

THE TENDENCY OF SCIENTIFIC PUBLICATION ABOUT ENVIRONMENTAL MANAGEMENT SYSTEM REQUIREMENTS OF ISO 14001 IN BRAZIL

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SUMMARY: Environmental Management System (EMS) guided by ISO 14001 is essential for the sustainable organizational development considering the equity aspects of *triple bottom line* of sustainability. In this context, the study aims to investigate the literature tendencies about the topic with regard to environmental, socio-ecological aspects and economical implications, in Brazil. The methodology used was the quali-quantitative and descriptive approach with technical procedures of a systematic literature review. The keyword “environmental management system” and “ISO 14001” were inserted at Portal Capes platform, which returned with 144 scientific publications. Among these publications, after critical analysis in the inclusion parameters, 79 scientific articles were selected using the snowballing technique. The reading and tabulation of the datas based on *multiple assessor technique*. The results shown that have been an increasing concern with the researches about the theme in 1995, but the top of the researches has been studied since 2004. The publication of the articles has been concentrated in journals with *qualis* B1 to B3 in multidisciplinary area; most studies include the country as analysis unit, in diverse activities sectors. The theme approach tendency (environmental, socio-ecological and economical implications) based in *Chi-square tests* have a sensitive intensity, no consistency and reliability. Consequently, the existence of the inequality in the importance attributed to the themes and subthemes help in the indication of the new researches, which can clarify gaps in the theoretical and practical knowledge slightly explored, but they are essential to a better insertion of the environmental management system in the corporate world.

Keywords: Sustainability. Environment Management. Triple Bottom Line, Management System.

A TENDÊNCIA DA PUBLICAÇÃO CIENTÍFICA SOBRE OS REQUISITOS DO SISTEMA DE GESTÃO AMBIENTAL DA ISO 14001 NO BRASIL

RESUMO: O Sistema de Gestão Ambiental (SGA) orientado pela ISO 14001 é essencial para o desenvolvimento organizacional sustentável considerando os aspectos de equidade do *triple bottom line* de sustentabilidade. Nesse contexto, o estudo tem como objetivo investigar as tendências da literatura sobre o tema no que diz respeito aos aspectos ambientais, socioecológicos e implicações econômicas, no Brasil. A metodologia utilizada foi a abordagem quali-quantitativa e descritiva com procedimentos técnicos de revisão sistemática da literatura. As palavras-chave “sistema de gestão ambiental” e “ISO 14001” foram inseridas no portal da Capes que retornou com 144 publicações científicas. Dentre essas publicações, após análise crítica dos parâmetros de inclusão e por meio da técnica de bola de neve, foram selecionados 79 artigos científicos. A leitura e tabulação desses estudos ocorreram por meio da técnica de leitura múltipla avaliadora. Os resultados mostram que houve uma preocupação crescente com as pesquisas sobre o tema em 1995, mas o maior volume desde 2004, a publicação dos artigos tem se concentrado em periódicos com *qualis* B1 a B3 na área multidisciplinar, a maioria dos estudos abrange o país como unidade de análise, em diversos setores de atividades. A tendência de abordagem do tema (implicações ambientais, socioecológicas e econômicas)

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baseada em testes de Qui-quadrado apresenta uma intensidade sensível, sem consistência e confiabilidade. Consequentemente, a existência de desigualdade na importância atribuída aos temas e subtemas auxilia na indicação de novas pesquisas que podem esclarecer lacunas nos conhecimentos teóricos e práticos pouco explorados, mas essenciais para uma melhor inserção do sistema de gestão ambiental no mundo corporativo.

Palavras-chave: Sustentabilidade. Gestão Ambiental. *Triple Bottom Line*, Sistema de Gestão.

1 INTRODUCTION

The organizations are joining the environmental requirements from their consumers and suppliers to keep active in the marketplace and preserve their image (BRISOLARA; SILVA; CARDOSO, 2016). In this regard, the environment became essential in the process of theoretical reformulation and organizational practices.

In the modern business field the application of Environmental Management System (EMS), has been accepted by the organizations, since it aims to achieve the best performance in social, environmental and economical issues of the sustainability (*Triple bottom line*) (GIANNI; GOTZAMANI; TSIOTRAS, 2017). Ikram *et al.* (2019) point out that EMS adoption is effective to approach the *Triple bottom line* issues.

The EMS was instituted to regulate and manage companies and businesses with environmental bias (JUNKES; FERREIRA; ARAUJO, 2017), and to the sustainable organizational development (RINO; SALVADOR, 2017). Prajogo, Tang e Lai (2012) emphasize that EMS propose the integration between the business and environment, considering the environmental issues in each decision-making, process, products development and strategic planning.

The regulation *International Organisation for Standardization* (ISO) 14001 considered one of the best examples to achieve the EMS, because bases in the continuous improvement by *Plan-Do-Check-Act* (PDCA) (IKRAM *et al.*, 2019). ISO 14001 has the aim to standardize and establish criteria and procedures, which might develop the environmental issues present in companies and businesses. Mazzi *et al.*, (2016) emphasize the standards adopted by the regulamentation result in strategic benefits and it causes a rise in organizational popularity.

The global dissemination of ISO 14001 fostered relevant achievements regarding the increase of organization numbers and countries that have been using EMS (ISO, 2014). In addition, it can be used in all kind of businesses, types and sizes, as it adjusts to different geographical, cultural and social conditions (RINO; SALVADOR, 2017). In this conception, in order to have a higher multiplication and EMS use in organizations, it is fundamental the comprehension of the historical and current situation about the theme, making it easier at formulation establishing strategic plans to this system in the future (SALIM *et al.*, 2018).

The scientific researches about EMS are strong indicatives of the trajectory and the future perspectives, for example, in literature systematic review Salim *et al.* (2018) discovered that the socio-ecological and environmental aspects hold high emphasis in EMS studies. However, the economical implications are sub-emphasized, which might compromise ISO 14001 organizational applicability.

Ferenhof *et al.* (2014) carried out a systematic literature review about EMS in small and medium-sized enterprises. They found that the data point out, especially to: a) a lack of the knowledge about the environmental impacts; b) deficit of training, politics, consultancy, business cooperation and the system integration; c) higher initial costs to adopt ISO 14001; d) low costs to improve the sustainability and brand image.

Reis *et al.* (2018) review systematically about the benefits, difficulties and performance, reveals a positive impact in financial and organizational performance by means of the ISO 14001 certification.

They highlighted that the benefits encountered cover three different groups: internal (organizational improvement, environmental performance and costs), external (image and market) and organization relationships (environmental awareness, competitiveness and customers). Grandic (2017) also investigated ISO 14001 impacts in the organizational performance. The results show that EMS deployment linked to ISO 14001 has a positive impact on the results, innovation and environmental commitment.

All of these literature reviews contain issues related to adoption, deployment, benefits and difficulties, among others, in global scale. However, the systematic reviews regarding scientific studies published in Brazil have not been located, thus, this is a latent gap in the literature on EMS. In this context, this study aims to investigate the tendencies in the literature about the environmental management system theme, based on ISO 14001 related to the environmental, socio-ecological aspects and economical implications, in Brazil.

This study can be justified connecting theoretical and practical contributions about EMS (ISO 14001), since Boiral *et al.* (2018) also highlight the theoretical and empirical about the theme in scene is relatively underdeveloped. The theoretical contributions of this study can provide dubious issues or ones, which still have not been explored in Brazil on EMS and are relevant for its adoption and implantation. Moreover, the systematic reviews assist the enlightenment of the state of the art of the existing surveys and direct the sub themes for future studies.

2 THEORETICAL BENCHMARK

2.1 Brief theory over environmental management

The environmental management appeared as an idea to anticipate and avoid or solve the problematics related to the environment and the natural resources preservation (THOMPSON, 2002). From 1980s, it was focused in decrease the cost and the organizational tasks and it was recognized as green and clean (WEERASIRI; DISSANAYAKE; ZHENGANG, 2012). In 1990s, according to these authors, the increasing pressure of the *stakeholders* connected to the environment made the organizations recognize the environment impacts related to the operations through the environmental management application.

In 2000, the environmental management, started to understand “[...] processes and practices introduced by an organization to reduce, eliminate and, ideally, avoid the negative environmental impacts resulting from its business (COOPER, 1998, p. 112). Donaire (1999) defines it as a set of procedures to manage the business in its interface with the environment, and in addition, it is the organization endogenous and exogenous mobility to gain the environmental quality.

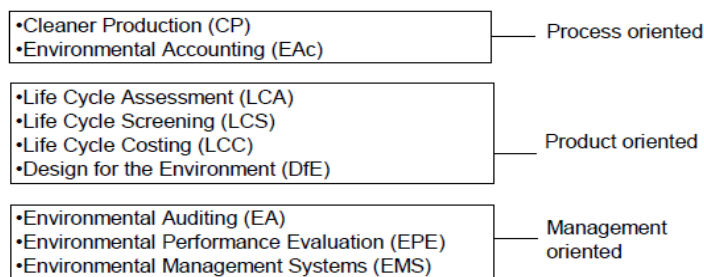
Rohrich (2011) proposes a set of policies and organizational practices that consider the health, security and the environmental protection of the society through the environmental impacts mitigations created by planning, implantation, operation, ampliation, relocation or deactivation of organizations activities. Following this same logic, the environmental management is considered a methodology to manage the organizational activities ensuring the implementation in the environmentally correct way (WANG; WU, 2013).

In addition to all this, the environmental management, aims to empower the organizations to reduce damage, so that the economical benefits are higher than the implementation costs (OLIVEIRA; PINHEIRO, 2010). Alcântara, Silva and Nishijima (2012) emphasise that this environmental management seeks to create techniques, plan, organize and manage the social and economical activities to use rationally the natural resources, as well as comply with the environmental legislation. Besides, it has multidisciplinary nature, because professionals from several knowledge areas can perform in environmental management, as long as duly authorized (ALCÂNTARA; SILVA; NISHIJIMA, 2012).

The companies use many different tools and methods to achieve environmental management, for example, Environmental Auditing, Environmental Impact Evaluation, Environmental Risk Assessment, Life Cycle Assessment, EMS, among others (EMILSSON;

HJELM, 2002; RAMOS *et al.*, 2009). In Figure 1 it is shown an overview of these tools or oriented methods to help the environmental management.

Figure 1. Tools and Methods applied in the environmental management



Source: Fet (2002, p. 2).

These instruments and methods provide environmental informations that help the environmental management to make organizations more ecological (EMILSSON; HJELM, 2002). Accordingly, it links with the sustainable development guidelines, therefore, this has an integrated view of the environment, based on a scientific and analytical approach to diagnose, generate data, and propose solutions, which reduce the environmental impacts caused by human activities (DIAS, 2006). Severo and Guimarães (2017) say that the companies' activities and the environmental protection are intertwined and contribute directly to the sustainable development.

2.2 Environmental Management System (EMS)

EMS is the most recognized and applied tool in environmental management (JABBOUR; SANTOS; NAGANO, 2008; WANG; WU, 2013). EMS can be defined as “[...] a set of management practices that allow companies identify and evaluate the effects of their activities in the environment, control and, possibly, enhance the environmental performance” (NOBARI *et al.*, 2018, p. 2574). These authors also complete that it meets the environmental legal requirements, preserves materials and energy, applying controls on the organization activities, reduces waste and increasing their efficiency.

ISO 14001, recognized as an international standard, presents the requirements and guidelines to develop and maintain the EMS effective (ISO 14001, 2015). It has a volunteer aspect; therefore, there are no legal and mandatory requirements to certify organizations. In this regard, the EMS adoption in ISO patterns represents a behavioural and managerial change process in the organization, in which implantation also must be conducted in an integrated and participative way.

EMS based on ISO 14001 is underpinned in the concept Plan-Do-Check-Act (PDCA), which provides an interactive process to achieve continuous improvement, being represented in 4 stages (ISO 14001, 2015). a) Plan: establish environmental goals and the required process to reach the results according to the companies environmental policies; b) Do: implement the processes as planned; c) Check : monitor and measure the processes with regard to the environmental policy, including commitments, environmental goals and operational criteria and report the results and d) Act: take actions to the continuous improvement.

The literature shows different types of EMS deriving from organizations, non-governmental institutions, universities, among others, and they can be classified into two groups (CAMPOS, 2001): a) the models, for example, Winter, Responsible Care® Program, International Chamber of Commerce, Strategies for Today's Environmental Partnership, Eco Management and Audit Scheme; b) the standards, for example, BS 7750 and ISO 14001. Table 1 reports briefly the main characteristics from these models and standards.

Table 1. EMS Types

<p>- Winter Model (1972): one of the first systems and was developed by Emst Winter & Sonh company with the aim to facilitate the implantation and define the schedule by establishing 20 EMS integrated modules. Its implementation was volunteer and did not provide certification to companies.</p> <p>- Responsible Care® Program (1984): This model emerged by means of an initiative from the chemical industry formed by <i>Chemical Manufacturers Association</i>, although not volunteer and not certifiable, it is a mandatory requirement for those that take part in this association. It consists in guiding principles, managerial, consultative and leadership practices. In Brazil, Brazilian Chemical Industry Association (ABIQUIM) coordinates it since 1990.</p> <p>- International Chamber of Commerce (ICC) (1986): This model focused on integrated administrative processes (planning, organization, implementation and control) to the business management and coherent with the environmental policy and their feedback cycles result in a continuous improvement. Its adoption is volunteer and do not generate certification.</p> <p>- Strategies for Today's Environmental Partnership (STEP) (1990): Created by <i>American Petroleum Institute</i> (API) with the aim to develop a guide to enable the improvement of the environmental, health and security performance in API. STEP adoption is volunteer and not certifiable.</p> <p>- Eco Management and Audit Scheme (EMAS) (1993): Created by the European Economic Community Council its goal is to foster the improvement of the organizational and environmental behaviour continuously and its evaluation is systematic. Every year a list of registered industries is published in the european community journal, in other words, it can be considered a kind of environmental performance certification, but its establishment is volunteer, too.</p> <p>- BS 7750 (1992): Considered the first regulation related to EMS and British Standards Institution (BSI) created it. This standard is not applied anymore, but its importance is unquestionable, because its system model is based in PDCA cycle and inspired the creation of <i>International Organization for Standardization</i> (ISO). The adoption</p>
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was voluntary, however generated a certification.

- **ISO 14001 (1996, 2004, 2015):** It is an environmental standard with EMS international scope and assists the organizations to define their policies and goals related to the environmental impacts. Its deployment is voluntary and creates a certification.

Source: adapted from Souza (2009), Barbieri (2017), Campos (2001), Donaire (1999).

The models and the standards described in Board 1 were essential to elaborate ISO 14001, since they were their pioneers and one of the characteristics in common is the voluntary deployment of these models and standards before the companies.

2.3 Benefits and criticisms in EMS deployment

The national and international literature reports numerous benefits, when the companies adopting ISO 14001 in almost all areas (organizational, commercial, corporate reputation improvement and those relating to the stakeholders management, among others) (VÍLCHEZ, 2017). Besides, there are also several criticisms about its implementation (bureaucratization, superficial and symbolic adoption, among others) as shown in Table 2.

Table 2. Summary of benefits and criticisms in ISO 14001 deployment

Benefits

=> **Competitive advantages:** through promotion and development of distinct abilities in the organizational, commercial and stakeholders management;

=> **Organizational skills:** it facilitates the international trade through harmonization of environmental management standards, and grants preferential access in foreign markets.

=> **Improve the operational efficiency:** based on continuous improvement;

=> **Reducing environmental impacts:** internal evaluations of energy and resources performance;

=> **Stakeholders management:** the voluntary adoption eases and legitimizes companies' environmental practices, assists in the integration of stakeholders' demands in the decision-making process.

Criticisms

=> **Bureaucratization:** excessive processes bureaucratization, documents, among others.

=> **Superficial or symbolic adoption:** ISO 14001 use to legitimize the environmental practices, but without formatting an effective commitment to the internal improvement.

=> **Skewed focus:** ISO 14001 focused in the process and not in the results to be achieved.

=> **Inconclusive results:** there is no consensus on the connection with ISO 14001 adoption and the environmental performance;

=> **Decoupling between organizational legitimacy and environmental performance:** ISO 14001 adoption can be decoupled between achieving the institutional legitimacy and the significant improvement in environmental performance.

Source: adapted from Vílchez (2017), Mazzi *et al.* (2016) and Boiral *et al.* (2018).

The most latent criticisms, according to Boiral *et al.* (2018) engage with the implementation cost and the EMS certification process, and explain they occur due to lack of resources in the organizations and the insufficient managers' commitment. Additionally, these authors still emphasise the successful implementation is founded in several factors and hardly approached by literature, for example, the way to implement ISO 14001, enterprise size and maturity of the environmental certification.

The most relevant benefits generated by ISO 14001 derive from the legal compliance, human resources management and the environmental performance evaluation (MAZZI *et al.*, 2016). Thus, it can be noticed there are various conflicting situations in ISO 14001 usage, although the organizations benefits have revealed to be the sturdiest and this is pointed out by literature and in practice (REIS *et al.*, 2018).

3 METHODOLOGICAL PROCEDURE

The approach of this research is quali-quantitative, descriptive and bibliographic, specifically, systematic literature review. The bibliographic research is recommended in view of being a strict and verifiable methodology; consequently, it reduces the probable bias in the research results (LAKATOS; MARCONI, 2012). These authors recommend the following steps for conducting the research: a) Choice of the theme; b) the work plan elaboration; c) identification; d) localization; e) compilation; f) annotation; g) analysis and interpretation; h) essay. In this way, in the aftermath the information in each of these steps are presented.

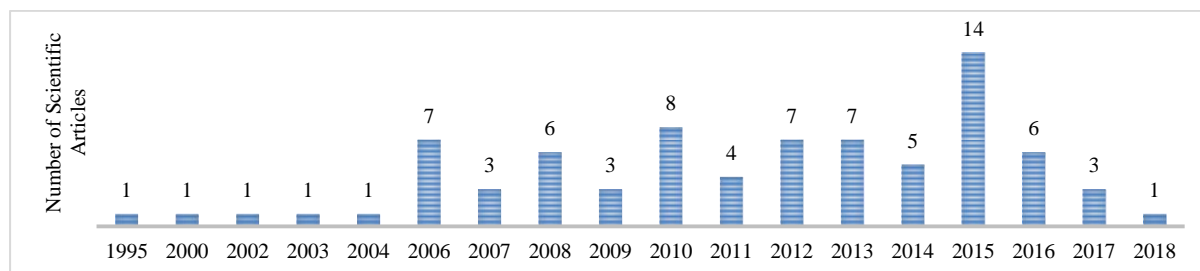
The theme of this study links to ISO 14001 and delimits the tendency of its use in Brazil from 1995 to 2018. In the definition stage of the work plan the parts of the study were established, in other words, the introduction sections, the theoretical frame, methodological procedures, analysis and results, conclusion and the references, as well as the issues, which will be described in every part, comprising a research backbone.

In the identification and the location it was defined "environmental management system" and "ISO 14001" as keywords and the base of journals consultation occurred by Coordination for the Improvement of Higher Level -or Education- Personnel (CAPES) which returned with 144 publications. The references of these publications also were revised using the snowballing technique that, according to Jalali and Wohlin (2012), recover publications, which have not appeared when collecting the initial scientific titles.

In the compilation stage there was the reading of the title and the publications summary considering the following criteria in the research: a) be based in a scientific journal publication with peer evaluation; b) address issues related to EMS linked with ISO 14001; c) have Brazil as

geographic reach; d) report. After this analysis, 79 scientific articles framed in the inclusion criteria were selected (FIGURE 2).

Figure 2. Summary of the quantity of articles



Source: Elaborated by authors

The annotation was conducted based on the integral reading of 79 articles by means of a table containing the format in the first head row: author and year, environmental aspects, socio-ecological, economical implications, geographical area, market sector and Qualis statement. Furthermore, in another board themes and subthemes were stratified, according to Salim *et al.* (2018) suggestion, in which the publications associated with socio-ecological were classified in: a) Adoption Factors; b) International distribution process; c) Policy, overview and governance; d) Strategies and theory development. The theme Economical Implications was classified in sub themes regarding to: a) Economical benefits (general); b) Economical Benefits (cost and profitability); c) Economical Benefits (company value and image); d) Economical Benefits (market); e) Economical Benefits (others). And, finally, the theme environmental aspects was stratified in sub themes related to: a) Environmental Improvement (multiple impacts); b) Environmental Improvement (solid waste); c) Environmental Evaluation (Method); d) Life cycle Evaluation (ISO 14001 series).

The increase in quality (validity and reliability) of the data analysis and collection occurred through the method *multiple assessor*, suggested by Gast, Gundolf and Cesinger (2017), which consists in the involvement of all authors of this study in the articles reading and examination organizing and collecting all the informations by means of the collection boards. In the aftermath, the independent collections had compared and discussed to achieve a consensus, at the datas. The period of the articles collection, reading and refinement occurred from September 2018 to April 2019.

4 ANALYSIS AND RESULTS

4.1 Publications Characteristics

The analysis of scientific articles about EMS shows publications coverage in Brazil took place from 1995 to 2018 (TABLE 3). The publications had awoken after 2004, which can be explained by ISO 14001 publication. Besides, in South America, this fact supports the increase of loans granted by the Brazilian government (FAPESP, 2009).

Table 3. Publication Synthesis

Authors	Year	Journal/program	Qualis ⁶
Nahuz	1995	RAE. Business Administration Journal	B1
Layrargues	2000	RAE. Business Administration Journal	B1
Rolim and Aires	2002	Administrative Science Journal	B4
Corazza	2003	RAE. Business Administration Journal	B1
Rohrich and Cunha	2004	RAC. Contemporary Administration Journal	B1
Avila and Paiva	2006	Management & Production	B1
Rodrigues and Ferreira	2006	RBC. Brazilian Accounting Journal	B4
Bispo and Cazarini	2006	Management & Production	B1
Bertolino and Frank	2006	READ. Administration Electronic Journal	B2
Tauchen and Brandli	2006	Management & Production	B1
Bacci, Landim and Eston	2006	REM. Mines School Journal	B2
Miranda <i>et al.</i>	2006	Pretext Journal	B3
Dal Piva <i>et al.</i>	2007	Brazilian Journal of Regional Management and Development	B1
Alberton and Costa Junior	2007	RAC. Contemporary Administration Journal	B1
Naime and Souza	2007	Management and Development	B4
Pombo and Magrini	2008	Management & Production	B1
Dionysio and Santos	2008	Information & Information	B1
Fernandes, Silva and Lótics	2008	GEPROS. Management of Production, Operation and Systems	B3
Silva Filho	2008	Online Production Journal	B3
Campos and Melo	2008	Online Production Journal	B3
Miranda, Correia and Kilimnik	2008	Pretext Journal	B3
Negreiros and Ambrozini	2009	Nucleus (ITUVERAVA.)	B2
Burlani and Selig	2009	Online Production Journal	B3
Ceruti and Silva	2009	Academic Journal: Agricultural and Environmental Science	B4

⁶ Qualis Statement in interdisciplinary área with evaluation in 2014 to 2016.

Ambrozini, Silva and Noieto	2010	Nucleus (ITUVERAVA.)	B2
Oliveira and Serra	2010	PRODUCTION (ABEPRO)	B1
Naime, Andara and Santos	2010	Management and Development	B4
Finger, Moretto Neto and Vieira	2010	Administration Science Journal	B2
Neves and Rozemberg	2010	RGSA: Social and Environmental Management Journal	B2
Grael and Oliveira	2010	Production (ABEPRO)	B1
Fumagalli, Corso and Silva	2010	REBRAE. Brazilian Strategy Journal	B2
Oliveira and Pinheiro	2010	Management & Production	B1
Pedroso <i>et al.</i>	2011	GEPROS. Management of the Production, Operation and Systems	B3
Sampaio and Exler	2017	Administration and Accounting Journal of FAT	B4
Brendler and Brandli	2011	Management & Production	B1
Barauna <i>et al.</i>	2011	Brazilian Journal of Regional Management and Development	B1
Sampaio, Borschiver and Morgado	2012	UniVap Journal	B2
Kneipp <i>et al.</i>	2012	Administration Science Journal	B2
Ribeiro and Jabbour	2012	Int J Sust Dev World ⁷	A2
Porto and Schütz	2012	Science & Collective Health	B4
Simon and Wolff	2012	Disciplinarum Scientia Natural and Technological	B5
Alcântara, Silva and Nishijima	2012	Electronic Journal in Management, Education and Technology	B2
Sucena and Stephan	2012	Journal of Transport Literature	B2
Machado Junior <i>et al.</i>	2013	Production (ABEPRO)	B1
Tessaro, Pedrazzi and Tessaro	2013	Environmental and Sustainability Management Journal	B2
Sgarbi, Schlosser and Campani	2013	Augmdomus	---
Pereira <i>et al.</i>	2013	Organizational Accounting Journal	B4
Leonardo, Abbas and Bulla	2013	Focus:Accounting Reflection	B2
Silveira, Alves and Flaviano	2013	Environmental Sustainability & Management Journal	B3
Tiscoski and Campos	2013	RGO. Organizational Management Journal	B2
Martens, Nadae and Carvalho	2014	Environmental Management & Sustainability Journal	B2
Targueta <i>et al.</i>	2014	Online Perspective: Human and Social Sciences Applied	B4
Colares and Matias	2014	Environmental Management and Sustainability Journal	B2
Queiroz <i>et al.</i>	2014	Sustainability Metropolitan Journal	B2

⁷ International Journal of Sustainable Development & World Ecology

Jabbour	2014	RAUSP. Administration Journal	B1
Welzel, Haupt and Martins	2015	Iberoamerican Journal of Strategic Management (IJSM)	B2
Salgado and Colombo	2015	RAM. Mackenzie Administration Journal	B1
Neitzke <i>et al.</i>	2015	Journal of Management, Financial and Accounting	B2
Mendonça and Silva	2015	HOLOS (Natal. Online)	B2
Eckert, Corcini Neto and Boff	2015	Environmental Management and Sustainability Journal	B2
Oliveira Neto <i>et al.</i>	2015	Management & Production	B1
Turco, Gallardo and Faria	2015	IPTEC Journal	---
Campos, Matos and Bertini,	2015	Electronic Journal of Management and Health	B4
Maranhão and Teixeira	2015	Iberoamerican Strategic Journal	B2
Spennassato <i>et al.</i>	2015	Interciencia (Caracas)	B1
Feil, Strasburg and Naime	2015	University Management of Latin American - GUAL	B3
Santos, Sehnem and Freitas	2015	Environmental Management and Sustainability Journal	B2
Florêncio, Silva and Nunes	2015	Veredas Favip (Online)	B3
Chiroli <i>et al.</i>	2015	Interciencia (Caracas)	B1
Brisolara, Silva e Cardoso	2016	Environmental Management and Sustainability Journal	B2
Jacomelli, Rodrigues and Hack	2016	Applied Tourism	---
Esteves and Henkes	2016	Environmental Sustainability & Management Journal	B3
Santos and Matos	2016	Administration Journal of UFSM	B3
Berneira and Godecke	2016	Administration Journal of UFSM	B3
Ayres, Otto and Serrat	2016	Thema Journal	B4
Silva, Melo and Lucena	2017	Principia Journal	B4
Crotti and Maçaneiro	2017	REAd. Electronic Journal of Administration	B2
Gomes	2017	Bulletin of the Environmental Observatory Alberto Ribeiro Lamego	B4
Passos and Costa	2018	Marketing & Tourism Review	B4

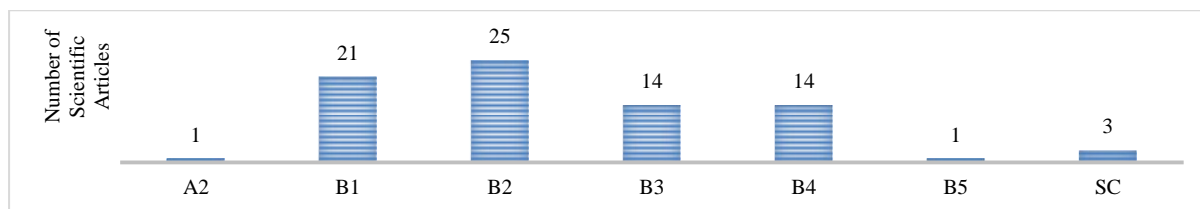
Source: elaborated by authors

The quantity of scientific journals, without repetitions is 54, these journals published 79 articles. Therefore, 46,8% of the scientific journals published only one article from 1995 to 2018, in which the higher article concentration occurred in the Management & Production journal with 5 publications. In addition to these findings, the arithmetic average of publications per journal is 1,46, the standard deviation is 0,81 and the coefficient of variation is 0,55, this means the articles publications are dispersed in relation to the scientific journals. This spraying of publications relating to EMS is also noted by Boiral *et al.* (2018) emphasizing that in average the number of

publications is 4 or 5 per year, furthermore, despite the certification number has multiplied from 2001 to 2013, the publications in this period didn't increase significantly.

Qualis evaluation reveals that 75,9% of publications are classified between B1 and B3 statements in interdisciplinary area (FIGURE 3).

FIGURE 3. Qualis Statement Synthesis

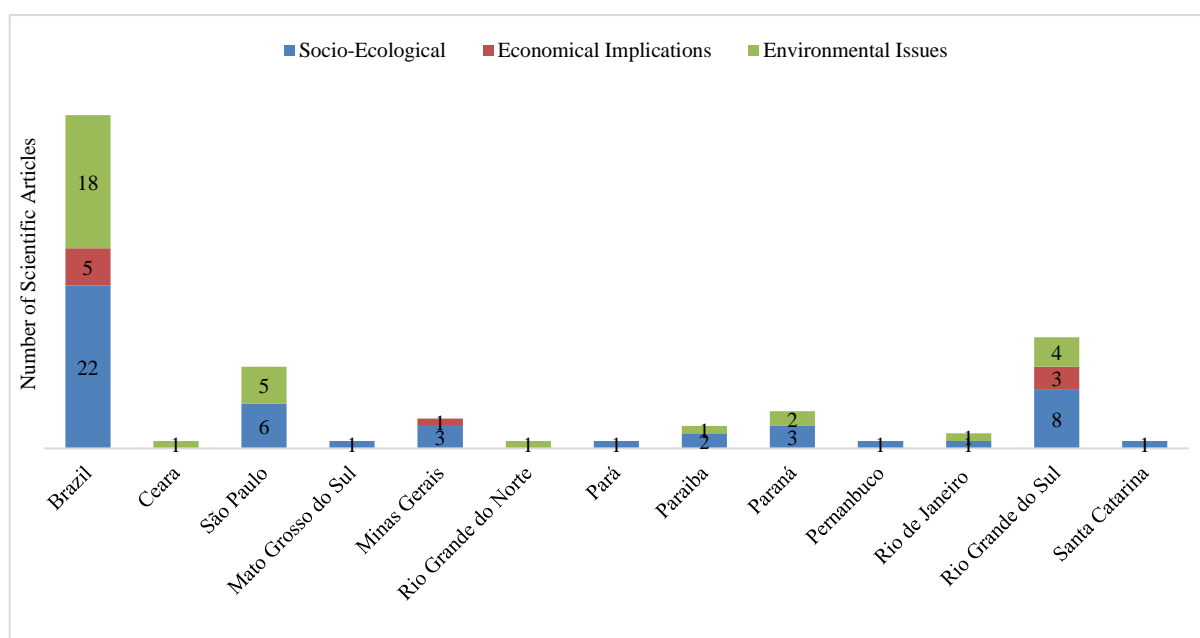


Source: Elaborated by authors.

The statements demonstrate the topic EMS linked to ISO 14001 have relevance in academic area. Therefore, the themes and sub themes related to EMS are current and important in practical and theoretical discussions.

The geographical distribution in scientific studies undertaking, mostly, covers the national territory as a whole, with no region specification, as verified in publications in item Brazil (56,9%) in Figure 4. This fact can be explained as a result of publications relating the literature review. Moreover, Rio Grande do Sul (19,0%), and São Paulo (14%) stands out for the quantity of the studies conducted.

FIGURE 4. Geographical Distribution

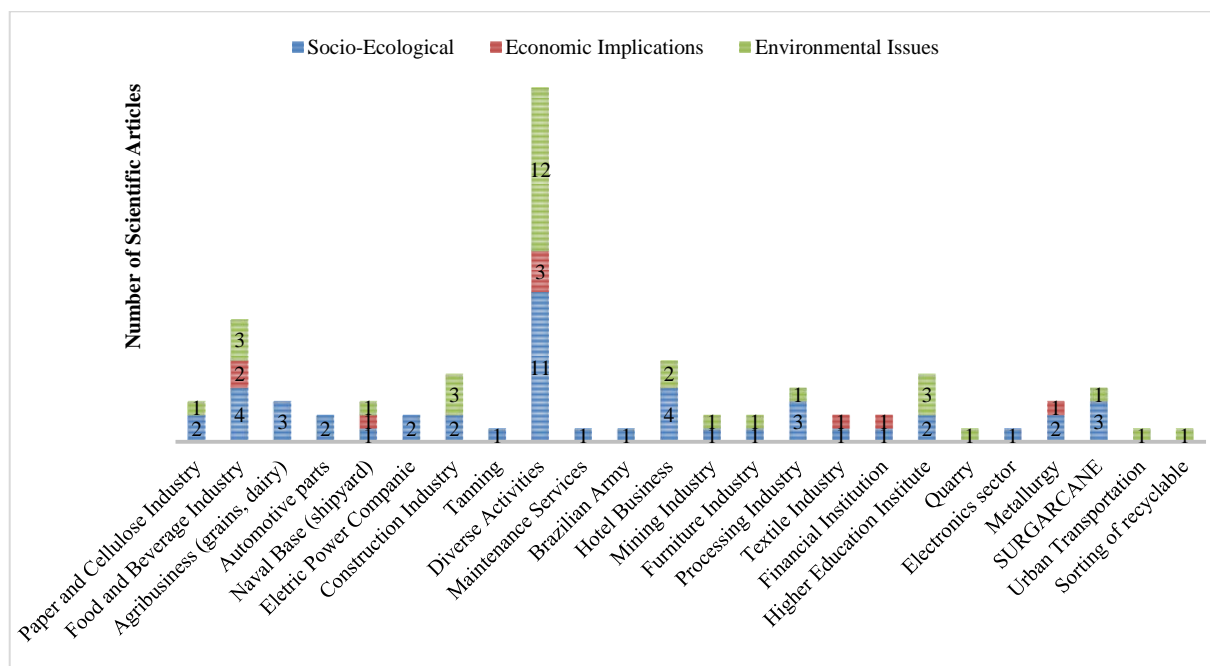


Source: Elaborated by authors.

Rio Grande do Sul has studies in three themes (socio-ecological, economical implications, and environmental aspects); in the other states (FIGURE 4) the concern is concentrated in socio-ecological themes and environmental aspects. These results demonstrate that studies relating to the theme economical implications do not report a concern in most States; however, the absence of economical health in organizations may preclude EMS adoption.

The scientific articles, by and large, use different activities (33,0%) as a study basis, which can be due to theoretical review performed that combine a large amount of business activities (FIGURE 5).

FIGURE 5. Activities cover by the studies



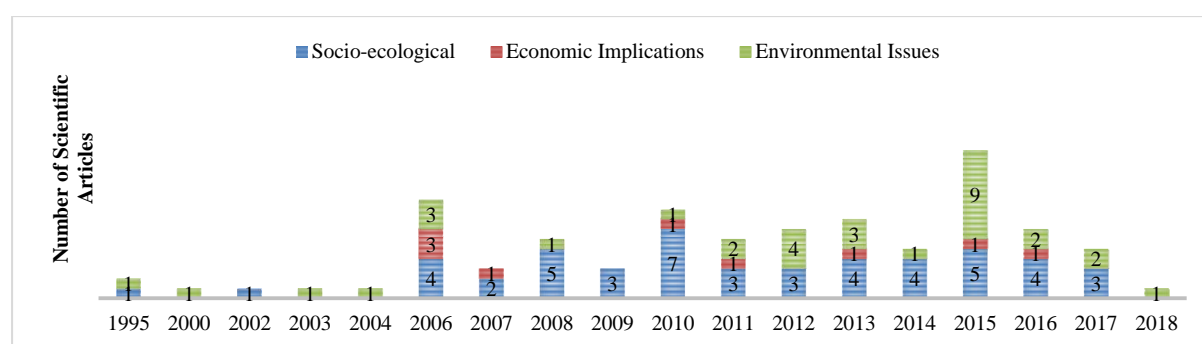
Source: Elaborated by authors.

The most representative specific activity, with the largest number of articles, it is food and beverage industry; moreover, it includes studies linked to socio-ecological aspects, economical implications and environmental aspects. The aim of this graphic is the diversity of economic sectors, which had used to as analysis form, besides the main approach is socio-ecological aspects. In this regard, it stands out that ISO 14001 can be adopted by organizations regardless their activity (ISO 14001, 2015) or size (RINO; SALVADOR, 2017).

4.2 General Trend

The scientific articles analysis published per year, according to Figure 6, shows, by means of *Chi-square tests*, that χ^2 is 0,288 and has a positive trend forecast. This result translates the articles general tendency related to the theme Environmental Management System, in particular, ISO 14001 presents a growing tendency and, still has emphasis in literature, on the other hand, this practice requires clarifications. The scientific articles show that the socio-ecological issues had mentioned 49 times, the economical implications (9 times) and the environmental aspects (33 times) (FIGURE 6).

FIGURE 6. Publication Trend



Source: Elaborated by authors.

Chi-square tests of socio-ecological aspects reveal that $\chi^2 = 0,288$, the economical aspects an $\chi^2 = 0,355$ and the environmental aspects an $\chi^2 = 0,1163$, respectively, positive, negative and positive. In this regard, this linear regression sinalizes a fragile precision indication of tendency, but emphasizes that in general it is positive and increasing, except the economical implications. This statement is consistent with Wang and Wu (2013) when it highlights the publications tendency regarding EMS are increasing in the foreseeable future, considering the growing interest among stakeholders and researchers for sustainability.

4.3 Thematic Tendencies

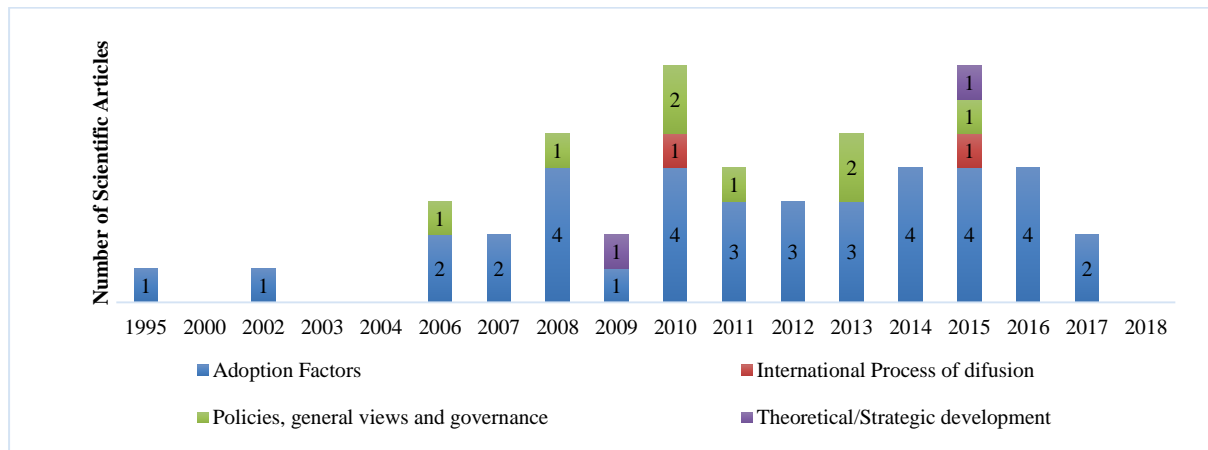
4.3.1 Socio- ecological

The socio-economical issues show a largest number of studies from 2010 to 2015, furthermore, it had also noticed that the studies began, mainly in 2005 (FIGURE 7).

The concentration of the scientific studies relating to socio-ecological issues is linked to EMS adoption factors (ISO 14001), considering the period from 1995 to 2018. The adoption factors relate to EMS implementation process, for example, (ROLIM; AIRES 2002; MIRANDA; CORREIA; KILIMNIK, 2008; DAL PIVA *et al.*, 2007; PEDROSO *et al.*, 2011; NAIME;

ANDARA; SANTOS, 2010; OLIVEIRO; PINHEIRO, 2010; SIMON; WOLFF, 2012; CROTTI; MAÇANEIRO, 2017).

FIGURE 7. Number of Social Ecological publications



Source: Elaborated by authors.

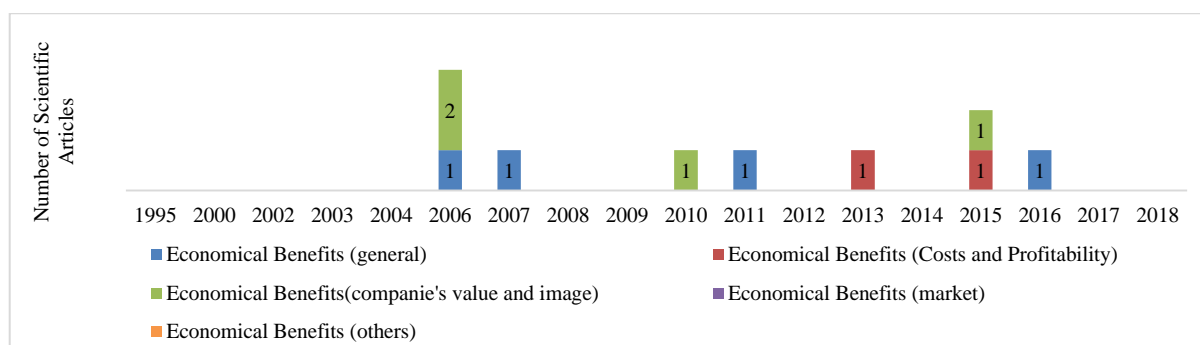
The socio-ecological studies about policies, overview and governance are associated with environmental programs (NEGREIROS; AMBROZINI, 2009; AMBROZINI; SILVA; NOLETO, 2010; PEDROSO *et al.*, 2011; SANTOS; SEHNEM; FREITAS, 2015), environmental and social controls (BERTOLINO; FRANK, 2006), guidelines concerning to ISO 14001 (NEVES; ROZEMBERG, 2010), decision-making processes (DIONYSIO; SANTOS, 2008), among others. The sub-themes related to the international diffusion process and the theory/strategy development are scarce, consequently, this result adheres to Salim *et al.*, (2018) that also detaches the low number of publications in these subthemes and show a tendency with a high-level of uncertainty.

4.2.2 Economical Implication

The scientific articles bound to the economical implications study related to EMS (ISO 14001), comprehend the most retracted fraction (11,4%), in other words, they add 10 publications from 1995 to 2018 (FIGURE 8).

The sub themes linked to the economical implications, connect, in particular, to the economical benefits of the company value and image. For example, the studies of Ambrozini, Silva e Noleto (2010), Salgado and Colombo (2015), Avila and Paiva (2006) e Miranda *et al.* (2006); and the general economical benefits of financial performance (BRISOLARA; SILVA; CARDOSO, 2016; ALBERTON; COSTA JUNIOR, 2007, RODRIGUES; FERREIRA, 2006; BARAUNA *et al.*, 2011).

FIGURE 8. Number of publications about economical implications



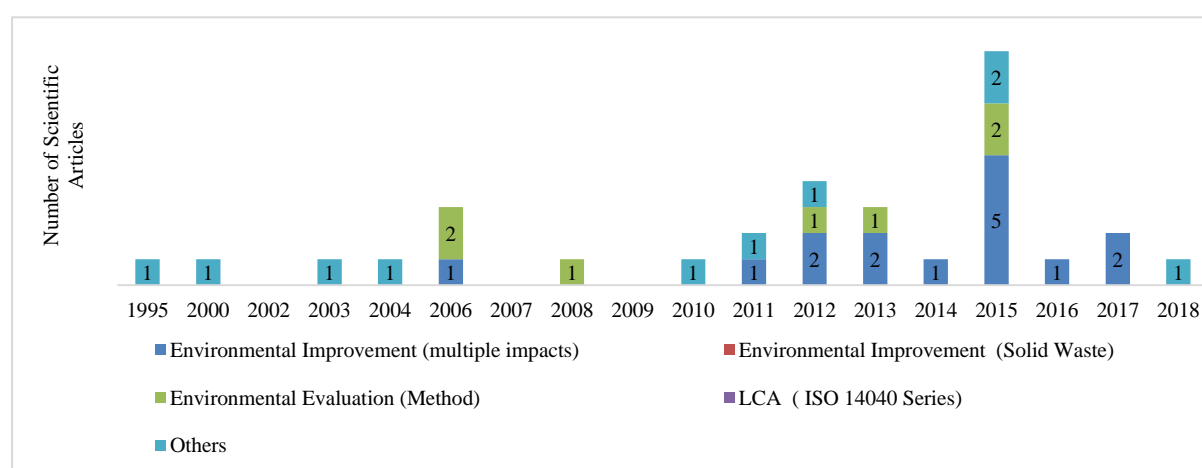
Source: Elaborated by authors.

The sub themes regarding the economical benefits in the market, costs and profitability, among others are scarce and scattered from 1995 to 2018. Heras-Saizarbitoria e Boiral (2013) point out that even though some results obtained in relation to ISO 14001 economical implications, these are not clear.

4.3.3 Environmental Aspects

The scientific articles which discuss the environmental aspects are sporadic over the period (1995 to 2018), and the year with largest number of publications was 2015 with 9 (FIGURE 9).

FIGURE 9. Number of publications about the theme Environmental Issues



Source: Elaborated by authors.

The most studied sub themes connected environmental improvements (multiple impacts) that handle about the environmental impacts analysis and evaluation. For example, Ribeiro and Jabbour (2012), Porto and Schütz (2012), Sgarbi, Schlosser and Campani (2013), Queiroz *et al.* (2014), Eckert; Corcini Neto e Boff (2015); and all about the theme related to others. There is the

management system integration (LAYRARGUES, 2000; ROHRICH; CUNHA, 2004; GRAEL; OLIVEIRA, 2010; ALCÂNTARA; SILVA; NISHIJIMA, 2012) and the environmental insight and practices (PASSOS; COSTA, 2018; FEIL; STRASBURG; NAIME, 2015).

4.4 Discussion and implication of the main results

The scientific journals diversification used in the publications, and the disparity of geographical region and the industry sectors, demonstrate that there are specific concerns of the researchers to deepen EMS understanding and knowledge level. Furthermore, the journal diversification, regions and activities promote distinct experiences that help create specific and consensual knowledge. These results adhere to Hansen *et al.* (2015) that stress the participation of many stakeholders helping to promote a strong scientific consensus about the EMS importance, since it enables constructive and collaborative discussions. In addition, they are also consistent with Boiral *et al.* (2018) when they emphasize that ISO 14001 can be adopting in different companies and activities sectors, and the studies happen in heterogeneous context regarding the activity sector, the organizational size and region.

The trends of the themes studied reveal heterogeneity, since the thematic relating to the socio ecological and the environmental aspects are increasing, on the other hand, the studies about economical implications are increasingly scarce. This fact also occurred in the literature systematic review of Salim *et al.* (2018), consequently, the lack of proportionality, considering the sustainability tripod (environmental, social and economical) with multidisciplinary approach, can affect negatively the results applicability and assimilation in the organizational practice. Moreover, the shortage of the studies in economical thematic of EMS adoption has implications in the comprehension about potential benefits generated to companies, which can cause skepticism and distrust relating to the economical generation of this system.

The scarcity of studies about economical implications resulting from ISO 14001 adoption also can explained according to, the marketing and economical maturity, of these organizations. Thus, Reis *et al.* (2018) show that generally the organizations, which adopt ISO 14001 are already consolidated in the market and they have economical power. Therefore, it showed that ISO 14001 adoption can be linked to company perpetuation in the market in the long-term, because the companies are willing to attract new clients, investors, company image among others.

The themes and sub themes mentioned in the studies show an enigmatic tendency over the period under review, this means there is a high level of uncertainty in the future tendency identification evidenced in *Chi-square tests*. From this perspective, it is clear that there is an approximation and importance attributed to economical implications, socio ecological aspects

and environmental issues. These results can be used to signal the sub themes with shortages in researches, in academic area, so that these gaps can be completed in future studies. Furthermore, in organizational area, the clarification on the latent issues, for instance, economical implications might help the use of EMS with greater property in the future by organizations. This reflection is coherent with Boiral *et al.* (2018) that despite ISO 14001 impacts are object of different empirical and theoretical studies, their results are contradictory, and there are some difficulties to comprehend the theme, so they suggest increasing the empirical studies. This condition also corroborated by Grandic (2017) stating the empirical studies are insufficient about EMS based on ISO 14001.

The results of this systematic literature review, may help professionals, academics how understand the state of art in Brazil, clearly and consistently about EMS tendencies, fragilities and potentialities based on ISO 14001. Boiral *et al.* (2018) emphasize the isolated publications about this issue is something hard and exhausting for most managers and professionals. They may be influenced by one or few studies that aren't literature representative. In this regard, the results of this systematic review provide a broader view about EMS and time saving.

5 CONCLUSION

EMS is essential to achieve equity among *triple bottom line* aspects and direct the organizations to more sustainable environments. Thus, this study aimed to investigate the literature tendencies about the thematic Environmental Management System (ISO 14001) related to environmental aspects, socio-ecological and economical implications.

The main results show that EMS is a favorable area to scientific studies, what is demonstrated by the amount of studies selected to this research. Moreover, the scientific journals are well qualified by Qualis/CAPES evaluation. There is a number of magazines and geographical areas in which the articles are published. The organizational activities helped to base the studies. Therefore, these results converge for a better understanding and a knowledge deepening in the area, considering multidisciplinary view in the process.

The future tendencies regarding the themes and sub themes issue are enigmatic, and it does not present a consistent and trustful direction. However, it is important to mention that there are inequalities in the importance of the themes and sub themes attributed on the studies, which approach the economical implications and these are scarce. Therefore, the study based on new researches clarifying gaps in theoretical and practical knowledge which that were little explored, but they are essential to EMS greater coverage in the corporate world.

The results of these studies are limited in Brazil area, in other words, they can not be generalized, this because the studies conducted in other countries may suggest heterogeneous results when compared to these. Therefore, in future studies the thematic could be deepened on EMS with multidisciplinary orientation on economical implications

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