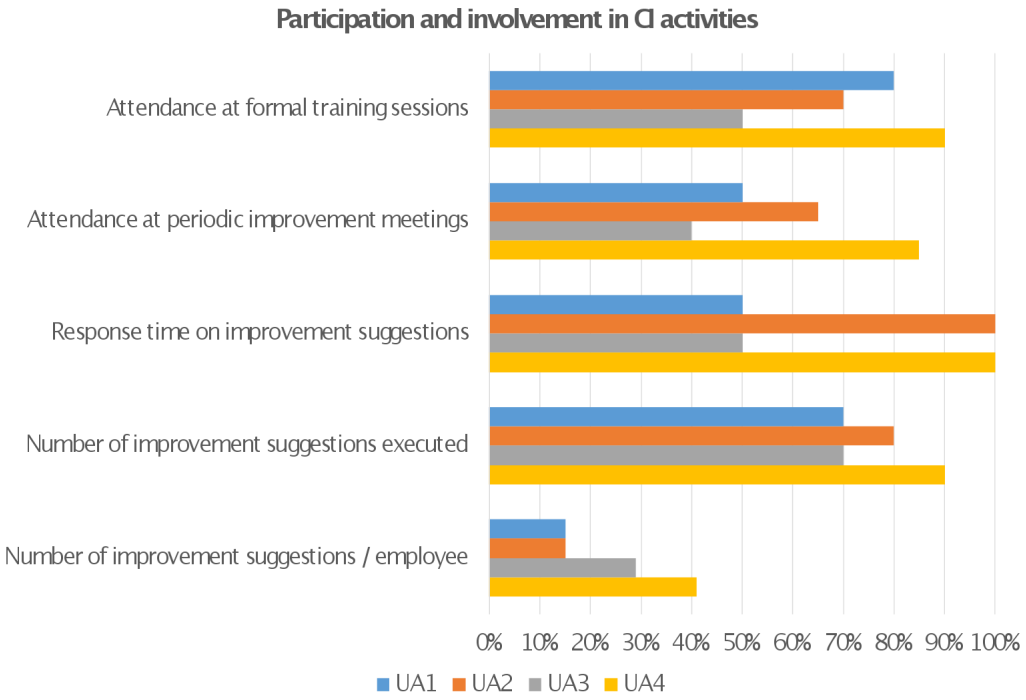
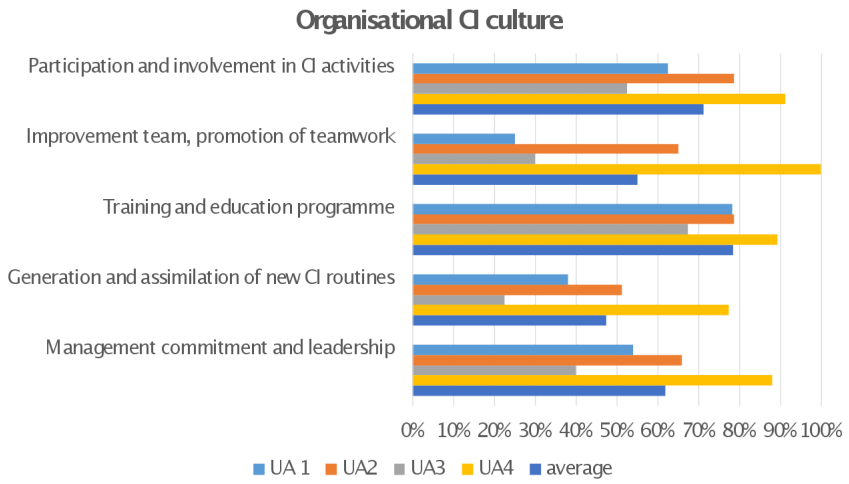

Management commitment and leadership
Attendance at meetings of improvement teams
Attendance at formal training sessions
Number of meetings between management and project leaders
Time dedicated to CIP follow up
Economic resources provided
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
UA1 UA2 UA3 UA4


Generation and assimilation of new CI routines
R8. The learning organisation - generating the ability to enable learning to take place and be captured at all levels.
R7. Continuous improvement of continuous improvement - the ability to strategically manage the development of CI
R6. Shared problem-solving - the ability to move CI activity across organisational boundaries
R5. Aligning CI - the ability to create consistency between CI values and behaviour and the organisational context (structures, procedures, etc.)
R4. Leading the way - the ability to lead, direct and support the creation and sustaining of CI behaviours
R3. Focusing CI - the ability to link CI activities to the strategic goals of the company
R2. Getting the CI habit - the ability to generate sustained involvement in CI
R1.Understanding CI: the ability to articulate the basic values of CI
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
Average UA1 UA2 UA3 UA4


Training and education program
Level of attendance at the training provided
Number of operators who have applied the training in their real work environment
Satisfaction of the trained employees
Number of employees trained
Number of training sessions provided
Number of training levels
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
UA1
UA2
UA3
UA4


Improvement team, promotion of teamwork
Number of meetings / month
Evolution of each team
Team size, nº of participants/team
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
UA1 UA2 UA3 UA4


Participation and involvement in CI activities
Attendance at formal training sessions
Attendance at periodic improvement meetings
Response time on improvement suggestions
Number of improvement suggestions executed
Number of improvement suggestions / employee
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
UA1
UA2
UA3
UA4


Organisational CI culture
Participation and involvement in CI activities
Improvement team, promotion of teamwork
Training and education programme
Generation and assimilation of new CI routines
Management commitment and leadership
0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%
UA 1
UA2
UA3
UA4
average