



## In Practice

System quality and security certification in seven weeks: A multi-case study in Spanish SMEs<sup>☆</sup>Domingo Gaitero<sup>a</sup>, Marcela Genero<sup>b,\*</sup>, Mario Piattini<sup>b</sup><sup>a</sup> *Proceso Social, c/ Julio Palacios 17, 28029, Madrid, Spain*<sup>b</sup> *Information Technology and Systems Institute, University of Castilla-La Mancha, Paseo de la Universidad, 4, 13071, Ciudad Real, Spain*

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## ABSTRACT

Every company wishes to improve its system quality and security, all the more so in these times of digital transformation, since having a good quality and security management system is essential to any company's commercial survival. Such needs are even more pressing for small and medium-sized enterprises (SMEs), given their limited time and resources. To address these needs, a Spanish company, *Proceso Social*, has developed an innovative method called "SevenWeeks" to allow SMEs to create or improve their quality and security management systems in just seven weeks, with a view to obtaining one or both of the ISO 9001 and ISO/IEC 27001 certifications.

We have evaluated the effectiveness and usefulness of SevenWeeks by carrying out a multi-case study of 26 Spanish companies, based on independent sources of evidence.

This allowed us to corroborate that SevenWeeks was indeed effective for and perceived as useful by all the companies, as it enabled them to create their own quality and security management systems in only seven weeks and to obtain the necessary ISO certification. The interviewees found SevenWeeks to be an agile and intuitive method, easy to implement, which reduces costs and effort. We also include some recommendations to improve and further develop the method.

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## 1. Introduction

Most of the software development organisations throughout the world are small and medium-sized enterprises (SMEs). These organisations have realised that in order to grow their business it is essential to improve their processes, and especially their quality and security management systems, particularly in these times of continuous digital transformation.

The standards most extensively used to improve companies' processes originate from the ISO (International Organization for Standardization). In the field of quality (general and software specific), the standard most often used by SMEs at an international level is the ISO 9001 (Pino et al., 2008; Du et al., 2016), while that employed for security is the ISO/IEC 27001 (Nicho, 2018). Indeed, according to the latest available ISO Survey of Management System Standard Certifications<sup>1</sup> (from 2018), there were 878,664 ISO 9001 certifications in total, of which 35,734 were for information technology organisations, and a total of 31,910

ISO/IEC 27001 certifications, of which 6822 involved information technology organisations.

Implementing the requirements of the ISO 9001 or ISO/IEC 27001 standards results in the attainment of a quality or information security management system that allows the company to systematically tackle problems in these areas and thus improve organisational quality or security. This is done by using the well-known PDCA (Plan-Do-Check-Act) cycle as part of a continuous improvement process.

However, for a company to become ISO compliant the implementation of many controls is required, some of which may not be appropriate for the characteristics of most SMEs. SMEs in general suffer from a lack of financial and human resources and from inadequate technical knowledge of quality/security management issues, making it difficult for them to attain standards such as the ISO 9001 or the ISO/IEC 27001 certifications. To address these difficulties, a Spanish company named *Proceso Social* has created an innovative method called "SevenWeeks". Its name springs from the fact that, in just seven weeks, the program enables an SME to create or improve its quality and security management systems with a view to obtaining the aforementioned certifications. For most SMEs, the predominant motivations for seeking such a certification originate from external pressures, such as customer demand and the ability to participate in public tenders, or simply from an internal desire for improvement.

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**Table 1**  
Goal of the multi-case study.

Analyse	SevenWeeks
For the purpose of With respect to From the point of view of In the context of	evaluating and improving effectiveness and usefulness method engineers and researchers SMEs in Spain

**Table 2**  
ISO 9001 and ISO/IEC 27001 structure.

0	Introduction
1	Scope
2	Normative references
3	Terms and definitions
4	Context of the organisation
5	Leadership
6	Planning
7	Support
8	Operation
9	Performance evaluation
10	Improvement
Annexes	...

The principal objective of this paper is to present the findings of a multi-case study which we carried out with 26 Spanish companies (all SMEs). The main goal of the study is presented in Table 1 using the GQM template (Goal-Question-Metric) (Basili and Rombach, 1988).

The paper is structured as follows: the next section presents the background to the two ISO/IEC standards, while Section 3 summarises the specific characteristics of the SevenWeeks method for ISO certification. Section 4 then provides a detailed description of the multi-case study, and Section 5 presents and discusses the related work in this field. Our conclusions and proposals for future work are presented in the final section.

2. Background

The ISO 9001 standard is the basis of the quality management system (QMS). A QMS consists of the elements of quality management that a company requires to effectively manage the quality of its products or services. As such, it includes the planning, control, and improvement of those elements of an organisation that in some way influence customer satisfaction and the achievement of corporate objectives. The ISO 9001 standard encourages the adoption of a QMS to clearly identify and manage opportunities for improvement. It is a generic standard that is applied in any productive sector or industry and affects all companies, regardless of their size.

The ISO/IEC 27000 family of standards contains a set of good practices for the establishment, implementation, maintenance, and improvement of Information Security Management Systems (ISMS). An ISMS is a set of policies and procedures that serves to standardise the management of Information Security, i.e., to ensure the confidentiality, integrity, and availability of an organisation's information and of the systems and applications that deal with it. ISO/IEC 27001 contains the set of specific requirements needed to implement an ISMS.

Both the ISO 9001 (ISO, 2015) and ISO/IEC 27001 (ISO/IEC, 2018) standards have the same structure (see Table 2).

Each standard has ten chapters, the first five (numbered from 0 to 4), of an introductory nature, refer to a declaration of principles, the structure and description of the company, general requirements, etc.. The second five present the best practices and requirements for the quality/information security management system.

Accordingly, the ISO 9001 and ISO/IEC 27001 certifications provide organisations with better credentials and give their users the assurance that they are being offered a good product/service and that their information is being protected. Moreover, certification is also a legal or contractual requirement for some industries or organisations.

Nevertheless, the implementation of a quality/information security management system in small organisations can pose a very challenging task because a company's "smallness" brings with it a number of unique problems, and the same group of people has to take on all the responsibilities, thus potentially overloading employees (Demirors et al., 1998). SMEs generally suffer from a lack of financial and human resources, inadequate technical knowledge of quality management, a poor knowledge of formalised systems, and insufficient experience as regards internal auditing (Ghobadian and Galleary, 1997). They often lack resources, which limits the initiatives that they can carry out (Poksinska et al., 2006), and they cannot afford the often excessive costs involved in the effort that is necessary to create, refine, and document the management system, the cost of training employees, audit costs, etc.). One should bear in mind, also, that the implementation of a quality/information security management system usually takes between nine to eighteen months from inception to registration.<sup>2</sup>

The ISO 9001 has been adopted by SMEs on a global scale for different purposes, both external and internal, depending on whether the involvement primarily results from a response to external pressures, such as market demand and regulatory requirements (Kakouris and Sfakianari, 2019), or from an internal desire for improvement. Most often the motivations for seeking a certification originate from external pressures, such as customer demand and the ability to participate in public tender. It has been shown in several studies (Van Der Wiele and Brown, 1997; Guler et al., 2002; Heras-Saizarbitoria and Boiral, 2013, 2015) that one of the main reasons why external or reactive motives are dominant among SMEs is because ISO certifications are one of the main legitimisation strategies employed by these firms to overcome the obstacles presented by their "smallness". Kumar et al. (2014) highlight that ISO 9000 is the most popular quality management initiative among SMEs, followed by the recent trend of implementing lean strategies to streamline business processes. Indeed, the ISO 9000 can be viewed as a strategic tool that enables SMEs to contend with market changes and adverse economic conditions (Rubio-Andrada et al., 2011).

Regarding Information Security Management Systems (ISMS), organisations tend to adopt several approaches, since security measurements naturally vary according to their business relevance. The preferred way to ensure that an ISMS is being properly implemented is to obtain a standard compliance certification, such as one from the ISO 27000 series, which helps organisations to keep their information assets secure (Hamdi et al., 2019).

3. Description of the SevenWeeks method

This section describes the main characteristics of the SevenWeeks method created by *Proceso Social*, after which it describes how and why this method evolved.

The method proposes a business management model based on five key elements: a business model map, a service catalogue, relationship models, document management and a series of indicators, all of which are contained in the management system shown in Fig. 1.

The SevenWeeks method was developed by following the company's own methodology, known as "ITAQA". Inspired by the

<sup>2</sup> <https://isoupdate.com/resources/exploring-the-time-commitment-for-iso-9001-implementation/>.

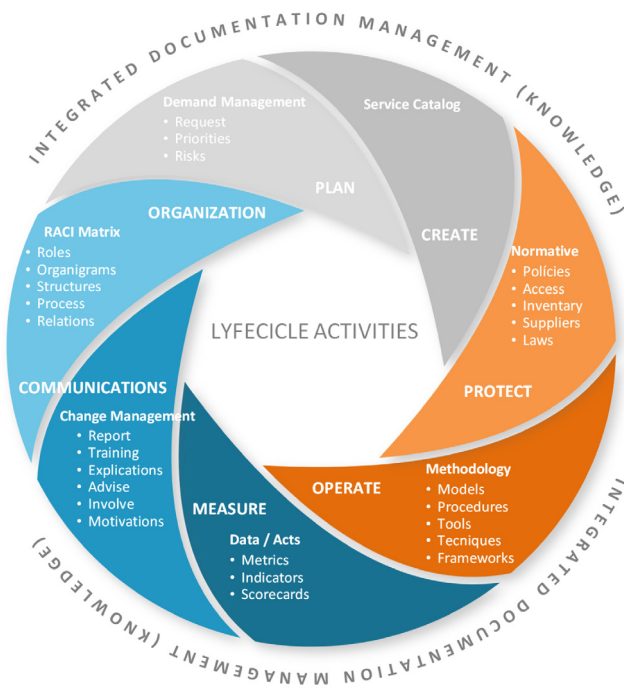


Fig. 1. Management system that serves as the basis for the SevenWeeks method.

legend in Greek mythology of Ulysses' journeys in search of his origins, its objective is to return to common sense ("back to basics") and away from technological sophistication, aiming thereby at saving time and costs, and ultimately providing SMEs with greater competitiveness. SevenWeeks makes possible the application of lean principles to quality management systems for SMEs, which translates into added value for the customer, continuous improvement, process cycle efficiency, etc. In fact, SevenWeeks promotes the use of the DMAIC cycle (Define, Measure, Analyse, Improve and Control), and visual techniques typical of Lean such as SIPOC (Supplies, Inputs, Process, Outputs and Customers) and VSM (Value Stream Mapping), with which the evolution of the system can be carried out in a quantifiable manner based on indicators. The teams will similarly evolve into Kaizen work groups (Imai, 1988), establishing a continuous improvement board that will guide the company's activities.

The first version of SevenWeeks was defined in January 2015 based on the models of ISO standards (9001, 27000, etc.) and other best practices of leading software models such as CMMI, ITIL, PMBOK and COBIT. In 2016, version 2 was defined, which incorporated improvements in the documents proposed by the method, unified these, and updated the method to fit the structure of the new ISO 9001:2015. The 36 forms in version 1 were simplified and condensed into nineteen new forms and quality records. The process maps were also improved. This version was applied to fifteen additional management systems. Version 3, which is the one currently employed, was defined in March 2018. In this version, all the documents were adapted and implemented using the R2Docuo documentation and workflow management system (<https://www.r2docuo.com/en/>) and implied a global process for industrialisation.

### 3.1. SevenWeeks Tasks

When implementing SevenWeeks, *Proceso Social* first carries out a "Zero Diagnosis" task to discover whether the company already has a quality or security management system, to determine in which standard the company wishes to be certified,

whether the initiative starts either as a business improvement or a commercial need, whether the company makes a product or offers a service, and the number of people working for the organisation.

*Proceso Social* then uses this information to build the "Zero Backlog", which shows whether it will be feasible to implement the standard in seven weeks. If this is the case, seven iterations are planned, with the client company ideally spending one week on each iteration.

*Proceso Social* also parameterises the templates of the Component Library based on the corresponding standard and identifies which document management tool is to be used. If the company does not have one, they are provided with R2 Docuo.

The tasks carried out in each iteration of SevenWeeks are shown in Table 3.

In each week, the different sections of the standard are addressed, and are grouped in accordance with the result of the "Zero Diagnosis". *Proceso Social* generally works two days a week in the premises of the client, while the rest of the time is spent in its own office. When working at the client's office, 50-minute sessions are planned with selected teams, each of no more than three people, during which the sections required by the standard are developed using Visual Thinking techniques and Kanban boards.

At the end of each week, a 75-minute review session is held in which the work done is approved and the iteration for the following week is confirmed. As the weeks go by, the duration of the reviews may increase, without ever exceeding two hours.

One element that companies particularly appreciate is the process map. This is created in the first week and allows for a visual management that promotes people's involvement. Fig. 2 shows an example of a process map.

After dealing with all the sections in the ISO standard during weeks one to five, an internal audit is carried out as part of the fifth week to check that all clauses of the relevant standard have been met. Depending on the results of this audit, the necessary projects will be started, provided that the given standard has been implemented. Finally, when the company has obtained its objectives, certification is requested from the corresponding certification entities (IGC, CSQ, Lloyd's Register, Tüv Rheinland, etc.).

The main key characteristics of SevenWeeks, that we believe make it particularly suitable for SMEs, are:

- A reduction in time, since the system implementation projects are carried out in only seven weeks, thus reducing costs.
- Adaptation of the management system to the company's business – and not vice versa.
- The active involvement of people, thus empowering staff in the quality process as part of a corporate culture and not merely as an obligation.
- Visual management techniques, such as the process map, which facilitate understanding for all those involved and strengthens their connection to the project.
- Information management, carried out by means of a workflow which is currently housed in the cloud.

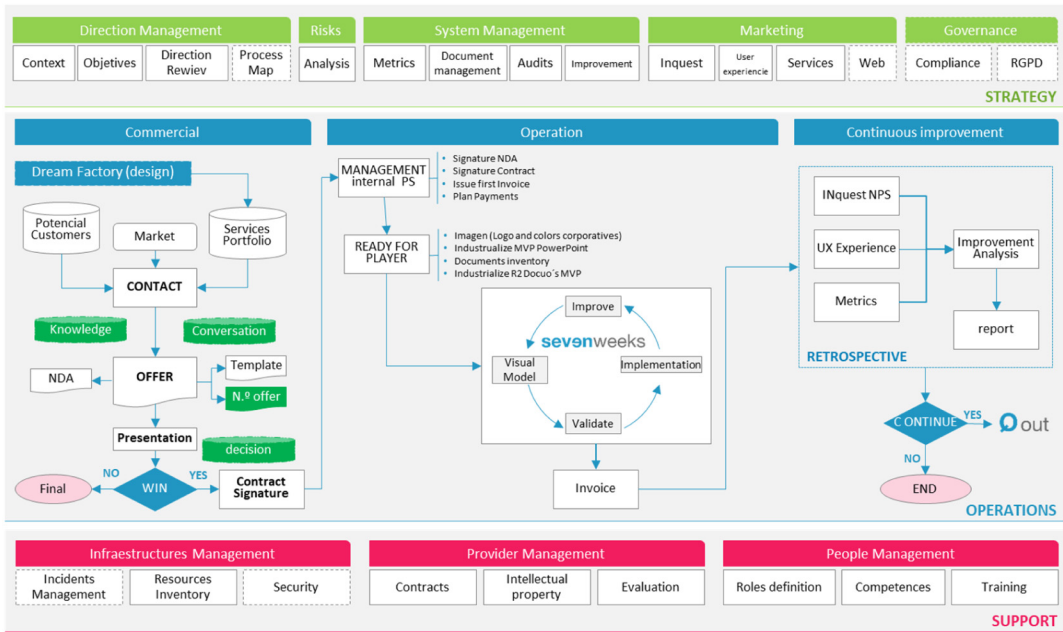
### 3.2. Qout description

The International Organisation for Standardisation (ISO) decrees that any certification is valid for three years, after which a certificate renewal audit will be carried out, with a follow-up audit being required annually to check the evolution of the system.

As part of their support to companies in this continuous improvement process, *Proceso Social* uses the Qout (Quality Outsourcing) method, which requires that at least four meetings a

**Table 3**  
Tasks of SevenWeeks.

WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	WEEK 7
Initial meeting Scope/context Parties concerned Laws SWOT/canvas Politics Objectives Communication	Infrastructures Objectives Risk Changes	Training Control and process Metrics	Control and process Metrics	Management review Internal audit	Final review Final meeting	Preparation for external audit



**Fig. 2.** Example of a process map.

year be held, at each of which a person external to the company carries out follow-up and control actions. Prior to the annual follow-up audit, the results of these quarterly meetings are used in an internal audit and are reviewed in order to ensure the evolution of the system and the success of the follow-up audit.

With regard to these planned meetings in the Qout method (see as an example Fig. 3), the model used is the same as in SevenWeeks, i.e., an iteration of one or two days with the work team during which the key activities, the appropriate indicators, and the performance of the previously planned actions are reviewed. As a result, after the first three years, a culture of continuous improvement has been implemented.

**4. Multi-case study description**

Yin (2017) defines a ‘case study’ as “an empirical enquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident”. The key characteristics of a case study are: (1) it is of a flexible type, dealing with the complex and dynamic characteristics of real-world phenomena, such as software engineering, and (2) its conclusions are based on a clear chain of evidence, whether qualitative or quantitative, collected from multiple sources in a planned and consistent manner. It was for this reason that we decided to use this type of research methodology to validate SevenWeeks, by employing a holistic multi-case study and following the guidelines defined by Runeson and Höst (2009), Runeson et al. (2012) and Verner et al. (2009).

The main characteristics of the case study will be detailed in the following sections.

**4.1. Multi-case study design**

The main goal of this multi-case study is to demonstrate the effectiveness and usefulness of SevenWeeks for those SMEs that wish to create and/or improve a quality or security management system to obtain the necessary ISO certification (ISO 9001, ISO/IEC 27001 or both). Furthermore, we believed that this case study would enable us to improve SevenWeeks itself.

To attain this research goal, we defined two main research questions, the first of which was sub-divided into two questions:

- RQ1. Is the SevenWeeks method useful for SMEs as a means of creating and/or improving a quality or security management system to obtain the requisite ISO certification (ISO 9001, ISO/IEC 27001, or both)? In determining the usefulness of SevenWeeks (in terms of its effectiveness and client satisfaction), we asked the following questions:
  - RQ1.1 Does SevenWeeks lead to the obtaining of the necessary ISO certification? This question is related to the effectiveness of SevenWeeks.
  - RQ1.2 Are the companies satisfied with the implementation of SevenWeeks? This question is related to the perceived satisfaction with SevenWeeks and its usefulness for the companies implementing it.
- RQ2. Are there any aspects of SevenWeeks that require improvement? The aim of this question was to collect evidence concerning the need to refine or improve SevenWeeks as a result of its application in the participating companies.



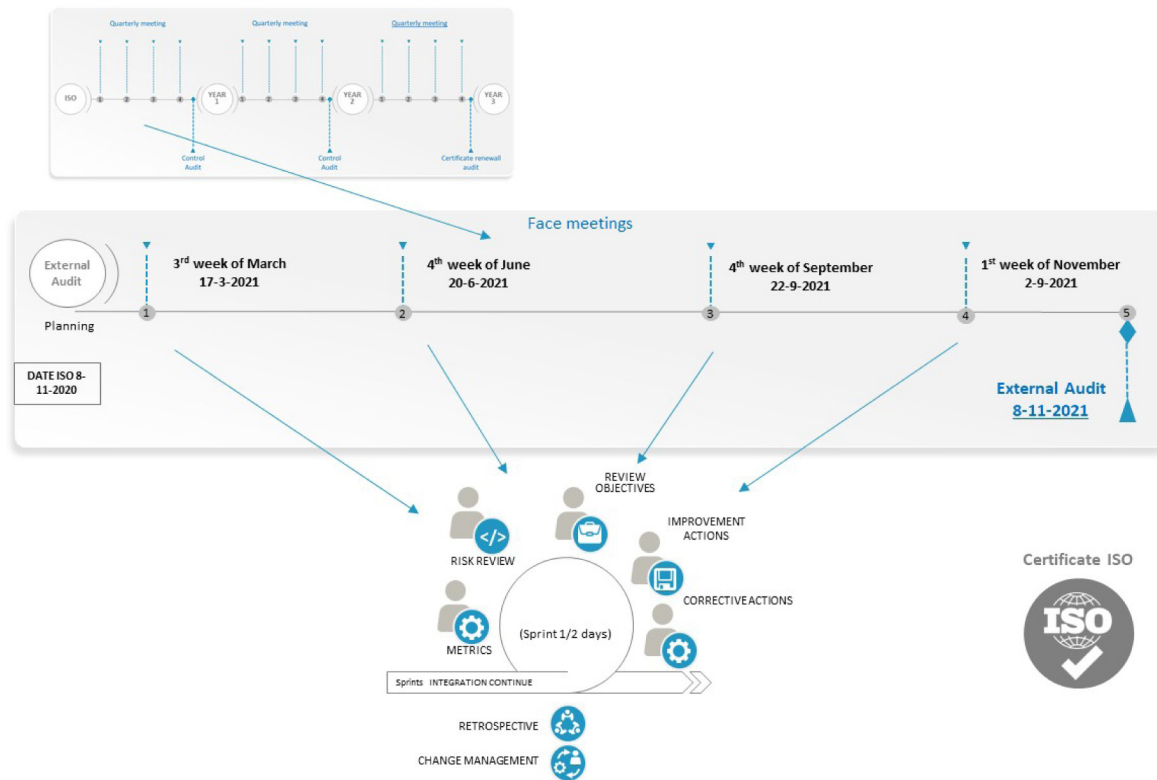


Fig. 3. Qout timeline example.

Twenty-six SMEs took part in this multi-case study (see Table 4). We cannot disclose the names of the companies for reasons of confidentiality and, consequently, we have to render them anonymous by using a numbering. Each company constitutes a separate case, and the unit of analysis is the implementation by *Proceso Social* of the SevenWeeks process in each SME. Nineteen of the 26 SMEs were in the ICT sector (Information and Communications Technology), whilst the rest were in different sectors such as education, publishing, law firms, etc. (see the fourth column of Table 4). In terms of size, ten were micro companies (meaning 1–5 employees), nine were very small companies (5–25 employees) and seven were small companies (>25 employees) (see the third column of Table 4).

#### 4.2. Data collection procedure

Data for each of these 26 companies were collected from 2015 until February 2020

The following three data sources were considered:

- External audits: following initial audits carried out by the certification companies, external audit reports were obtained for each of the SMEs. Among the information in these reports is the fact of whether the relevant SME has obtained the certification (RQ1.1), and any major or minor non-conformities with regard to the clauses contained in each standard (RQ2).
- Survey: after implementing SevenWeeks, a survey was conducted in each of the 26 participating SMEs as to the level of their satisfaction with the services offered by *Proceso Social* during that implementation (RQ1.2). Additionally, this survey contained open questions for the participants, which thus gave additional feedback on the implementation of SevenWeeks at their companies (RQ2).

- Interviews: to complement the feedback collected in the survey, the same external company also carried out interviews with each SME. The results of the same, along with those of the survey, made it possible to provide answers to questions RQ2 and RQ1.2.

The same people who completed the survey or participated in the interviews were responsible for obtaining the certifications and for implementing the quality or safety management system using SevenWeeks.

The data sources used to answer the research questions are illustrated in Fig. 4.

Several types of participants took part in this multi-case study: staff from *Proceso Social*, external certification companies, the company that carried out the survey and interviews, along with the UCLM researchers (the authors of this paper), who were present throughout the entire process.

In this multi-case study, a second-degree data collection method (Lethbridge et al., 2005) was followed, by which the researchers directly collected raw data without interacting with those participating in the survey, interviews, or external audits during data collection.

#### 4.3. External audits study

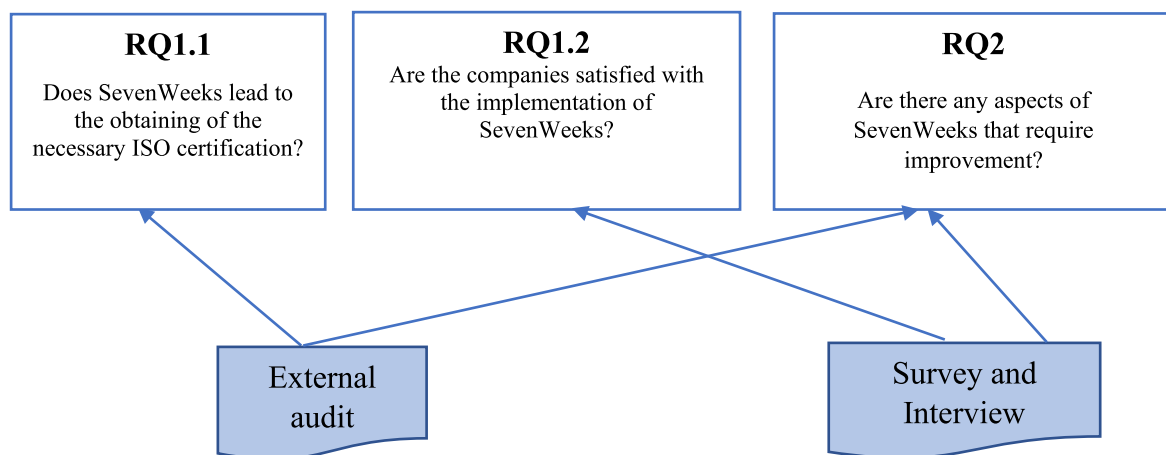
In this process, four certification companies (IGC, CSQ, TÜV Rheinland, and Lloyd's Register) carried out external audits. More specifically, fourteen external audits were carried out by IGC, seven by CSQ, one by TÜV Rheinland, and one by Lloyd's Register (see the sixth column of Table 4).

Two to three weeks after the initial external audits all the SMEs obtained the certification in the respective standard, which demonstrates that the SevenWeeks method achieved the objective pursued. Seventeen companies obtained the ISO 9001 certification, three obtained the ISO/IEC 27001, and six obtained both certifications (ISO 9001 and ISO/IEC 27001) (see Table 4).

**Table 4**

Overview of the SMEs involved in the multi-case study.

ID	ISO/IEC CERTIFICATION	ENTERPRISE SIZE	COMPANY SECTOR	INTERVIEW	CERTIFICATION COMPANY	EXTERNAL AUDIT
C1	9001	MICRO	non-ICT		IGC	
C2	9001	MICRO	non-ICT		IGC	EA-9001
C3	9001	MICRO	non-ICT		IGC	
C4	9001	VERY SMALL	non-ICT		IGC	EA-9001
C5	9001	VERY SMALL	non-ICT	X	IGC	EA-9001
C6	9001 and 27001	VERY SMALL	ICT	X	IGC	EA-27001
C7	9001 and 27001	VERY SMALL	ICT	X	IGC	EA-27001
C8	9001	SMALL	non-ICT	X	IGC	EA-9001
C9	9001 and 27001	SMALL	non-ICT		IGC	EA-27001
C10	9001	VERY SMALL	non-ICT		TÜV Rheinland	EA-9001
C11	9001	MICRO	non-ICT		IGC	EA-9001
C12	9001	MICRO	non-ICT	X	IGC	EA-9001
C13	9001 and 27001	VERY SMALL	non-ICT	X	CSQ	EA-27001
C14	9001	MICRO	non-ICT	X	IGC	EA-9001
C15	9001	SMALL	non-ICT		IGC	EA-9001
C16	9001	MICRO	ICT		IGC	EA-9001
C17	9001	SMALL	non-ICT	X	Lloyd's Register	EA-9001
C18	9001 and 27001	VERY SMALL	ICT		CSQ	EA-27001
C19	9001	MICRO	ICT	X	CSQ	EA-9001
C20	9001	MICRO	non-ICT	X	CSQ	EA-9001
C21	9001 and 27001	SMALL	ICT		CSQ	EA-27001
C22	9001	SMALL	non-ICT		CSQ	EA-9001
C23	9001	MICRO	non-ICT		CSQ	
C24	27001	VERY SMALL	ICT	X	CSQ	EA-27001
C25	27001	SMALL	non-ICT	X	CSQ	EA-27001
C26	27001	VERY SMALL	non-ICT	X	CSQ	EA-27001

**Fig. 4.** Relation between data sources and research questions.

Nonetheless, we also reviewed the external audit reports in order to discover whether there had been any non-conformities or improvement opportunities, and whether these were related to the implementation of the SevenWeeks method, and thus to see how this might be improved upon.

However, not all the companies offered us their external audit reports: we had access only to fourteen of the reports for ISO 9001 certification and nine for ISO/IEC 27001 (see the seventh column of Table 4). In five or more audit reports for ISO 9001 certification, minor non-conformities or observations were found with regard to the following clauses:

- Organisation Context: 4.1 Understanding the organisation and its context, 4.2 Understanding the needs and expectations of interested parties, and 4.4 Quality Management System and its processes.  
Almost no company follows the good practice of having a policy that indicates the strategic lines to follow during the development of their work. External audits confirm this as a main weakness of SMEs, i.e., a lack of formalisation in the organisation, and a lack of context and strategic plans (these

being usually “in the head” of SME managers and/or owners but not properly formalised). There is also a need for greater detail regarding customers’ expectations and requirements.

- Leadership: 5.3 Quality policy.  
Prior to the implementation of a quality management system, the company usually lacks even the figure of the “quality manager”, let alone an explicit policy in this regard. Although the SevenWeeks method insists on these aspects, it requires a certain corporate maturity for them to be actually implanted and “institutionalised” in the organisation.
- Planning: 6.1 Actions to address risks and opportunities.  
The absence of a risk management culture has a significant impact on the aspects covered in Section 6. The external audit detects whether a business risk analysis methodology has been implemented only as regards certain cases, and that in general the estimation of risks (which are usually undervalued) must be improved, along with an understanding that new risks may appear at any time. It also detects that appropriate actions are not always defined to address the risks, or that the result of the SWOT analysis is not

considered as a source to be employed in the definition of risks.

- 7. Support: 7.1 Resources.

A need to improve the IT infrastructure is generally detected, particularly as regards document management. Similarly, a need to improve the competencies of key personnel through periodic evaluations is often found.

- 9. Performance evaluation: monitoring, measurement, analysis, and evaluation.

The definition of indicators and their level of compliance is often deficient, meaning that the necessary processes must be improved so that the personnel take the actions required by the results obtained. Unfortunately, we verified that, in Spain at least, the measurement culture is largely absent in SMEs.

Regarding ISO/IEC 27001, some minor non-conformities or observations were found in at least five audit reports, affecting the following clauses:

- 10. Improvement: 10.3 Continuous improvement.

The audits detect a need to improve the documentation of the continuous improvement system, as well as a need for the management to place greater emphasis on those findings of the review that deal with the continuous improvement of management systems.

#### 4.4. Description of the survey

Following the application of the SevenWeeks method, and some two weeks after the company had obtained the certification, we decided to evaluate each of the 26 enterprises' level of satisfaction with the services offered by *Proceso Social* during the implementation of SevenWeeks. So as to maintain impartiality and avoid possible bias in the responses, it was decided that an external company, specialising in customer satisfaction studies, would carry out a survey of the staff who were responsible for obtaining the ISO certification in each SME. A questionnaire consisting of the ten questions shown in Table 5 was used. The answers to the first nine questions were based on a five-point Likert scale (1-strongly disagree, 2-disagree, 3-undecided, 4-agree, 5-strongly agree), and there was then a final open question that allowed the companies to make recommendations if they considered it necessary.

##### 4.4.1. Analysis and interpretation of the data collected in the survey

Firstly, we conducted a reliability analysis of the answers to the first nine questions. The value obtained in the Cronbach's Alpha was 0.849, showing that the questionnaire was reliable, and signifying that all the questions were related to measuring the same constructs — in this case, customer satisfaction. This shows that the questionnaire was consistent in what concerns the desired object of parametrisation.

**4.4.1.1. Analysis of questions Q1–Q8.** Since *Proceso Social* aims to attain the highest satisfaction of all SMEs, and since the median was 4 for most of the questions, we then grouped the responses into two categories of values: low (1, 2, 3) and high (4, 5), after which we grouped the values obtained within these categories.

Fig. 5 similarly reflects that all the questions had a high value, which generally shows that all the SMEs were satisfied in an overall sense, and not only with the implementation process of SevenWeeks. Q7 and Q8 attained the highest incidence of low values. We interpret this as meaning that, according to the companies' perceptions, more training in the tools and services provided by *Proceso Social* is required (Q7). Moreover, when *Proceso Social* implements its services it would be recommendable

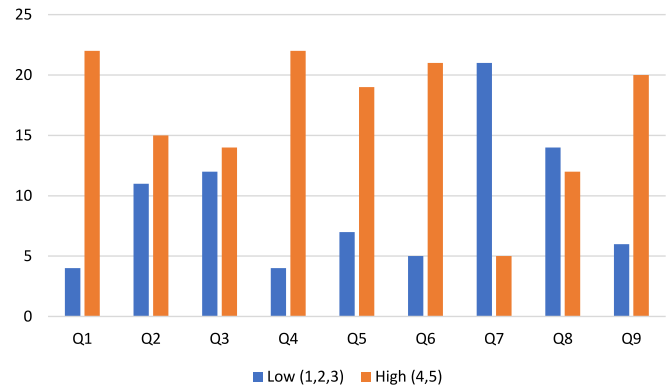


Fig. 5. Frequency distribution of responses per question grouped into low and high values.

for it to involve the relevant people with a sufficient level of influence from the outset (Q8).

Q2 and Q3 both attained approximately 50% of low values and 50% of high values. This means that *Proceso Social* should probably place more emphasis on the reasons for and benefits of implementing its services in SMEs (Q2), in addition to highlighting or quantifying the relevance of implementing those services (Q3).

We then carried out another study with the objective of analysing whether there was any correlation between the questions and the size of the SME, the enterprise sector, or the particular ISO certification they were pursuing.

Fig. 6 shows the box plots corresponding to the analysis of each question grouped by SME size.

Q7 in Fig. 5 shows that the best values were obtained from small-sized companies. The median score of the three company sizes was 3, but we can conclude that, regardless of the size of the company, further training in the tools and services provided by *Proceso Social* is probably necessary.

Regarding Q8, the best values were obtained from small companies, therefore we can take this as an indication that micro and very small companies had more difficulty in involving the relevant people with a sufficient level of influence from the beginning of the SevenWeeks implementation process.

Fig. 7 shows the box plots corresponding to the analysis of each question grouped by enterprise sector.

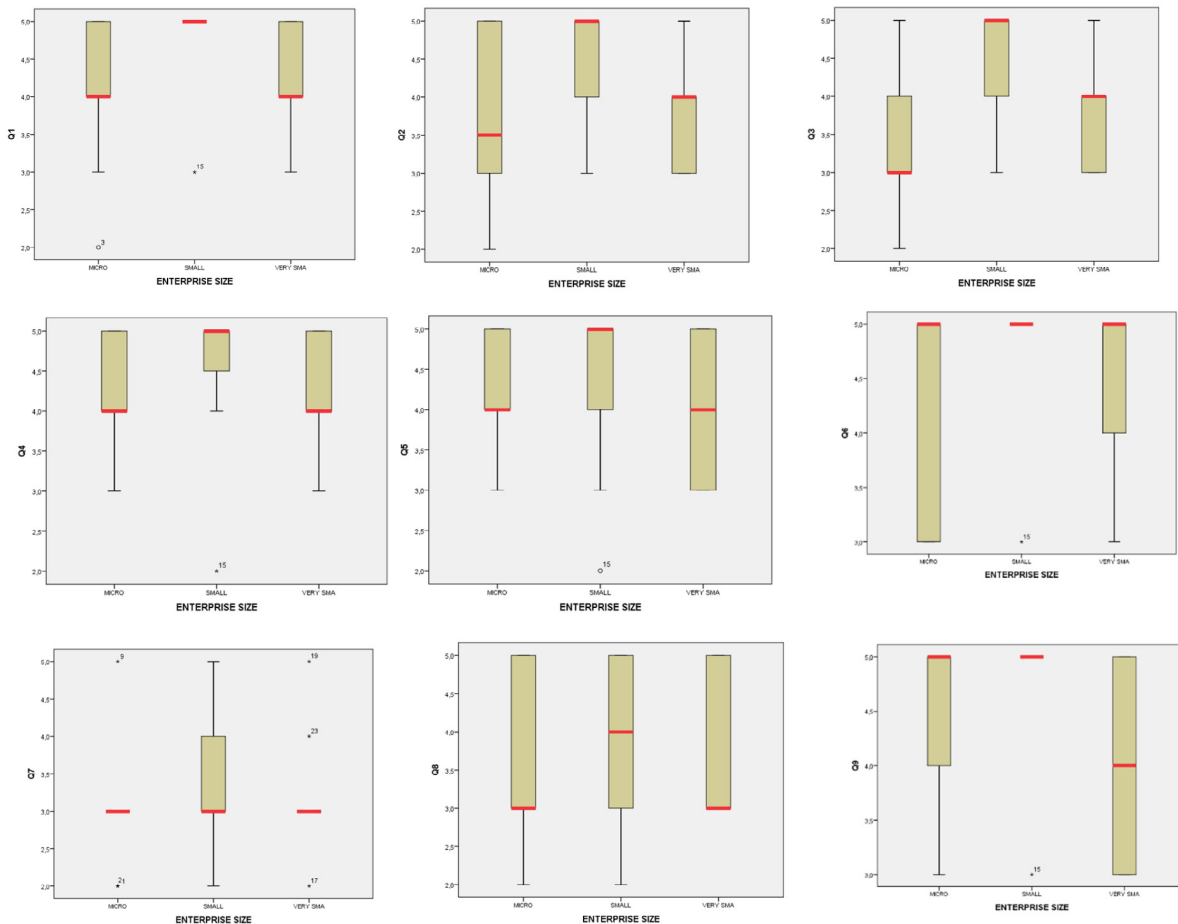
Upon analysing the answers given in Q7, we can conclude that, with respect to the enterprise sector, ICT people had more skills in tool management — which is logical given the technological nature of ICT companies. With respect to Q8, in non-ICT companies, people with a sufficient level of influence were more involved. In this case, we also analysed whether there was any connection between company sector and enterprise size but found that size distribution between ICT and non-ICT companies was similar.

We also carried out an analysis by the type of certification obtained (ISO 9001, ISO/IEC 27001, or both) and the results here were also similar. However, it is worth noting that the need to involve the appropriate company personnel with a sufficient level of influence from the beginning of the SevenWeeks implementation process was accentuated for those companies seeking to obtain both certifications.

**4.4.1.2. Analysing Q10.** An analysis of Q10 shows that only 20 of the 26 companies made recommendations. There were several recommendations made, regardless of the ISO standard pursued, and all related to the services provided by *Proceso Social* during the implementation of SevenWeeks, such as:

**Table 5**  
Satisfaction questionnaire.

No.	Questions
Q1	The service provided by <i>Proceso Social</i> in your company has been useful for you.
Q2	The reasons for providing this service and the benefits they provide are clear.
Q3	The organisation would have lost effectiveness or efficiency if it had not implemented these services.
Q4	The services provided by <i>Proceso Social</i> are well deployed.
Q5	The services provided by <i>Proceso Social</i> have been effectively communicated.
Q6	You can see the results obtained.
Q7	You were adequately trained in the tools and services provided by <i>Proceso Social</i> .
Q8	When <i>Proceso Social</i> implemented its services, the relevant people with a sufficient level of influence were involved from the beginning.
Q9	In general, you are completely satisfied with the services provided by <i>Proceso Social</i> .
Q10	Write the recommendations you consider appropriate.



**Fig. 6.** Results of questions by SME size.

- Q7: More training was generally recommended, preferably using the business language of each company. Nevertheless, the respondents stressed the need for shorter training sessions.
- Q8: A greater involvement of relevant personnel with a sufficient level of influence from the beginning of the implementation of SevenWeeks is required.

There were also additional findings:

- It is necessary to incorporate more appropriate tools, since the tools used for documentary management were neither very visual nor intuitive.
- The whole implementation process should be automated.

Specific recommendations concerning ISO/IEC 27001 were made, such as the need to improve the continuity plan, while integrating the GDPR (General Data Protection Regulation) with ISO/IEC 27001 was also considered to be a very good idea.

These recommendations will be considered when seeking to improve both SevenWeeks and its implementation process.

#### 4.5. Description of the interviews

As stated previously, to complement the feedback collected in the survey, the same external company that carried out the survey also carried out interviews, approximately one or two months after obtaining the certification. The 26 companies were sent an invitation to participate in the interviews. In total, thirteen SMEs agreed to be interviewed. Six open-ended questions (see Table 6) were asked, and the interviews lasted approximately 20 min each.



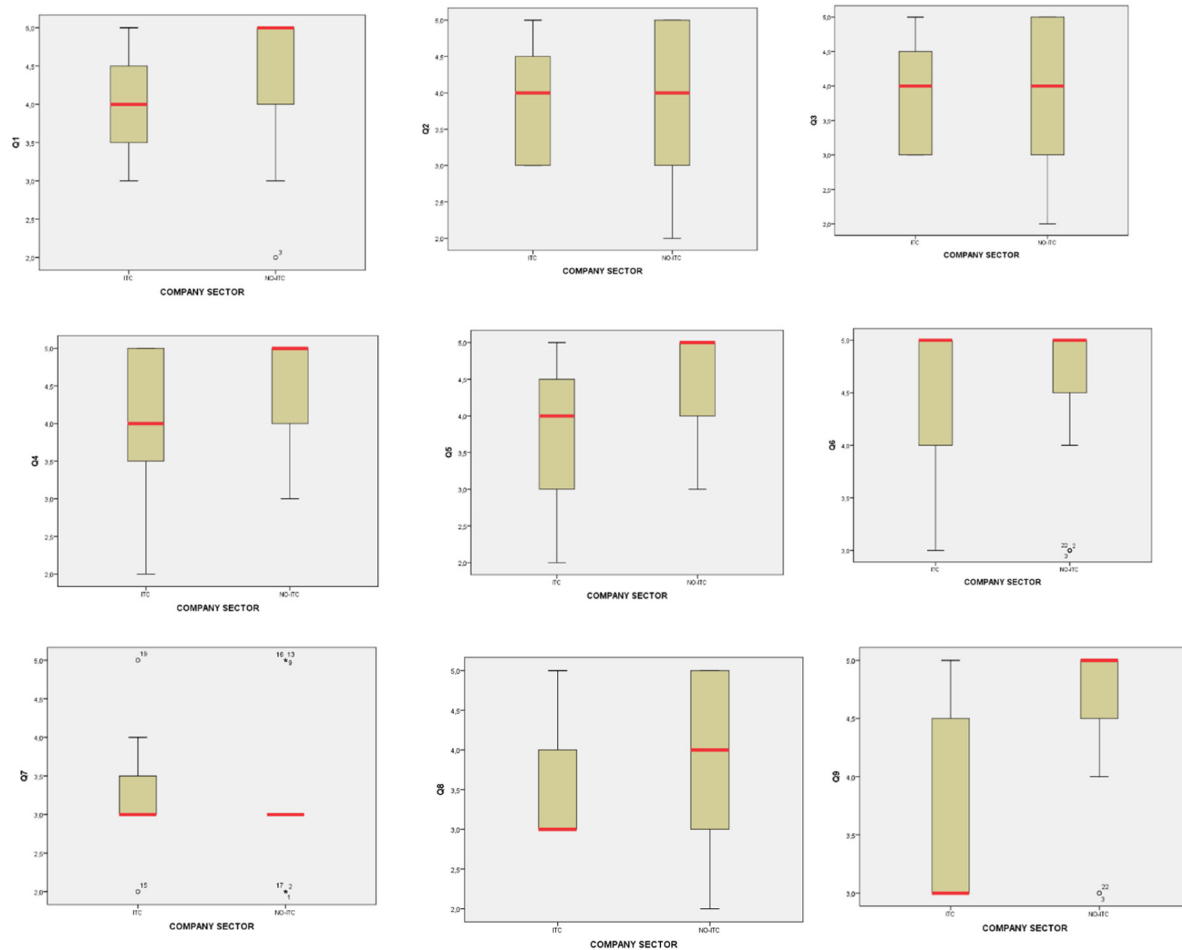


Fig. 7. Results of questions by SME sector.

**Table 6**  
Questions in the interview.

No.	Questions
Q1	What is the activity of your company?
Q2	What service has <i>Proceso Social</i> carried out for you? Consulting, preparation for a certification? If so, for which certification?
Q3	Has it somehow contributed to the management of the company and what has it contributed to you?
Q4	Was the process easy for you?
Q5	Were personnel of the SME involved? And how did they perceive it?
Q6	What would you highlight in the <i>Proceso Social</i> service as regards the implementation of SevenWeeks?

The enterprises that were interviewed are marked with an “X” in the fifth column of Table 4.

The external company that conducted the interviews provided us with reports concerning the interviews.

#### 4.5.1. Analysis and interpretation of the data collected in the interviews

The answers to the questions Q1 and Q2 of the interviews are summarised in columns 2 and 4 of Table 4. Q1 was synthesised into two values, ITC and non-ITC, while Q2 reflects the ISO certification that each company sought to obtain.

The findings related to the other interview questions are presented below, along with some of the interviewees' responses.

#### Q3. Has it somehow contributed to the management of the company and what has it contributed to you?

The interviews highlighted the value of SevenWeeks in showing the importance of working in a manner that involves continuous improvement and quality.

[IntC5] “It adds value in terms of the importance of working on continuous improvement. It brings a new vision of the quality issue and has made the team aware of the relevance of quality”.

SevenWeeks also helps to improve the management of the company with a strategic alignment and data-based decision support.

[IntC6] “I am realizing that growing is made easier this way — for example, when hiring, you know what you need, and the person who arrives knows what they have to do and what documentation to read. In addition, it gives us greater control over the equipment, and greater security. Another benefit was establishing indicators, being able to measure. You no longer say, “I think this is going well”, if you lack objective data. We often have perceptions of profitability that do not correspond to reality”.

[IntC8] “It contributed to us, rendering more effective our reorganization, implementation processes, documenting and communication”.

[IntC13] “It aligns staff with the strategic objectives of the company. The “team vision” is achieved by means of a cross-sectional analysis of the company”.

#### Q4. Was the process easy for you?

In general, all interviewees agreed that SevenWeeks was easy to implement. They also highlighted the visual and graphic aspects of the method.

[IntC6] “Less papers, more diagrams, faster and easier”.

[IntC7] “The process has been very simple and fits perfectly with our day-to-day work”.

[IntC8] “Yes, very comfortable, easier than expected”.

[IntC13] “SevenWeeks has a very graphic process. It analyses the company’s processes and graphically makes a flow chart, applying “agile” “canvas” “SWOT” methodologies. It leaves everything explicit and the management is very powerful for the direction”.

[IntC24] “Yes, we did not need to spend as much time as we at first thought”.

#### Q5. Were personnel of the SME involved? And how did they perceive it?

In general, at the beginning, although there was an awareness of the need to obtain certification, some companies did not have a team for this purpose. Gradually, the necessary personnel did become involved, although as they are SMEs, in some cases a single person was responsible for obtaining the certification. Their perception of SevenWeeks was nevertheless very favourable, since implementing SevenWeeks requires fewer resources and improves communication.

[IntC8] “Yes, at the beginning there was rejection throughout the company, but then they soon saw the benefit”.

[IntC24] “Yes, two professionals were involved. We didn’t need to spend as much time as we thought”.

[IntC25] “It managed to involve the entire organisation even when they initially showed no interest”.

[IntC19] “For me it was like a Master’s degree: I learned a lot that I didn’t know about my company”.

#### Q6. What do you highlight about the *Proceso Social* service as regards implementing SevenWeeks?

SMEs highly valued the fact that *Proceso Social* offers a service for implementing SevenWeeks that adapts to the reality of small companies due to its simplicity and speed of implementation, i.e., it requires fewer resources to obtain the certification.

[IntC5] “The main value of *Proceso Social* is speed”.

[IntC8] “They have simplified the complex and have helped us in the relationship with the certifying entities”.

[IntC12] “The main value of implementing SevenWeeks by *Proceso Social* is its speed, simplicity, and turning something tedious into something interesting”.

[IntC14] “Speed, kindness and patience”.

[IntC17] “I highlight the adaptability, treatment of the team, and the speed as regards solving doubts and the needs that arise”.

[IntC26] “Simplify the complex. Empathy with the team and they strive to involve us all”.

#### 4.6. Summary of findings per research question

In summary, the following findings were obtained:

- Regarding RQ1, we can conclude that, according to strong evidence shown in the external audit reports, surveys, and interviews:

- The services offered by *Proceso Social* for the implementation of SevenWeeks do provide the means to obtain the requisite ISO certification (ISO 9001, ISO/IEC 27001, or both).
- Both the survey and the interviews reflect a clear company satisfaction with the services provided by *Proceso Social* to create or improve a quality or security management system to obtain the necessary ISO certification (ISO 9001, ISO/IEC 27001, or both). They also highlight that SevenWeeks is seen as being an agile, simple, visual, fast, and intuitive method. Moreover, it is regarded as easy to implement, thus reducing costs and efforts, and fundamentally adaptable to the reality of SMEs.

- Regarding RQ2, the following aspects of SevenWeeks should be improved:

- Regardless of the size of the company, it is necessary to provide further training in the use of the tools and services provided by *Proceso Social*, especially for non-ICT companies.
- It is advisable to automate the whole quality or security management system using visual and intuitive tools.
- More emphasis should be placed on the need for the personnel who have a sufficient level of influence to be involved to a greater extent from the outset in *Proceso Social*’s services related to SevenWeeks. This is especially true in micro and very small companies, and the need is even more pressing in the case of those SMEs that wish to obtain both certifications (ISO 9001 and ISO/IEC 27001).
- It is also necessary to emphasise, right from the beginning, the reasons for and benefits of implementing a quality or security management system. In this way, all the personnel involved in the implementation of SevenWeeks should clearly perceive its benefits and consequently be motivated to collaborate in this process, which will thus help them to obtain the necessary ISO certifications.
- The process employed to obtain the ISO/IEC 27001 certification specifically requires improvement as regards the continuity plan.
- Regarding the specific clauses for the different standards, SevenWeeks ensures a certifiable quality or security management system, which must be improved iteratively and complemented with the Qout method.

#### 4.7. Threats to validity

The validity of a study denotes the trustworthiness of its results, and to what extent the results are true and not biased by the researchers’ subjective points of view. It is therefore necessary to consider certain issues that may threaten the validity of the case study. In the following subsections the threats to the validity are analysed in detail, based on the four aspects of validity defined by Runeson and Höst (2009) and Runeson et al. (2012).

- Construct validity. In this case study, the effectiveness of SevenWeeks was investigated, on the one hand, using an objective measure, which was that of obtaining or not obtaining the desired certification, and on the other hand, by reference to the perceived satisfaction of the companies, measured by means of a survey and interviews. A company expert in the field of customer satisfaction surveys was hired for this purpose, and we therefore trust that the correct

questions were used in both the survey questionnaire and the interviews. It should be noted that in the case of the survey, according to the Cronbach's Alpha obtained (close to 1), all the questions were cohesive in measuring the same construct, namely the satisfaction perceived by the companies.

- **Internal validity.** This aspect of validity is of concern when causal relations are examined. When the researcher is investigating whether a factor affects one of the factors being investigated there is a risk that the factor investigated will itself also be affected by a third factor. In this case, however, we believe that the application of the SevenWeeks method is the main (and only feasible) reason for the achievement of the certification in SMEs. Indeed, some of the SMEs had previously and unsuccessfully attempted to implement a management system of their own. In fact, we know (and ISO confirms this<sup>3</sup>) that implementing ISO 9001 or ISO/IEC 27001 can take from nine to eighteen months, meaning that the implementation of the SevenWeeks method is the only plausible explanation for the results we analysed.
- **External validity.** This aspect of validity determines to what extent it is possible to generalise findings, and to what extent the findings are of interest to other people outside the particular study. In this respect, in this multi-case study we obtained data from a sizeable number of Spanish SMEs (with less than 50 employees), from different business sectors, and we therefore believe that the results could be extrapolated to SMEs from other countries, especially considering that the implementation of ISO standards (such as ISO 9001 and ISO/IEC 27001) is similar all over the world, and that the certification procedures are also equivalent. Indeed, most of the certification bodies are partners of IQNet<sup>4</sup> and are accredited by ILAC, (International Laboratory Accreditation Cooperation) which certifies their homogeneity. However, we do acknowledge that further research is required to produce evidence with which to evaluate the extent to which our findings may be applicable to other organisations outside Spain. Furthermore, it is possible that SevenWeeks could be successfully applied to other management system implementations, such as ISO 14000 (environmental management system), if the certification and implementation of the management system follows the same structure as that of ISO 9001 and ISO/IEC 27001. However, at this point, we cannot say what success the method might obtain in other kinds of certifications (devices, products, etc.).
- **Reliability.** This aspect of validity determines to what extent the data and the analysis are dependent on the specific researchers. In this case study, the data were obtained from various sources and collected by independent companies (i.e., the company that conducted the survey and interviews, and the certification company). As previously mentioned, the internal audits carried out by *Proceso Social* were not taken into account as a source of data in this study in order to avoid possible bias and conflict, as *Proceso Social* is the same company that created the SevenWeeks method and which implemented it in the 26 SMEs. The data were analysed by UCLM researchers, and *Proceso Social* did not intervene in this analysis. Once the evidence had been analysed, the findings were presented to *Proceso Social* to determine their rationale, but never to disguise the results.

## 5. Related work

As stated in the Introduction, there are several existing works on the implementation of ISO 9001 in SMEs. For most SMEs, marketing considerations are their main motivation for seeking an ISO certification, especially when they need to compete on the international market (Christmann and Taylor, 2006; Rayner and Porter, 1991). The findings obtained by Heras-Saizarbitoria and Boira (2018) show that, contrary to common belief and the dominant neo-institutional approach to ISO certification, firms tend to adopt ISO 9000 as a symbolic response to various internal organisational contingencies, rather than as part of their adaptation to external pressures. In this respect, we have noticed that both motivation and client and/or market requirement are the most prevalent reasons.

Shah et al. (2015) confirm that existing software process improvement frameworks are too heavy for SMSH (small and medium software houses) and that there is a need for lean quality models that will help these SMSH to establish a quality culture with minimal effort and resources. In this respect, and as shown in Section 3, SevenWeeks incorporates a lean philosophy, thus making it a suitable approach for use by SMSH.

Kautz et al. (2000) include three lessons in their findings for small organisations that wish to perform improvement activities: first, that it makes sense to use a structural model to organise the process; second, that the model should be adjusted to the specific conditions of the organisation; and third, improvement activities for a project should be performed with clearly assigned and documented roles, responsibilities and resources. Our own findings are similar, in the sense that the SevenWeeks process map and its adjustment to SMEs are key aspects of the method. Regarding the third lesson, the Qout method is a necessary complement towards guaranteeing a continuous improvement process.

In terms of security management systems for SMEs, Valdevit et al. (2009) specifically describe the experience of assisting an SME to obtain the first national ISO/IEC 27001 certification for a private company, with an implementation guide for the deployment of an ISMS. Their recommendations are as follows: a smooth approach must be developed, and processes introduced. A PDCA paradigm and a management system can benefit users, by providing implementation guidance for each process of the PDCA cycle; also, a framework of documentation tools and templates should be created as a support for the implementation. The multi-case study presented in this paper corroborates these conclusions.

Haufe et al. (2016) propose an ISMS process framework based on the ISO/IEC 27000 series, COBIT and ITIL. This framework describes identified processes, and their interaction and interfaces are specified, focusing on the operation of the ISMS rather than just on measures and controls. SevenWeeks similarly places emphasis on the process map rather than putting effort into measures and controls.

Mercl and Horalek (2019) deal with the implementation of a Security Information and Event Management (SIEM) system at two companies, while Suhaimi et al. (2014) propose a database system that manages the ISO/IEC 27000 series and ISMS documents. In both cases, the supporting environment is identified as being essential to the success of the security management system implementation. This aspect is also included in SevenWeeks, with the incorporation of the latest version of the R2Docuo management and workflow tool.

## 6. Conclusions and future work

The company *Proceso Social* has created an innovative method called "SevenWeeks", which creates or improves a quality or

<sup>3</sup> <http://isoupdate.com/resources/exploring-the-time-commitment-for-iso-9001-implementation/>.

<sup>4</sup> <https://www.iqnet-certification.com/>.

security management system in small and medium-sized enterprises (SMEs) that can help to obtain an ISO 9001 or ISO/IEC 27001 certification in just seven weeks.

In this paper, we have evaluated the effectiveness and usefulness of the SevenWeeks method by presenting a holistic multi-case study carried out in 26 Spanish SMEs: ten micro companies (1–5 employees), nine very small (5–25 employees) and seven small (>25 employees) companies. In this multi-case study, in order to avoid any bias in the results, we have used findings from different external companies, including external audit reports obtained from certification companies, and a survey and series of interviews carried out by an external company specialised in customer satisfaction studies. The main findings are:

- The services provided by *Proceso Social* for the implementation of SevenWeeks have helped the 26 companies to obtain the necessary ISO certification (ISO 9001, ISO/IEC27001, or both).
- Both the survey and the interviews reflect that the companies are clearly satisfied with the services provided by *Proceso Social*, emphasising that in their opinion SevenWeeks is an agile, simple, visual, fast, and intuitive method. Moreover, it is seen as easy to implement, thus reducing costs and efforts, and as being fundamentally adaptable to the reality of small companies.

These findings lead us to conclude that SevenWeeks is indeed effective and is perceived as useful by the companies that have implemented it.

One of the critical success factors of SevenWeeks is the way it places the customer – rather than the creator/promotor of the standard – in the key role of observer, thus making it a truly customer-centric method. Furthermore, SevenWeeks follows the lean principles for process improvement and enables a true industrialisation process of the improvement and certification process.

Moreover, it should be noted that all the companies contracted to *Proceso Social* use the Qout method for the follow-up audit to check the evolution of the quality/security management systems implemented.

As to future work, the recommendations that emerged from this case study will be implemented in future versions of the SevenWeeks method, as follows:

- Automating the whole quality or security management system. In fact, *Proceso Social* is already increasing its own digitalisation. One step in this direction is the creation of the “Hydra” system based on the R2Docuo management and workflow tool. The commonalities of all the ISO standards (i.e., their processes and the workflows are the same, although evidently not the content) have been used as the basis on which to industrialise the design of their clauses, thus resulting in a time saving of 85%. In fact, the Hydra system allows an SME to have multiple standards in the same repository without duplicating procedures.
- Increasing the use of visual and intuitive tools. As one of the key aspects for the success of the method, *Proceso Social* is further improving the use of visual tools by considering design thinking, the customer’s journey, and user experience best practices as possible tools to be incorporated into future developments of the process.
- Performing more training and involving the most influential people in an organisation, particularly in order to raise awareness among an SMEs’ personnel as regards the efforts required to implement management systems. In this respect *Proceso Social* is incorporating Management 3.0 best practices (Appelo, 2010).

In addition, we intend to carry out a multi-case study to evaluate to what extent SevenWeeks could be successfully applied to software process improvement, in relation to the ISO/IEC 29110 (Larrucea and Santamaria, 2018) or the ISO/IEC 15504/33000 (Garzás et al., 2013) standards. In fact, there is evidence that most small software organisations do not adopt the existing standards because they perceive them as being orientated towards large organisations, and studies have shown that small firms’ negative perceptions of process model standards are primarily driven by negative views of cost, documentation, and bureaucracy (Laporte et al., 2008). For all the reasons mentioned above, and based on the real evidence we have adduced, we believe that SevenWeeks could have a remarkable impact on SME practices.

## CRedit authorship contribution statement

**Domingo Gaitero:** Conceptualization, Methodology, Resources, Investigation, Writing - review & editing. **Marcela Genero:** Conceptualization, Methodology, Validation, Formal analysis, Investigation, Writing, Visualization. **Mario Piattini:** Conceptualization, Writing - review & editing, Supervision, Project administration, Funding acquisition.

## Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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## References

- Appelo, J., 2010. Management 3.0: Leading Agile Developers. Developing Agile Leaders.
- Basili, V., Rombach, D., 1988. The TAME project: Towards improvement-oriented software environments. *IEEE Trans. Softw. Eng.* 14 (6), <http://dx.doi.org/10.1109/32.6156>.
- Christmann, P., Taylor, G., 2006. Firm self-regulation through international certifiable standards: Determinants of symbolic versus substantive implementation. *J. Int. Bus. Stud.* 37, 863–878. <http://dx.doi.org/10.1057/palgrave.jibs.8400231>.
- Demirors, E., Demirors, O., Dikenelli, Keskin, B., 1998. Process improvement towards ISO 9001 certification in a small software organization. In: *Proceedings of the 20th International Conference on Software Engineering*, Kyoto, Japan, pp. 435–438. doi:10.1109/ICSE.1998.671600.
- Du, Y., Yin, J., Zhang, Y., 2016. How innovativeness and institution affect ISO 9000 adoption and its effectiveness: evidence from small and medium enterprises in China. *Tot. Qual. Manag.* 27 (12), 1315–1331. <http://dx.doi.org/10.1080/14783363.2015.1075874>.
- Garzás, J., Pino, F.J., Piattini, M., Fernández, C.M., 2013. A maturity model for the spanish software industry based on ISO standards. *Comput. Stand. Interfaces* 35 (6), 616–628. <http://dx.doi.org/10.1016/j.csi.2013.04.002>.
- Ghobadian, A., Gallea, D., 1997. TQM And organization size. *Int. J. Oper. Prod. Manage.* 17 (2), 121–163. <http://dx.doi.org/10.1108/01443579710158023>.
- Guler, I., Guillén, M.F., Macpherson, J.M., 2002. Global competition, institutions and the diffusion of organizational practices: The international spread of ISO 9000 quality certificates. *Adm. Sci. Q.* 47 (2), 207–232. <http://dx.doi.org/10.2307/3094804>.



- Hamdi, Z., Norman, A.A., Molok, N.N., Hassandoust, F., 2019. A comparative review of ISMS implementation based on ISO 27000 series in organizations of different business sectors. *J. Phys.: Conf. Ser.* 1339, 012103. <http://dx.doi.org/10.1088/1742-6596/1339/1/012103>.
- Haufe, K., Brandis, K., Colomo-Palacios, R., Stantchev, V., Zombeta, S., 2016. A process framework for information security management. *Int. J. Inf. Syst. Proj. Manag.* 4 (4), 27–47. <http://dx.doi.org/10.12821/ijispm040402>.
- Heras-Saizarbitoria, I., Boiral, O., 2013. ISO 9001 and ISO 14001: Towards a research agenda on management system standards. *Int. J. Manag. Rev.* 15 (1), 47–65. <http://dx.doi.org/10.1111/j.1468-2370.2012.00334.x>.
- Heras-Saizarbitoria, I., Boiral, O., 2015. Symbolic adoption of ISO 9000 in small and medium-sized enterprises: The role of internal contingencies. *Int. Small Bus. J.* 33 (3), 299–320. <http://dx.doi.org/10.2139/ssrn.2219563>.
- Imai, M., 1988. *Kaizen: The Key To Japan'S Competitive Success*. Mc GrawHill.
- ISO, 2015. *ISO 9001:2015. Quality Management Systems – Requirements*. International Organization for Standardization, Geneva.
- ISO/IEC, 2018. *ISO/IEC 27001:2013. Information Technology – Security Techniques – Information Security Management Systems – Requirements*. International Organization for Standardization, Geneva.
- Kakouris, A., Sfakianari, E., 2019. Motives for implementing ISO 9000 – does enterprise size matter?. *Int. J. Prod. Perform. Manag.* 68 (2), 447–463. <http://dx.doi.org/10.1108/IJPPM-03-2018-0096>.
- Kautz, K., Hansen, H.W., Thaysen, K., 2000. Applying and adjusting a software process improvement model in practice: The use of the IDEAL model in a small software enterprise. In: *Proceedings of ICSE 2000*. ACM Press, Limerick, pp. 626–633. <http://dx.doi.org/10.1145/337180.337492>.
- Kumar, M., Khurshid, K.K., Waddell, D., 2014. Status of quality management practices in manufacturing SMEs: a comparative study between Australia and the UK. *Int. J. Prod. Res.* 52 (21), 6482–6495. <http://dx.doi.org/10.1080/00207543.2014.948574>.
- Laporte, C.Y., Alexandre, S., O'Connor, R.V., 2008. A software engineering lifecycle standard for very small enterprises. In: *Euro SPI 2008*. CCIS, pp. 129–141.
- Larrucea, X., Santamaria, I., 2018. Survival studies based on ISO/IEC29110: industrial experiences. *Comput. Stand. Interfaces* 60, 73–79. <http://dx.doi.org/10.1016/j.csi.2018.04.006>.
- Lethbridge, T., Sim, S., Singer, J., 2005. Studying software engineers: data collection techniques for software field studies. *Empir. Softw. Eng.* 10 (3), 311–341. <http://dx.doi.org/10.1007/s10664-005-1290-x>.
- Mercl, L., Horalek, J., 2019. SIEM Implementation for small and mid-sized business environments. *J. Eng. Appl. Sci.* 14 (9), 10497–10501. <http://dx.doi.org/10.36478/jeasci.2019.10497.10501>.
- Nicho, M., 2018. A process model for implementing information systems security governance. *Inf. Comput. Secur.* 26 (1), 10–38. <http://dx.doi.org/10.1108/ICS-07-2016-0061>.
- Pino, F.J., García, F., Piattini, M., 2008. Software process improvement in small and medium software enterprises: a systematic review. *Softw. Qual. J.* 16 (2), 237–261. <http://dx.doi.org/10.1007/s11219-007-9038-z>.
- Poksinska, B., Eklund, J.A.E., Dahlgaard, J., 2006. ISO 9001:2000 in small organisations: Lost opportunities, benefits and influencing factors. *J. Qual. Reliab. Manag.* 23 (5), 490–512. <http://dx.doi.org/10.1108/02656710610664578>.
- Rayner, P., Porter, L.J., 1991. BS5750/ISO9000-the experience of small and medium-sized firms. *Int. J. Qual. Reliab. Manag.* 8 (6), 16–28. <http://dx.doi.org/10.1108/EUM0000000001639>.
- Rubio-Andrada, L., Del Mar Alonso-Almeida, M., Rodríguez-Antón, J.M., 2011. Motivations and impacts in the firm and stakeholders of quality certification: Evidence from small-and medium-sized service enterprises. *Total Qual. Manag. Bus. Excell.* 22 (8), 833–852. <http://dx.doi.org/10.1080/14783363.2011.593858>.
- Runeson, P., Höst, M., 2009. Guidelines for conducting and reporting case study research in software engineering. *Empir. Softw. Eng.* 14, 131–164. <http://dx.doi.org/10.1007/s10664-008-9102-8>.
- Runeson, P., Höst, M., Rainer, A., Regnell, B., 2012. *Case Study Research in Software Engineering: Guidelines and Examples*. John Wiley and Sons, Hoboken.
- Shah, F.T., Shamail, S., Akhtar, N.A., 2015. Lean quality improvement model for quality practices in software industry in Pakistan. *J. Softw. Evol. and Proc* 27, 237–254. <http://dx.doi.org/10.1002/smr.1709>.
- Suhaimi, A.I.H., Goto, Y., Cheng, J., 2014. An information security management database system (ISMDS) for engineering environment supporting organizations with ISMSs. *IEICE Trans. Inf. Syst.* E97-D (6), 1516–1528. <http://dx.doi.org/10.1587/transinf.E97.D.1516>.
- Valdevit, T., Mayer, N., Barafort, B., 2009. Tailoring 27001 for SMEs: a guide to implement an information security management system in small settings. In: *Software Process Improvement - 16th European Conference, EuroSPI 2009, Alcalá de Henares (Madrid), Spain, September 2-4, Communications in Computer and Information Science* 42, pp. 201–212. [doi:10.1007/978-3-642-04133-4\\_17](http://dx.doi.org/10.1007/978-3-642-04133-4_17).
- Van Der Wiele, T., Brown, A., 1997. ISO 9000 series experiences in small and medium-sized enterprises. *Tot. Qual. Manag.* 8 (2–3), 300–304. <http://dx.doi.org/10.1080/09544129710297>.
- Verner, J.M., Sampson, J., Tosic, V., Bakar, N.A.A., Kitchenham, B.A., 2009. Guidelines for industrially-based multiple case studies in software engineering. In: *Third International Conference on Research Challenges in Information Science, Fez, Morocco*, pp. 313–324. <http://dx.doi.org/10.1109/RCIS.2009.5089295>.
- Yin, R.K., 2017. *Case study research and applications: Design and methods*. Sage publications.

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