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An instrument for the assessment of management systems integration

Um instrumento para a avaliação de sistemas de gestão integrados

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Abstract: Management systems, such as ISO 9001, ISO 14001 and OHSAS 18001 have been increasingly employed in organizations and their joint use has led to a trend towards their integration. Many benefits, as improvement in decision making, reduction in the risk of development of redundant and conflicting activities, and a better use of resources can be obtained through integration. Therefore, an instrument that assesses the degree of maturity of Integrated Management Systems (IMS) should be employed in organizations for improvements in the integration. According to a literature review conducted in this study, no research that takes the concept of maturity models as a point of support has focused on the evaluation of such maturity level in IMS. An exploratory review, a systematic literature review on IMS, and a literature search regarding maturity models were performed. A tool assessed by academic experts and industry professionals was developed and involved 21 questions divided into 4 areas, namely Policy; Planning; Implementation / Execution; and Verification / Action. An overview of research into IMS, as well as the tool developed can be highlighted in the present research. It can be concluded that the number of studies on IMS has increased over the years, which is important from the point of view of both the market and the academic area.

Keywords: Integrated Management System; Maturity model; ISO; Assessment.

Resumo: *A utilização de sistemas de gestão, tais como ISO 9001, ISO 14001 e OHSAS 18001, tem aumentado, assim como a necessidade de integrá-los. A integração traz diversos benefícios como melhora na tomada de decisão, diminuição do risco de se ter atividades redundantes e contraditórias, bem como melhor utilização de recursos. É importante se estabelecer uma forma de avaliar o grau de maturidade em Sistemas de Gestão Integrados (SGI), tendo em vista que a integração proporciona muitos benefícios. Um instrumento que faça essa avaliação poderá propor melhorias visando uma integração maior. Por meio de uma revisão na literatura, foi possível notar que não há trabalhos que realizem a avaliação da maturidade da integração de sistemas de gestão tomando como ponto de apoio o conceito de modelos de maturidade e a estrutura utilizada pelo modelo apresentado na ISO 9004. Foi feita uma revisão exploratória seguida de uma revisão bibliográfica sistemática sobre SGI, assim como foi realizada uma pesquisa bibliográfica sobre modelo de maturidade. O passo seguinte foi o desenvolvimento de uma ferramenta que recebeu a avaliação de especialistas acadêmicos e profissionais da indústria. Conta com 21 questões divididas em 4 áreas, sendo elas: Política; Planejamento; Implementação/Execução; e Verificação/Ação. Como resultado alcançado, é possível destacar a apresentação de um panorama geral sobre as pesquisas em SGI, bem como a proposta de uma ferramenta de avaliação do grau de maturidade da integração dos sistemas de gestão. Conclui-se que têm aumentado, ao longo dos anos, trabalhos relacionados à SGI e que tal estudo é importante tanto do ponto de vista do mercado como acadêmico.*

Palavras-chave: *Sistema de Gestão Integrado; Modelo de maturidade; ISO; Avaliação.*

1 Introduction

An increase in the use of certifications, such as those developed by the International Standards Organization (ISO), has occurred due to their international and general nature. Initially, their use was restricted to the manufacturing sector, but over time has expanded to public agencies, hospitals, transportation, and many other sectors. As of 2000, in response to specific requirements ISO has developed new standards for these categories, as is the case of ISO / TS 16949, which is focused on the automotive sector (Boiral, 2011).

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This increase is evidenced by the ever-growing number of companies which have adopted management systems. For example, 497,919 companies worldwide were certified to the ISO 9001 - Quality Management System in 2003 (ABNT, 2008), a number that jumped to 1,129,446 in 2013. Another example of growth can be observed through the ISO 14001 - Environmental Management System (ABNT, 2004), which went from 64,996 certifications in 2003 to 301,647 in 2013 (ISO, 2014). These data show the increasing growth in this area in recent years.

The implementation of parallel systems requires duplicate efforts for the organization, both in terms of documentation, control of forms, procedures, etc., as well as difficulty in ensuring the alignment of these different management systems with the company's strategy (Zeng et al., 2007). If, on the one hand, it is possible to identify problems related to the discrete use of standards, on the other, there is an increase in the number of standards and organizations that adopted them. Therefore, it becomes important to study the integration.

Just as there is some popularization in terms of the use of norms, there is a parallel increase in the need to evaluate the maturity of several areas. According to Fraser et al. (2002), maturity is linked to the idea of maturation, conveying the notion of transition from an early to an advanced stage, and it may be necessary to go through several intermediary stages before reaching effective maturity. Maturity means that the process is well understood, documented, constantly applied in the organization, and monitored and improved on a regular basis. Mature behaviors do not appear randomly, but must be developed over time. In the specific case of integrating management systems, assessing integration readiness impacts directly on the performance, and as Zeng et al. point out above, the use of parallel systems may imply problems such as lack of alignment between management systems and the organization's strategy.

The maturity approach has its origin in quality management with the work conducted by Crosby, who proposed the Quality Management Maturity Grid. One of the best-known models developed from Crosby's work was the Capability Maturity Model (CMM), which focuses on the software sector. Based on the concept used in the CMM, several other models were derived (Fraser et al., 2002). There are maturity models for several areas, including quality management, software development, product development, and innovation. In addition to these, ISO 9004 (ABNT, 2010a) presents a maturity model, but it is focused on the evaluation of quality management systems and does not address the integration of different management systems.

According to Wendler (2012), maturity models provide organizations with a simple and effective way to measure the quality of their processes. In his article, the author performed a systematic review of maturity models and confirmed that, although the application of maturity models is broad, there is a great concentration of studies related to the area of software development and software engineering. In his research, he observed that the theme has gained importance over the last few years, demonstrated by the increasing number of publications, which have increased from 15 to 34 articles a year between 2003 and 2009.

At the same time, as the variety of norms grows, there is an increase in the number of organizations that make use of them, often implanting more than one in their companies, whether motivated by internal reasons, such as process improvement, or external ones, such as clients' contractual requirements. Because organizations are typically structured by departments and areas of expertise, it is only natural that, at first, the implementation of the standards take place separately, with each area implementing the standard most related to its specific competence. For example, the quality area can be responsible for the implementation project of ISO 9001 – Quality Management System (ABNT, 2008); the environmental for the ISO 14001 - Environmental Management System (ABNT, 2004); human resources for the OHSAS 18001 - Occupational Health and Safety System (BSI, 2007); and so on. As discussed earlier, this strategy leads to the duplication of efforts and potential misalignment with the organization's strategy. In the studies already carried out, it is noted that the integration between these different norms is very important. However, just as important as analyzing the issue of integration is assessing how integrated they are, which can be achieved through an analysis of the maturity level of system integration. The objective of this work is to develop an instrument to assess the maturity of integrated management systems.

2 Literature review

2.1 Management systems

Management systems have emerged as a way to assist the continuous improvement of organizations, collaborating with the formation of a structure that contributes to the management of a specific area. There are different types of management systems, and in this work the following were used: ISO 9001 - Quality Management System (ABNT, 2008); ISO 14001 - Environmental Management System (ABNT, 2004); OHSAS 18001 - Occupational Health and Safety System (BSI, 2007); and NBR 16001 - Social Responsibility Management System (ABNT, 2012). The reason for

choosing such systems is their popularity, as well as the fact that they ultimately contribute to sustainability. For the scope of this work, it was decided to use the NBR 16001 (ABNT, 2012) rather than ISO 26000 Guidelines on Social Responsibility (ABNT, 2010b), since the former presents requirements for the social responsibility management system while the latter is based on guidelines. It is noted, however, that NBR 16001 is a Brazilian national standard and is not globally recognized as is ISO 26000. Another important aspect is that compliance with NBR 16001 does not lead to compliance with ISO 26000, although NBR 16001 may assist in the process of implementing some ISO 26000 guidelines.

2.2 Integrated Management System (IMS)

Integrated management systems emerge when two or more systems unite in a way that results in the loss of independence of one or both, but without giving up their individual identities. This integration varies in scope and control (Karapetrovic & Willborn, 1998). The integration can be summarized as a process of linking different management systems in a single one, for which common resources are used to improve the satisfaction of the parties (Bernardo et al., 2009).

Standards have become more compatible over time and various countries are developing their own guides for integrating them, including New Zealand, Australia, France, Denmark, Spain, and the Netherlands (Jørgensen et al., 2006). In addition to these initiatives promoted by individual countries, in 2008 ISO published the book *The integrated use of management system standards*, which provides advice on how to integrate standardized management systems (ISO, 2008).

The research developed by Casadesús et al. (2011) reveals that the organizations that integrate their management systems, in particular ISO 9001 and ISO 14001, benefit more from the use of ISO 9001 than companies that use ISO 9001 alone.

Several researchers have found similarities while studying the benefits of integration. The benefits most cited were the decrease in the number of documents, along with cost reduction, improved communication, decreased audits, improved decision making, and improved resource utilization (López-Fresno, 2010; Salomone, 2008; Zutshi & Sohal, 2005). Other benefits were: ease of promoting continuous improvement (Simon et al., 2012); improvement in worker motivation; more customer-oriented decision making; culture change (López-Fresno, 2010); greater alignment with strategic planning; a holistic vision rather than a fragmented view of standards; greater commitment of employees; greater effectiveness of training, which started to encompass all standards in an integrated way (Zutshi & Sohal, 2005); greater consistency in management and less bureaucracy (ISO, 2008, Vitoreli & Carpinetti, 2013); fewer redundant activities; and focused efforts and improved coordination among the areas (Vitoreli & Carpinetti, 2013).

2.3 Maturity model

Maturity models help improve organizational performance by identifying strengths and weaknesses, thereby contributing to benchmarking (Khoshgoftar & Osman, 2009). Maturity representation by using the number of cumulative stages facilitates visualizing where the company is, and how far it must go to achieve best practices, with the lower stages serving as a support to reach the requirements of the higher stages (Maier et al., 2012).

The pioneering maturity model was developed by Crosby and became known as Crosby's Quality Management Maturity Grid (Maier et al., 2012). It was published in the book *Quality is Free*, which presented 5 levels of maturity and 6 measurement categories, i.e. six points of evaluation (Crosby, 1979).

One of the best known models, the Capability Maturity Model (CMM), was inspired by Crosby's maturity matrix (Paulk, 2008), and developed by the Software Engineering Institute (SEI) of Carnegie Mellon University, which also developed various other models based on the CMM, notably the Capability Maturity Model Integration (CMMI) process (De Bruin et al., 2005).

The ISO 9004 norm, published in 2010, presents a maturity model to evaluate the quality management system, which is formed by 5 levels of maturity and serves as a form of self-assessment (ABNT, 2010a).

Chart 1 summarizes the main characteristics of the models discussed in the previous paragraphs.

3 Methodology

The present research opted for an exploratory review, followed by a systematic literature review on IMSs. Next, an exploratory review of the Maturity Model was carried out, followed by the creation of an IMS assessment tool, based on the main standards used and integrated by companies, as well as the maturity models found. Once a tool for assessing IMS maturity was created, it was evaluated by four academic experts and two industry professionals who work directly in this area, in the manufacturing and service sectors respectively. These evaluations aimed to verify the need for possible corrections in the proposed tool. To that end, they received a copy of the assessment tool to evaluate it without having to complete it, since the purpose was to evaluate the instrument itself and not the company. The detailing of the steps is given below (Figure 1).

Chart 1. Summary of characteristics of maturity models.

	Developer	Features
Quality Management Maturity Grid	Crosby	It is a tool with easy and quick application. The six questions that constitute the grid address general issues that encompass the understanding and attitude of management, perception of quality by the company, problem solving, and cost of quality.
CMMI	Software Engineering Institute	CMMI is one of the best-known maturity models worldwide and has served as the basis for many other models. Its application is much more complex when compared to Crosby's Grid, needing a professional with detailed understanding. It was initially created for the software area, but today it is widely used to improve the process of developing products and services.
ISO 9004 Model	ISO	This model assists in the evaluation of the quality management system and assesses the following aspects of the norm: management for sustained success; strategy and policy; resource management; process management; monitoring; measurement; analysis and critical analysis; and improvement, innovation and learning. Its application is at an intermediate level to the two mentioned above.

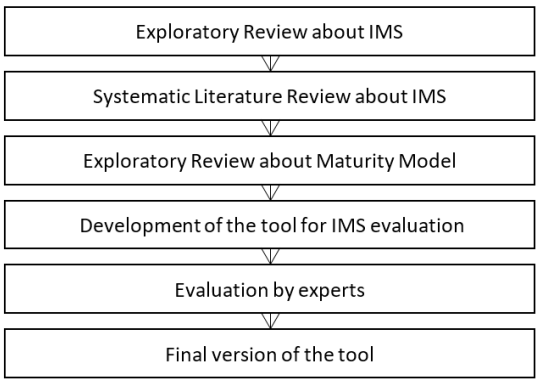


Figure 1. Summary of the method used. Source: Authors.

3.1 Bibliographic review

Firstly, we conducted a search for IMSs in national and international databases—also called exploratory research—which resulted in 21 articles and 1 dissertation, and served as starting point for the entire work.

The next step entailed performing a systematic literature review (SLR) of IMSs. According to Conforto et al. (2011), SLRs contribute to increasing the accuracy and reliability of the bibliographic review. This is a widespread methodology in the areas of medicine, psychology, and social sciences. The authors' proposal was to adapt the SLR to the area of operations management because it is better suited to the study area of this work.

Based on the readings of articles related to the themes, we built a search string to use in the Web of Science and Scopus databases. A string is a junction of terms that are used to promote standard searches across different databases. These two databases were selected because they are considered the broadest ones in the area. Next, we present the string used; for both databases, the search was limited by word searches in the title, abstract and keywords.

String: ("ISO" OR "OHSAS") AND ("integrated management system" OR "integrated management systems" OR ("standardized management systems" Normalized management system "OR" normalized management systems ") AND (integrat *)))).

After using the string in the Web of Science and Scopus databases, 173 results were found, but 43 were duplicates, available on both. In addition, a subsequent study was done after the SLR, based on previously read articles (bibliographical references), as well as on the alerts registered in the databases used. In this last search, 19 more articles were found. The total of articles selected and used in this work that addressed the issue of the integration of management systems was 74.

After reviewing the literature on SGI and noting the lack of an instrument to evaluate maturity, an exploratory bibliographical review on maturity models was carried out.

3.2 Development of the tool

The development of the assessment tool was based on the work conducted by De Bruin et al. (2005) to create a methodology that assists in the development of maturity models, the steps of which are shown in Figure 2 and detailed below.

The first stage is to establish the scope of the model, which will influence the other phases. This step defines whether the model will focus on a specific or general area. Another point to be addressed in this phase regards the stakeholders, who can come from universities, industries, NGOs, and government, and can help in the development of the model (De Bruin et al., 2005). This work has a specific focus on IMSs and the stakeholders are the companies, since it was designed to be applied in industries by specialists working in this area, in order to assess its suitability.

The second phase determines the structure or design of the model, which will serve as a basis for development and application. In this phase the needs of the target audience will be incorporated, reflected in questions such as: "Why will they apply the model?"; "How can the model be applied in different organizational structures?"; and "What needs to be involved in your application?" (De Bruin et al., 2005). The instrument proposed in this paper aims to be easily applied by the specialists who work directly with management systems in the company. The result that will emerge from the application of the instrument will allow the company to make a diagnosis of its situation and propose improvements for reaching a higher level of maturity. The instrument was created in order to serve any type of organization and was based on the four following standards: ISO 9001 (ABNT, 2008); ISO 14001 (ABNT, 2004); OHSAS 18001 (BSI, 2007); and NBR 16001 (ABNT, 2012). Based on the structure of these standards, the instrument was divided into four groups: policy, planning, implementation/implementation, and verification/action.

The third step is known with populate where it is defined the content of the model, which requires identifying what needs to be measured in the maturity assessment and how. It is also necessary to establish the components (De Bruin et al., 2005). In the well-developed knowledge areas, the components can be discovered through a literature review, and here the components are the requirements of the standards and the items of the standards.

Table 1 shows the relationship between the items of the standards addressed by each question, that is, questions 1 to 4 regarding the policy were elaborated based on items 5.3 of ISO 9001, 4.2 of ISO 14001, 3.3 of OHSAS 18001 and 3.2 Of NBR 16001. The questions were divided according to the separation made in the second phase, in which four groups were considered (Policy, Planning, Implementation / Implementation, Verification / Action).

The fourth phase entails testing the model. At this stage, some experts were asked to use the instrument and give their suggestion. It is important to know if the structure is adequate, whether it is easy to answer, and whether the questions and the time needed to answer are appropriate to the purpose of the research (De Bruin et al., 2005).

In this work, the stage was divided into two phases: evaluation by academic experts, and review by industry professionals. Of the four academic specialists, three work in the area of quality and one with maturity models. As for the two industry professionals, both are responsible for integrating the management systems in their respective companies. A total of six assessments were made. The version presented to the companies had already been reviewed by the academic experts. Based on the suggestions given by the interviewees, a final version of the instrument was proposed. The academic experts were selected based on their knowledge about the subject being studied. The selection criterion for companies required that they had at least two integrated management systems, in addition to availability and proximity

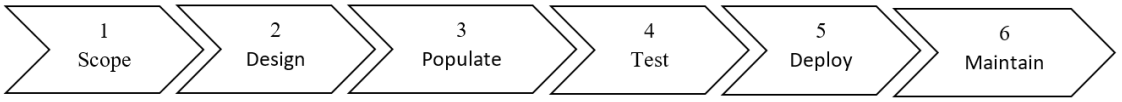


Figure 2. Phases of the model development. Source: De Bruin et al. (2005).

Table 1. Relation between the questions of the tool and the items of the norms.

	Questões Nº	ISO9001	ISO14001	OHSAS18801	NBR16001
Policy	1 to 4	5.3	4.2	3.3	3.2
Planning	5 to7	5.4	4.3	3.5	3.3
Planning	8	4.2.2	4.4	3.6.5	3.5.2
Planning	9 and 10	4.2	4.4.4/4.4.5	3.6.5/3.6.6	3.5
Implementation/Execution	11	7.1	4.4.6	3.6.7	3.4.5
Implementation/Execution	12 and 13	5.5.1	4.4.1	3.6.1	3.3.7
Implementation/Execution	14	6	4.4.1	3.6.1	3.3.7
Implementation/Execution	15	6.2.2	4.2.2	3.6.2	3.4.1
Implementation/Execution	16	5.5.3	4.4.3	3.6.4	3.4.3
Implementation/Execution	17	8.2	4.5.1	3.7.1	3.6.1
Verification/Action	18 and 19	8.2	4.5	3.7	3.6
Verification/Action	20	8.3	4.5.3	3.7.3.2	3.6.3
Verification/Action	21	5.6	4.6	3.8	3.6.5

to the university. Four companies were contacted and two of them gave a positive response. After the acceptance, an invitation letter was sent by e-mail to formalize the contact. A copy of the proposed tool was delivered to the interviewee, and it was made clear that the purpose of the interview was not to assess the maturity level of the organization itself, but rather to assess the applicability and consistency of the instrument.

The fifth phase is known with deploy and consisted of making the model available for use and to implement it, and the sixth phase entails maintaining the model (De Bruin et al., 2005). The availability consists of making the model easily accessible to professionals of the area. The maintenance will depend on each organization, and it is advisable that they periodically carry out the tool to verify the points that have evolved and those that still require improvements.

4 Results

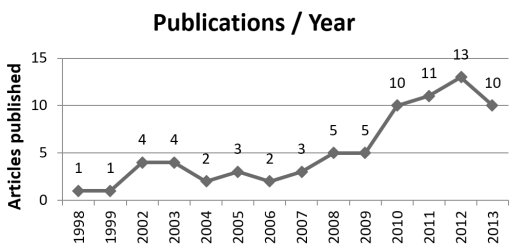
The main result of this study is the proposal of an instrument of maturity assessment aimed at the integration of management systems. An intermediate and equally important result is the survey of the general panorama on IMS research.

4.1 SLR of IMS

According to the literature survey, the increase in publications addressing IMSs from 2010 onwards is clear, as can be seen in Graph 1.

The countries that have published and researched the most are Spain with 14 publications, followed by China, Portugal, and Canada with 6 each. In this research, we found 8 Brazilian publications, but only three of them were found during the systematic research. It cannot be said that Brazil has published the second most, due to the fact that the exploratory research has been carried out in national congresses that do not have worldwide coverage.

We mostly found the research survey method, in which a structured questionnaire is sent to companies, which respond without having been visited by the researcher. Another widely-used method was theoretical research and case study. A very small number of research works in this area made use of the method known as action research and of interviews with specialists.



Graph 1. Number of publications per year.

A number of the studies found are focused on integration models and their benefits, difficulties, and motivations.

The journals with the most published articles on the subject were: *Journal of Cleaner Production*, with 12 publications from 2006 onwards and an average of 1 to 2 articles per year, and *The TQM Journal* concentrated from the year 2010, and only in 2010 there were 5 publications.

4.2 IMS assessment tool

Based on a literature review of maturity models and the structure of standards ISO 9001, ISO 14001, OHSAS 18001, and NBR 16001, the tools were created to evaluate the level of integration of an IMS. The main maturity models that influenced the elaboration of this work were the CMMI (2006) and that presented in ISO 9004. The CMMI was chosen because it is well-known worldwide and has served as the basis for the development of many other models. As for the ISO 9004 model, it was the only model found in the area of management systems.

Chart 2 presents a comparison between the levels presented in the CMMI (2006) and the items created for the IMS assessment tool.

The IMS tool has two axes, as can be seen in both Appendix A (Table 1A) and Chart 3.

In Appendix A, the tool is presented in full and, in Chart 3, a small part of it is given by way of illustration. Horizontally, maturity levels based on the CMMI (2006) are shown, as presented in Chart 2. In the first column the activities and key elements that will be evaluated in the following columns are entered, following the order of maturity. In order to choose the activities and key elements, the ISO 9001, ISO 14001, OHSAS 18001, and NBR 16001 standards were used as a basis. It is worth mentioning that specific aspects of these standards were not taken into account so that the tool could be broad enough to also encompass other standards.

In total, three versions of the same instrument were developed. The first was evaluated by academic experts, giving rise to the second, which was presented to industry professionals. This version underwent few changes when compared to the third and last version.

To use the tool, it is only necessary to indicate which of the 5 options in each line is better suited to the reality of the organization in which one works. The instrument aims to be easily applied by the specialists who work in the company directly with management systems. After answering the 21 questions, it will be necessary to make a general analysis of the situation, followed by a plan of action to focus

on the points at lower levels, so that they can reach higher levels of maturity.

One of the areas evaluated is that of the policies, as presented in Chart 3, but there are three other areas, each addressing a number of issues and points, as shown in Chart 4. A separate assessment of the maturity level can be conducted if, at the time of reporting, the issues are evaluated by area, because in this way it may be possible to verify that a particular company needs to focus on a certain specific area. For example, one conclusion that a particular firm may reach is that its level of planning maturity is good, but in terms of policy it needs to strive harder to reach a higher level because all or some of the issues addressed within its policy are not mature enough.

Chart 2. Comparison between the maturity levels of the CMMI and of the IMS assessment tool.

CMMI Source: Carnegie Mellon Institute (CMMI, 2006)		**IMS assessment tool**	
Initial	The processes are generally chaotic. Success is the result of individuals' competence, not arising from the use of proven processes. The organization produces products and services that work, but the budget is usually exceeded, deadlines are not met, and it is difficult to repeat successes.	Level 1	The organization cannot work on its standards in an integrated way. When some integration initiative occurs, it is noted that it is not solid and, with the slightest degree of difficulty, integration can be undone. The benefits are not apparent.
Managed	The processes are planned and executed according to a policy. The people who work are experienced and everything is controlled, monitored, and reviewed. Discipline helps to maintain existing practices even during turbulent times	Level 2	It is possible to notice an effective integration in some points of the norms, and even the nonintegrated parts are aligned between themselves, thereby avoiding contradictions between norms.
Defined	The processes are well understood and described in standards, procedures, and methods. What sets level 2 apart from 3 is the scope. In level 2, the standards and procedures may be different in each instance of the process. In level 3, there is some homogeneity in standards and procedures, and a greater rigor in their description.	Level 3	Integration is already a reality. Practically 100% of the requirements are integrated. The problem is that integration did not bring the expected benefits, perhaps in part because it was not done properly, or because it failed to properly increase the real benefits, leaving the feeling that it was not as beneficial as it should be.
Quantitavely managed	Quantitative objectives are set for quality and process performance. Quality and process performance are translated into statistical terms and managed throughout the processes.	Level 4	Integration is total and strongly linked to strategic planning. In the unfolding of the strategic plan there are quantitative indicators directly related to the objectives of the IMS.
Optimized	The focus is on continuous enhancement of process performance through incremental and innovative improvements. The quantitative goals of process improvements are continually revised to reflect changes at the strategic level.	Level 5	There is a continuous review of the quantitative indicators defined in level 4.

Chart 3. IMS assessment tool (example).

	Level 1	**Level 2**	**Level 3**	**Level 4**	**Level 5**
	POLICY				
Existence of an integrated policy.	Each standard has its own policy.	Each standard has its own policy and there is an alignment between the polices in order to avoid contradictions.	There is a single policy that represents all the integrated standards.	There is a single policy that represents all the integrated standards. The policy items are aligned with the strategic plan and are converted into quantitative indicators.	There is a single policy that represents all the integrated standards. The policy items are aligned with the strategic plan and are converted into constantly revised quantitative indicators.

Chart 4. Questions of the IMS assessment tool grouped by area and points addressed.

# Questions	Area	Points addressed
4	Policy	Existence of an integrated policy, top management participation, updating and dissemination of documentation
6	Planning	Preparation, team, goals and targets, manual of procedures/ instructions/records, control of procedures/instructions/records
7	Implementation/Execution	Operational control, roles/responsibilities/authorities, team resources, training, communications monitoring
4	Verification/Action	Internal audit, external audit, non-conformities/corrective and preventive actions, management review

5 Conclusions

The objective of this work was to create a maturity assessment tool to evaluate the degree of integration of the IMS of an organization, thus allowing a return in both the academic and practical aspects.

To that end, we conducted an exploratory bibliographical review and an SLR of IMSs, followed by an exploratory bibliographic review of maturity models. The SLR revealed a considerable increase in studies about IMSs, from 4 publications in 2002 to 13 in 2012. Despite this increase, there remains a lack of an instrument to evaluate how integrated these systems are. Organizations choosing to operate management systems separately have difficulty in ensuring alignment between systems, leading to overlapping efforts.

Among the influences that shaped the creation of the IMS assessment tool are the CMMI (2006), the model presented in ISO 9004, and the step-by-step presented by Bruin et al. to help create different maturity models.

The tool here presented will help companies that have more than one implanted management system to conduct a self-analysis of their situation concerning integration, and based on the tool's results can serve as a basis for devising an action plan to achieve integration. In total, there are 21 points evaluated.

As suggestions for future studies, the authors recommend the application of the tool in companies with the purpose of evaluating the level of maturity and not the tool itself. Also, this application should be in a survey format, to enable companies to assess their readiness and maturity level.

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Appendix A. Full tool.

Table 1A. IMS assessment tool.

	1	2	3	4	5
	POLICY				
Existence of an integrated policy	Each standard has its own policy.	Each standard has its own policy and there is alignment between them in order to avoid contradictions.	There is a single policy that represents all the integrated standards.	There is a single policy that represents all the integrated standards. The policy items are aligned with the strategic plan and are converted into quantitative indicators.	There is a single policy that represents all the integrated standards. The policy items are aligned with the strategic plan and converted into quantitative indicators that are constantly reviewed.
Top management participation	Top management does not prioritize the development of an integrated policy.	Top management prioritizes the elaboration of an integrated policy, acting as a sponsor.	Top management played an important role in the integration of the policy, since it acted as a sponsor and participated actively in its elaboration.	Top management played an important role in the integration of the policy, since it acted as a sponsor and participated actively in its elaboration, besides conducting evaluations to verify the implementation of the policy.	Top management played an important role in the integration of the policy, since it acted as a sponsor and participated actively in its elaboration, besides conducting evaluations to verify the implementation of the policy and constantly validate it, revising it when necessary.
Policy update	Updating of the different policies is done with a focus on certification and in a non-integrated manner.	Much attention is paid to updating of the different policies, always seeking to keep them aligned.	Much attention is paid to updating the integrated policy.	Much attention is paid to updating the integrated policy, which is strictly controlled.	Much attention is paid to updating the integrated policy, which is strictly controlled, and this process is continuously improved.
	POLICY				
Policy dissemination	Policies are disseminated in a separate manner, and only once, involving some of those who work at the company or act on its behalf.	Policies are disseminated in a separate manner, on a frequent basis, involving everyone working at the company or acting on its behalf.	Policies are disseminated in an integrated manner and on a frequent basis so that all who work at the company or act on its behalf can be aware of them.	Policies are disseminated in an integrated manner and on a frequent basis so that all who work at the company or act on its behalf can be aware of them. Indicators are used to verify awareness of the policies.	Policies are disseminated in an integrated manner and on a frequent basis so that all who work at the company or act on its behalf can be aware of them. Indicators are used to verify awareness of the policies. Actions are taken based on this, aiming at continuous improvement of the dissemination process.

Appendix A. Continued...

	1	2	3	4	5
	PLANNING				
Plan development	The plan to establish the standards is made independently.	The plan to establish the standards is made jointly, but on paper, they are considered separately.	The plan is made jointly and as a result, the company presents a single plan.	The plan is developed jointly, the company has a single plan and quantitative / qualitative targets are set for its Implementation.	The plan is developed jointly, the company has a single plan, and quantitative / qualitative targets are set for its implementation. There is periodic review of the plan.
Team carrying out the planning	Planning is done separately: each standard has its own planning team, which is usually formed according to availability.	Planning of standards is done by a single team, usually formed according to availability and concerned with alignment between the plans.	Planning of standards is done by a single team, selected based on knowledge of norms.	Planning of standards is done by a single team, selected based on knowledge of norms. Planning involves people at the operational and strategic levels. Indicators assess team performance during planning.	Planning of standards is done by a single team, selected based on knowledge of norms. Planning involves people at the operational and strategic levels. Indicators assess team performance during planning and are periodically reviewed.
	PLANNING				
Objectives, goals, and requirements	Objectives, goals, and requirements are independently addressed.	Objectives, goals, and requirements are treated independently, but also aligned.	Objectives, goals, and requirements are aligned and integrated.	Objectives, goals, and requirements are aligned and integrated, as well as converted into quantitative indicators, which are measured to verify the extent to which they meet the objectives.	Objectives, goals, and requirements are aligned and integrated, as well converted into quantitative indicators, which are measured to verify how well they meet the objectives, and if not, action plans are made.
Manual	Each standard has its own manual.	Each standard has its own manual and there is an alignment between the manuals.	There is a single manual that encompasses all the standards.	There is a single manual that encompasses all the standards, which is distributed to the relevant sectors.	There is a single manual that encompasses all the standards, which is distributed to relevant sectors, and the information within is rooted in the organization.

Appendix A. Continued...

	1	2	3	4	5
Procedures, instructions, and records	Procedures, instructions, and records are treated in a completely separate manner.	Procedures, instructions, and records are treated in a separate and aligned manner.	Procedures, instructions, and records are integrated	Procedures, instructions, and records are integrated and disseminated.	Procedures, instructions, and records are integrated and disseminated, and the information contained therein is rooted in the entire organization.
Control over updating procedures, instructions, and records	Control over updating procedures, instructions, and records is separate.	Control over updating procedures, instructions, and records is separate but an aligned.	Control over updating procedures, instructions, and records is integrated.	Control over updating procedures, instructions, and records is integrated. There are indicators to monitor these controls.	Control over updating procedures, instructions, and records is integrated. There are indicators to monitor these controls, which are constantly reviewed.
	IMPLEMENTATION/EXECUTION				
Operational control	The process for identifying key operations and activities for each of the management systems is done separately.	The process for identifying key operations and activities for each of the management systems is done separately but in an aligned way.	The process for identifying key operations and activities for each of the management systems is done in a joint manner.	The process for identifying key operations and activities for each of the management systems is done in a joint manner and indicators are used to verify which operations and activities are important.	The process for identifying key operations and activities for each of the management systems is done in a joint manner and indicators are used to verify which operations and activities are important. Reviews are conducted for increased operational performance.
Roles, responsibilities, and authorities	The roles, responsibilities, and authorities are informally established for each of the standards.	It is clear what the roles, responsibilities, and authorities are for each of the standards, and this is formalized.	It is clear what the roles, responsibilities, and authorities of all people in the IMS are, and this is formalized.	It is clear what the roles, responsibilities, and authorities of all people in the IMS are, this is formalized, and in line with strategic planning.	It is clear what the roles, responsibilities and authorities of all people in the IMS are, and this is formalized, in line with strategic planning, and accompanied by constant reviews to adapt to changes.

Appendix A. Continued...

	1	2	3	4	5
Implementation team	Implementation is done separately: each standard has its own team to conduct the implementation.	Implementation of standards is done by a single team that envisions the standards separately.	Implementation of standards is done by a single team that works in an integrated way.	Implementation of the IMS is done by a single team. Indicators monitor their performance.	Implementation of the IMS is done by a single team. Indicators monitor their performance, and are revised to meet the objectives.
Resources (human, infrastructure, financial)	Resources are not always sufficient and are divided in an uneven manner between the standards.	Resources are sufficient but are divided unevenly between standards, i.e., some standards receive more resources than others.	Resources are sufficient for the IMS, and are distributed considering the integration.	Resources are sufficient for the IMS, and are distributed considering the integration. Indicators are used to monitor resource use.	Resources are sufficient for the IMS, and are distributed considering the integration. Indicators are used to monitor resource use and, when necessary, revised.
	IMPLEMENTATION/EXECUTION				
Training	Training is conducted to meet the needs of the standards independently. Records are kept separately.	Some training is made available, which may consider more than one standard, and records may or may not be kept together.	Training is made available, taking into account as many norms as possible, or those that may impact the subject addressed in the training. Training logs are managed in an integrated way.	Trainings is available to take into account as many norms as possible, or those that may impact the subject matter covered in the training. Training logs are managed in an integrated way and there are indicators that measure training effectiveness.	Trainings is made available to take into account the greatest possible number of standards or those that may impact the subject addressed in the training. Training logs are managed in an integrated way and there are indicators that measure training effectiveness. Training is consistently reviewed, according to the results of evaluations and effectiveness.
Communication	Each standard has a person responsible for its communication, and this occurs independently.	Each standard has a person responsible for its communication, and these activities are aligned.	There is a single structure for all communication of the norms, which is considered in an integrated manner.	There is a single structure for all communication of the norms, which is considered in an integrated manner. Indicators are used to measure its effectiveness.	There is a single structure for all communication of the norms, which is considered in an integrated manner.. Indicators are used to measure its effectiveness, and are constantly reviewed to provide better communication.

Appendix A. Continued...

	1	2	3	4	5
Monitoring and measurement (product, environment, health and safety, or other types)	The organization monitors and measures key characteristics that may have significant impacts, and this is done independently, with each management system being considered separately.	The organization monitors and measures the key characteristics that can have significant impacts, and this is done independently, with each management system being considered in a separate, but aligned, manner.	The organization monitors and measures key characteristics that can have significant impacts in an integrated manner.	The organization monitors and measures the key characteristics that can have significant impacts in an integrated way and this monitoring is done considering quantitative indicators.	The organization monitors and measures the key characteristics that can have significant impacts in an integrated way and this monitoring is done considering constantly updated quantitative data.
	VERIFICATION/ACTION				
Internal audit	Internal audits are performed by different teams, at different times, and generate separate reports.	Internal audits are done by a single team and at the same time, generating separate reports.	Internal audits are performed by a single team and at the same time, generating a single report.	Internal audits are performed by a single team and at the same time, generating a single report. Indicators are established to assess the evolution of the systems.	Internal audits are done by a single team and at the same time, generating a single report. Indicators are established in order to evaluate the evolution of the systems, and when necessary, improvement actions are defined.
External audit (of the certifying body)	The external audit is done by different auditors, at different times, and generate separate reports.	External auditing is done by a single auditor, who audits all integrated standards, generating separate reports.	The external audit is done by a single auditor, who audits all the integrated standards, generating a single report.	The external audit is done by a single auditor, who audits all the integrated standards, generating a single report. Indicators are established to assess the evolution of the systems.	The external audit is done by a single auditor, who audits all the integrated standards, generating a single report. Indicators are established to evaluate the evolution of the systems, and when necessary, improvement actions are defined.
Non-conformities, corrective and preventive actions	Non-conformities, corrective and preventive actions are treated in a totally separate way between the norms.	Some aspects related to non-conformities, corrective and preventive actions are dealt with in an integrated manner.	Non-conformities, corrective and preventive actions are treated in an integrated manner.	Non-conformities, corrective and preventive actions are dealt with in an integrated manner. Indicators are deployed to assess and monitor the evolution of non-conformities, corrective and preventive actions	Nonconformities, corrective and preventive actions are dealt with in an integrated manner. Indicators are implemented to assess and monitor the evolution of nonconformities, corrective and preventive actions, and the results of the indicators are reviewed and improved.

Appendix A. Continued...

	1	2	3	4	5
	VERIFICATION/ACTION				
Management review	Analysis is done completely separately.	Analysis is done separately, seeking alignment between the norms.	Analysis is done jointly and in an integrated manner.	Analysis is done in a joint and integrated manner, establishing goals and indicators for performance evaluation of the systems.	Analysis is done in a joint and integrated manner, establishing goals and indicators for performance evaluation of the systems, and when applicable, actions are implemented to improve performance.