Bibliometric analysis on the topic of "integrated management systems": A first glance

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ABSTRACT

The research topic "Integrated Management Systems" has been addressed by a large number of authors throughout the last years. However, a widespread, comprehensive and extensive literature review about this phenomenon has not been carried out yet. This paper intends to present the first results of a work in progress aiming at the development of that systematic, widespread, comprehensive and extensive literature review addressing the standardized integrated management systems research domain. This project encompasses some features (scarcely reported at traditional literature review studies) such as a bibliometric (scientometric) analysis of the papers indexed in Scopus, Web of Knowledge and Google Scholar and an improved visualization tool (affinity diagram) considering the subtopics addressed in each paper. The soundest bibliographic databases (Scopus, Web of Knowledge and Google Scholar) were queried adopting the following keywords at the "Title" field: "Integrated Management Systems", "Integration of Management Systems" or "Management Systems Integration". The resulting papers were then selected based on the appropriateness of the content summarized in the abstract. A total of 341 papers published at conference proceedings, journals or as book chapters or books comprised the final sample. The content analysis of the papers from 2016 onwards was summarized by one of the new (management) quality tools- the affinity diagram. The bibliometric and citation analysis took into account all the papers (1995-2019). Results present some insights and report the most useful publication strategies to assure and maximize the probability of being cited by the peers.

Keywords: Integrated management systems, literature review, bibliometric analysis, affinity diagram, citations analysis.

1. INTRODUCTION

1.1 *Integration of Management Systems*

The standardized Management Systems (MSs) integration phenomenon rouse the attention of researchers some years before the publication of the first edition of ISO 14001 (1996). As of this year scholars focused a great deal of effort discussing the proper strategies to implement and the appropriate models to adopt in order to assure a successful and efficient integration between the Quality MS (QMS - ISO 9001) and the Environmental MS (EMS - ISO 14001) (Copping, 1995). Throughout the following years (1997-2000) several implementation processes were reported generically (Jackson, 1997; Wilkinson and Dale, 1999; Douglas and Glen, 2000) or in specific and different contexts, such as, in the cement industry (Adams and Niehoff, 1997), natural gas industry (Hamzah *et al.*, 1998), railway industry (Chan *et al.*, 1998), steel industry (Weismayr and Pammer, 1999) and pulp and paper industry (Petrini *et al.*, 2000). The following stream of bibliography (2001-2005) proposed some integration models in line with concepts closely related with the phenomenon itself, such as, total quality management (Wilkinson and Dale, 2001), corporate sustainability (Asif *et al.*, 2003) and sustainable businesses (Lund, 2004), risk based approach (Labodová, 2004) and safety culture (Walter, 2005). In addition, several integration strategies were outlined by several authors such as Karapetrovic (2002), Matias and Coelho (2002), Mackau (2003) and Shaw (2004). It should be mentioned that some relevant "thought reflections" and in-depth papers were published throughout 2001-2005, namely, those co-authored and authored by Karapetrovic (Jonker and Karapetrovic, 2004; Karapetrovic, 2003).

The stream of bibliography published during 2006-2010 reported the experience of the organizations when implementing integrated management systems (IMSs) (Salomone, 2008; Voinea and Pamfilie, 2009; Khanna *et al.*, 2010). So, the expectations, benefits attained and difficulties faced were a subtopic addressed by several authors such as Nouri *et al.* (2010), Zeng *et al.* (2006) and Griffith and Bhutto (2008). Furthermore, several integration levels were identified by Jørgensen *et al.* (2006) and Bernardo *et al.* (2008) and some specific and peculiar organizational functions such as the audit in an integrated context was a subtopic addressed by Bernardo *et al.* (2010).

The bibliography published throughout 2011-2015 introduced several novel subtopics. Among them one should highlight the proposal of a framework focused on the audit function by Domingues *et al.* (2011), the identification of the KPIs (or HSE related indicators) more suitable to be adopted in an integrated context (Neves and Sampaio, 2011; Mariouryad *et al.*, 2015), the leadership role in an organization adopting multiple MSs (Milliman and Grosskopf, 2011), the introduction of macroergonomics in the context of IMSs (Domingues *et al.*, 2012) and the stakeholder management concept (Genaro and Loureiro, 2015). It also should be mentioned the work of Olaru exploring the information from IMSs in Romania and proposing an integrated risk MS (Hohan *et al.*, 2011) and introducing the construct of social responsibility into an IMS (Olaru *et al.*, 2011).

1.2 *Bibliometric Assessment*

There is a growing interest in the bibliometric analysis by the academic community. This fact suggest that researchers do not look anymore at the publishing stage as the final stage of the academic research process. It seems that an "assurance to be cited" stage has been added to the whole process which, in fact, raises the questions: Why we publish for? or To whom we publish for?

The bibliometric analysis (Ellegaard and Wallin, 2015) enables the development of improved visualization tools (Moed, 2005) which is a topic of utmost importance in an ever increasing small world of big data. A quick search at Scopus database lists more than 400 papers adopting bibliometric tools and techniques in the last year (2018) aiming at "making sense" of the large amount of information now available online (Cronin, 2001). However, a great deal of authors such as Kostoff (1998) advice some caution on the adoption of these methodologies.

This paper is structured as follows: Section 1.2 presents a brief literature review pointing out the soundest subtopics and milestones achieved by the IMSs research community throughout the years. Section 1.2 introduces the aim of bibliometric and citation analysis tools and techniques. Section 2 describes the research methods adopted in the current paper and sections 3 and 4 report, discuss and dissect some of the results available so far in this ongoing project. Finally, section 5 summarizes the research process, points out some implications and outlines some future research avenues.

2. MATERIALS AND METHODS

The soundest bibliographic databases (namely Scopus, Web of Knowledge (WoK) and Google Scholar) were queried adopting the following keywords at the "Title" field: "Integrated Management Systems", "Integration of Management Systems" and "Management Systems Integration". The resulting papers were then selected based on the appropriateness of the content summarized in the abstract. A total of 341 papers published at conference proceedings, journals or as book chapters or books comprised the final sample. The content analysis of the papers from 2016 onwards was summarized in an affinity diagram In order to develop the affinity diagram each keyword was analyzed and clustered according to the underlying and unifying concept (first iteration). The following iterations enabled the identification of high order concepts. The bibliometric and citation analysis considered all the papers (period 1995-2019). The citations per document breakdown by year were retrieved from the Google Scholar database.

Table 1 presents the bibliometric indexes of the sample according to the different databases queried.

Table 1. Bibliometric indexes of the sample.

	Scopus	WoK	Google Sch.
h	36	26	50
i10	77	45	107
n	281	169	275

Figure 1 displays the distribution (breakdown by year) of the total amount of papers (percentage) that comprised the sample. On this regard, one should stress that the sample is heterogeneous and biased (more papers from the recent years) which, on other side, points out the growing interest on this topic year after year.

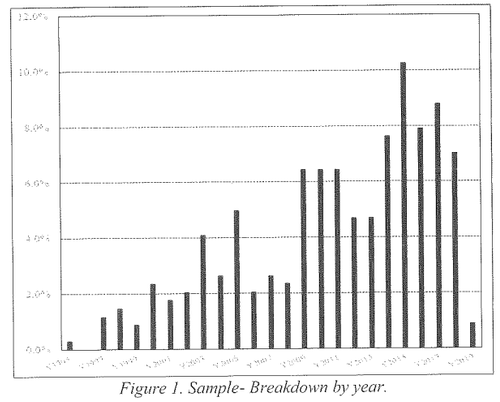


Figure 1. Sample- Breakdown by year.

3. RESULTS

3.1 *Affinity Diagram*

Figure 2 presents the affinity diagram of the subtopics addressed in the papers published between 2016 and 2019. It is possible to breakdown the subtopics among three major dimensions (higher order concepts): Theories (development), Strategies and Practices. Among the development of new theoretical propositions ("Theories" dimension) it should be pointed out that some papers proposed principles and identified several research gaps supported on an in-depth literature review focusing on particular issues within the wider domain of IMSs such as the paper authored by Nunhes *et al.* (2016), the one authored by Kafel (2016) and that authored by Dahlin and Isaksson (2017). In 2018, for the first time, a model aiming at the assessment of diffusion of IMSs among different countries was proposed by Cabecinhas *et al.* (2018) and several approaches towards the quantification of IMSs maturity were reported (Domingues *et al.*, 2016; Dragomir *et al.*, 2017; Moumen and El Aoufir, 2018; Poltronieri *et al.*, 2019).

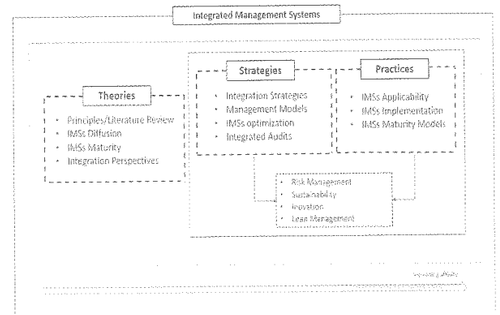


Figure 2. Affinity diagram (2016-2019).

Concerning the "Strategies" dimension one should stress that several integrated management models and

frameworks were proposed from 2016 onwards supported on several concepts that revolve around the IMSs phenomenon. Among them one should point out the lean-integrated MS model (Souza and Alves, 2018), the SIMS-RC supported on the concept of responsible care (Muhamad *et al.*, 2018) and several approaches in line with the sustainability construct such as those published by Rebelo *et al.* (2016) and Gianni *et al.* (2017).

The "Practices" dimension encompasses a great deal of studies reporting the IMSs implementation, such as those authored by Chountalas and Tepaskoualos (2018), Ionescu *et al.* (2018) and Nowak and Pawluk (2016) and some studies pointing some innovative approaches to deal with IMSs (Darabont *et al.*, 2019).

3.2 *Bibliometric Analysis*

Figure 3 displays the boxplot (breakdown by source- Conference proceedings vs Journals/Book Chapters) of the sample. The results suggest the appropriateness of publishing in journals over the publication in conference proceedings. However, the networking possibilities and opportunities that a conference offers and entails are not comparable of those offered by other sources. In addition, a large amount of researchers stress that the number of citations, *per se*, may not be the solely proxy variable impacting on the assessment of the quality of a paper.

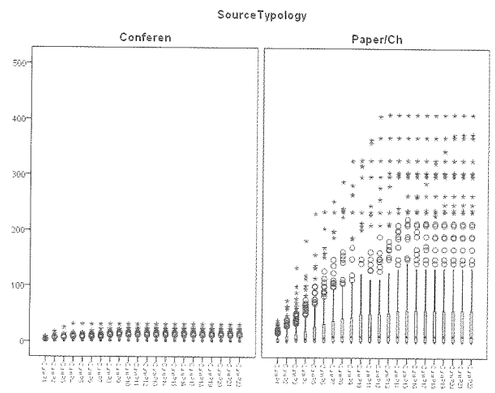


Figure 3. Boxplot according to source (breakdown by year after publication).

Additionally, Figure 3 discloses those outstanding papers (if measured against the number of citations), *i.e.*, the outliers and severe outliers. In fact, one may conclude that the benchmark paper (authored by Jørgensen *et al.*, 2006) in this research domain attained circa 400 citations so far but a great deal of papers were cited over 100 times.

Figures 4 and 5 present the probability (smoothed) curves (citations) breakdown by source (Conference proceedings vs. Journals/Book chapters) based on the sampled papers. Each curve depicts (plots) the cumulative number of papers (percentage) with *n* citations year after year.

A quick glance at these figures seemingly show the add value of publishing in journals or book chapters when compared with the option of publishing at conference proceedings.

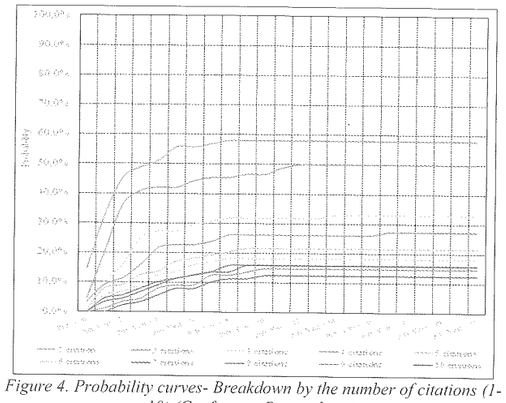


Figure 4. Probability curves- Breakdown by the number of citations (1-10) (Conference Proceedings).

In addition, more than 40% of the conference proceedings and nearly 17% of the papers published in journals were never cited. Moreover, solely the probability plots "1 citation- Con. Proc." and "6 citations- Journals/Book Chapters" are comparable entailing a seemingly benefit/effort ratio of 6 when choosing a generic journal over a conference proceeding to publish.

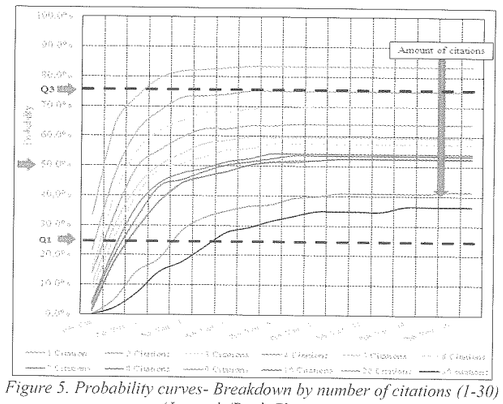


Figure 5. Probability curves- Breakdown by number of citations (1-30) (Journals/Book Chapters).

A deeper analysis of Figure 5 shows that a single citation at the publication year entails a Q2 (Quartile 2) paper whereas two or more citations a Q1 paper. However, four years afterwards solely papers cited more than 20 times are eligible as Q1 papers and, two years on, an amount of not less than 30 citations is a necessary condition to be a Q1 paper. Furthermore, the probability curves 7 to 10 citations are almost indistinguishable suggesting that the major effort to be carried out is to achieve 7 citations. Afterwards, the gaps between the probability plots decrease considerably.

4. DISCUSSION

The results presented and achieved so far in this ongoing project suggest the add value of opting by a journal when publishing research outputs. However, the resulting outputs of a conference or symposium are extremely important in a more intangible perspective such as the networking activities that are carried out. In addition, the adoption of the probability plots depicted in Figures 4 and 5 enable the researchers with a tool to map their present and past studies in the context of bibliometric analysis. Furthermore, novel researchers may plan their research outputs based on this method.

5. CONCLUSIONS

A mixed hybrid qualitative (affinity diagram)/ quantitative (citations plots) approach to literature review is presented in this paper (first output of an ongoing project). Based on a sample of 341 papers indexed in the Scopus, WoK and/or Google Scholar some visual aids (affinity diagram and citation probability plots) were presented.

Concerning the affinity diagram three major dimensions (higher order concepts) were identified being addressed by the mainstream research community in the last years: Theories, Strategies and Practices.

Regarding the bibliometric analysis it is possible to point out that researchers actively publishing in the IMSs research domain may now ascertain at which Quartile their papers belong and may outline a more quantitative strategy (focused on the amount of citations) throughout the research journey.

In addition, as stressed previously, this study encompasses a broader project aiming at the development of a systematic literature review supported on innovative approaches such as improved visualization tools and bibliometric analysis. This comprehensive literature review study will address a research gap identified in the IMSs research domain.

6. ACKNOWLEDGMENTS

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7. REFERENCES

Bernardo, M., Casadesus, M., Karapetrovic, S. and Heras, I. (2010). An empirical study on the integration of management system audits. *Journal of Cleaner Production, 18(5)*, 486-495.

Bernardo, M., Casadesus, M., Karapetrovic, S. and Heras, I. (2008). Management systems integration degrees: Empirical study. *In proceedings of the 11th QMOD Conference.*

Cabecinhas, M., Domingues, P., Sampaio, P., Bernardo, M., Franceschini, F., Galetto, M., Gianni, M., Gotzamani, K., Mastrogiacomo, L. and Hernandez-Vivanco, A. (2018). Integrated management systems diffusion models in south European countries. *International Journal of Quality and Reliability Management, 35(10)*, 2289-2303.

Chan, Y.K., Gaffney, P., Neailey, K. and Ip, W.H. (1998). The establishment of an integrated management system- A paradigm for railway engineering management. *TQM Magazine, 10(6)*, 420-424.

Chountalas and Tepaskoualos (2018). Selective integration of management systems: a case study in the construction industry. *TQM Journal*, in press.

Copping, P. (1995). Efficiency through integration of management systems. *In proceedings of AusIMM annual conference on adding value to our resources- Our future.*

Cronin, B. (2001). Bibliometrics and beyond: Some thoughts on web-based citation analysis. *Journal of Information Science, 27(1)*, 1-7.

Dahlin, G. and Isaksson, R. (2017). Integrated management systems- interpretations, results, opportunities. *TQM Journal, 29(3)*, 528-542.

Darabont, D.-C., Bejinariu, C., Baciu, C. and Bernevig-Sava, M.-A. (2019). Modern approaches in integrated management systems of quality, environmental and occupational health and safety. *Quality- Access to Success, 20*, 105-108.

Domingues, J.P.T., Sampaio, P. and Arezes, P.M. (2011). Beyond "Audit" definition: A framework proposal for integrated management systems. *In proceedings 61st Annual IIE Conference and Expo.*

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Ellegaard, O. and Wallin, J.A. (2015). The bibliometric analysis of scholarly production: How great is the impact?. *Scientometrics, 105(3)*, 1809-1831.

Genaro, A.F.S. and Loureiro, G. (2015). Stakeholder management as an approach to integrated management system (IMSSTK). *Advances in Transdisciplinary Engineering, 2*, 31-39.

Gianni, M., Gotzamani, K. and Tsiotras, G. (2017). Multiple perspectives on integrated management systems and corporate sustainability performance. *Journal of Cleaner Production, 168*, 1297-1311.

Griffith, A. and Bhutto, K. (2008). Improving environmental performance through integrated management systems (IMS) in the UK. *Management of Environmental Quality: An International Journal, 19(5)*, 565-578.

Hamzah, A., Saleh, A.A., Subagio, M. and Santoso, B. (1998). *Environmental management system integration on natural gas operational practices: Experience in the Kangean block area, Indonesia. In proceedings of SPE International Conference on Health, Safety, and Environment in Oil and Gas Exploration and Production.*

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Copping, P. (1995). Efficiency through integration of management systems. *In proceedings of AusIMM annual conference on adding value to our resources- Our future.*

Cronin, B. (2001). Bibliometrics and beyond: Some thoughts on web-based citation analysis. *Journal of Information Science, 27(1)*, 1-7.

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Ellegaard, O. and Wallin, J.A. (2015). The bibliometric analysis of scholarly production: How great is the impact?. *Scientometrics, 105(3)*, 1809-1831.

Genaro, A.F.S. and Loureiro, G. (2015). Stakeholder management as an approach to integrated management system (IMSSTK). *Advances in Transdisciplinary Engineering, 2*, 31-39.

Gianni, M., Gotzamani, K. and Tsiotras, G. (2017). Multiple perspectives on integrated management systems and corporate sustainability performance. *Journal of Cleaner Production, 168*, 1297-1311.

Griffith, A. and Bhutto, K. (2008). Improving environmental performance through integrated management systems (IMS) in the UK. *Management of Environmental Quality: An International Journal, 19(5)*, 565-578.

Hamzah, A., Saleh, A.A., Subagio, M. and Santoso, B. (1998). *Environmental management system integration on natural gas operational practices: Experience in the Kangean block area, Indonesia. In proceedings of SPE International Conference on Health, Safety, and Environment in Oil and Gas Exploration and Production.*

Hohan, A.I., Olaru, M. and Keppler, T. (2015). Integration of risk management practices in the framework of an integrated management system environment-health and safety-

information security. *Quality - Access to Success, 16*, 289-295.

Ionescu, G.H., Firoiu, D., Pîrvu, R., Bădîrcea, R. and Drăgan, C. (2018). Implementation of integrated management systems and corporate social responsibility initiatives- A Romanian hospitality industry perspective. *Sustainability, 10(10)*, 3684.

Jackson, S.L. (1997). The ISO 14001 implementation guide: Creating an integrated management system. ISBN: 978-0-471-15360-3.

Jørgensen, T.H., Remmen, A. and Mellado, M.D. (2006). Integrated management systems- Three different levels of integration. *Journal of Cleaner Production, 14(8)*, 713-722.

Kafel, P. (2016). Benefits of management systems integration. *Studia Oeconomica Posnaniensia, 4(10)*, 122-133.

Karapetrovic, S. (2002). Strategies for the integration of management systems and standards. *TQM Magazine, 14(1)*, 61-67.

Karapetrovic, S. and Willborn, W. (1998). Integration of quality and environmental management systems. *TQM Magazine, 10(3)*, 204-213.

Khanna, H.K., Laroiya, S.C. and Sharma, D.D. (2010). Integrated management systems in Indian manufacturing organizations some key findings from an empirical study. *TQM Journal, 22(6)*, 670-686.

Kostoff, R.N. (1998). The use and misuse of citation analysis in research evaluation. *Scientometrics, 43(1)*, 27-43.

Labodová, A. (2004). Implementing integrated management systems using a risk analysis based approach. *Journal of Cleaner Production, 12(6)*, 571-580.

Lund, H.L. (2004). Strategies for sustainable business and the handling of workers' interests: Integrated management systems and worker participation. *Economic and Industrial Democracy, 25(1)*, 41-74.

Mackau, D. (2004). SME integrated management system: A proposed experiences model. *TQM Magazine, 15(1)*, 43-51.

Mariouryad, P., Golbabaei, F., Nasiri, P., Mohammadfam, I. and Marioryad, H. (2015). Study of the continuous improvement trend for health, safety and environmental indicators, after establishment of integrated management system (IMS) in a pharmaceutical industry in Iran. *Journal of Clinical and Diagnostic Research, 9(10)*, 18-20.

Matias, J.C.O and Coelho, D.A. (2002). The integration of the standards systems of quality management, environmental management and occupational health and safety management. *International Journal of Production Research, 40(15)*, 3857-3866.

Milliman, J. and Grosskopf, J. (2011). Lessons in leadership: Operationalizing sustainability through an integrated management system. *Environmental Quality Management, 20(4)*, 15-28.

Moed, H.F. (2005). Citation analysis in research evaluation. ISBN-13 978-1-4020-3714-6, Springer.

Moumen, M. and El Aoufir, H. (2018). An integrated management system: from various aspects of the literature to a maturity model based on the process approach. *International Journal of Productivity and Quality Management, 23(2)*.

Neves, A. and Sampaio, P. (2011). Key performance indicators in integrated management systems: state-of-the-art. *In proceedings of the 7th International Symposium on Occupational Safety and Hygiene (SHO)*, 437-441.

Nouri, J., Abbaspour, M., Fard, M.T. and Mohammad Fam, I. (2010). Advantages of integrated management system in educational centers. *Journal of Food, Agriculture and Environment, 8(3-4)*, 1259-1264.

Nowak, A. and Pawluk, A. (2016). Integrated management system in relation to sustainability in hard coal production industry. *Inzynieria Mineralna, 17(2)*, 45-52.

Nunhes, T.V., Motta, L.C.F. and Oliveira, J. (2016). Evolution of integrated management systems research on the Journal of Cleaner Production: Identification of contributions and gaps in the literature. *Journal of Cleaner Production, 139*, 1234-1244.

Ochsenkuehn, R. (2001). Greening the supply chain bottom-line advantage through management system integration. SAE Technical papers.

Olaru, M., Rizea, C. and Sava, T. (2011). Promoting the concept of social responsibility by SMEs in Romania in the context of concerns the implementation of integrated management systems. *In proceedings of the 7th International Conference on Management of Technological Changes*, 53-56.

Osareh, F. (1996). Bibliometrics, citation analysis and co-citation analysis: A review of literature I. *Libri, 46(3)*, 149-158.

Petrini, J., Firman, C., Marshall, J. and Waech, N. (2000). Implementation of an integrated management system for quality, environment and safety at Blandin paper company paper mill and forestry operations. *In TAPPI Proceedings-Environmental Conference and Exhibit*, 693-699.

Poltronieri, C.F., Ganga, G.M.D. and Gerolamo, M.C. (2019). Maturity in management system integration and its relationship with sustainable performance. *Journal of Cleaner Production, 207*, 236-247.

Rebelo, M.F., Santos, G. and Silva, R. (2016). Integration of management systems: towards a sustained success and development of organizations. *Journal of Cleaner Production, 127*, 96-111.

Voinea and Pamfilie, R. (2009). Considerations regarding the performance improvement of the hospital healthcare services from Romania by the implementation of an integrated management system. *Amfiteatru Economic, 26(1)*, 339-346.

Walter, R. (2005). Integrated management systems and safety culture. In proceedings of the AIChE Spring National Meeting Conference.

Weismayr, C. and Pammer, K. (1999). LCI/LCA as part of an integrated management system in the steel industry. *SAE Technical Papers*.

Wilkinson, G. and Dale, B.G. (1999). Integrated management systems: An examination of the concept and theory. *TQM Magazine, 11(2)*, 95-104.

Wilkinson, G. and Dale, B.G. (2001). Integrated management systems: A model based on a total quality approach. *Managing Service Quality: An International Journal, 11(5)*, 318-330.

Zeng, S.X., Lou, G.X. and Tam, V.W.Y. (2006). Integration of management systems: The views of contractors. *Architectural Science Review, 49(3)*, 229-235.

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