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Sustainability in the age of information and knowledge: a systematic review

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ABSTRACT

Introduction: Debates on sustainability, Information and knowledge Management have been held in different contexts - social, economic, academic and governmental. Sustainability is seen as key to keeping the environment balanced and with available resources. From this, organizations are required by customers, investors and society to adopt good practices, in this context information and knowledge are seen as indispensable resources in efficient and effective management. **Objective**: This article is to investigate how academic research is discussing Sustainability in the fields of Information and Knowledge Management. **Methodology**: The Scopus and Web of Science databases were selected to establish the corpus of the systematic literature review. To this end, the PRISMA method was applied, with inclusion criteria being only articles published in periodicals, written in Portuguese or English and that discussed Information and Knowledge Management and Sustainability. This process resulted in 18 articles to be examined based on content analysis. **Results**: It was identified that research focuses on areas of civil construction and large industries in countries such as China, India, Pakistan and the United Kingdom and that information and knowledge management are seen as tools in the search for sustainability. **Conclusion**: The different notions of intentionality identified contribute to visualizing the attribution of values by subjects in a social and institutional context, something that helps to observe the dimensions of materiality of objects.

KEYWORDS

Sustainability. Information. Knowledge. Systematic review.

A sustentabilidade na era da informação e do conhecimento: uma revisão sistemática da literatura

RESUMO

Introdução: Debates sobre sustentabilidade, Gestão da Informação e do conhecimento têm sido realizados em diversos contextos - social, econômico, acadêmico e governamental. A sustentabilidade é vista como chave para manter o ambiente equilibrado e com recursos disponíveis. A partir disso, organizações são cobradas por clientes, investidores e sociedade para adotarem boas práticas, nesse contexto a informação e o conhecimento são vistos como recursos indispensáveis na gestão eficiente e eficaz. **Objetivo:** neste artigo é investigar como as pesquisas acadêmicas estão discutindo Sustentabilidade nos campos da Gestão da Informação e do Conhecimento. **Metodologia:** As bases de dados *Scopus* e *Web of Science* foram selecionadas para estabelecer o

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corpus da revisão sistemática de literatura. Para tanto, foi aplicado o método PRISMA, tendo como critérios de inclusão apenas artigos publicados em periódicos, escritos em língua portuguesa ou inglesa e que discutisse sobre Gestão da Informação e do Conhecimento e Sustentabilidade. Esse processo resultou em 18 artigos para serem examinados a partir da análise de conteúdo. **Resultados:** Identificou-se que as pesquisas se concentram em áreas de construção civil e indústrias de grande porte em países como China, Índia, Paquistão e Reino Unido e que a gestão da informação e do conhecimento são vistas como ferramentas na busca pela sustentabilidade. **Conclusão:** Foi possível inferir que a Gestão da Informação, Gestão do Conhecimento e Sustentabilidade estão sendo explorados, discutidos e apresentam vínculos entre as temáticas centrais e seus respectivos conceitos. Fato que colabora na aplicação de técnicas, ferramentas e sistemas de forma eficiente, e, portanto, constituem-se como temas a serem investigados.

PALAVRAS-CHAVE

Sustentabilidade. Informação. Conhecimento. Revisão sistemática

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1 INTRODUCTION

Sustainability is a topic that is gaining attention in various contexts, including business, government, academia, and society. Organizations are seeking management models to enhance their sustainability practices, whether they are related to the environment, society, or the economy. Thus, companies often adopt mechanisms to demonstrate the level of transparency and ethics in their business due to market reasons, regulatory norms, market demand, and investor and entrepreneur awareness (Souto; Pizzol, 2019).

From the 20th century onwards, organizations have become increasingly interested in sustainability due to the negative impacts caused by industry and commerce on nature and humanity. As a result, sustainability has been incorporated into organizational strategic planning, with a focus on economic, social, and environmental perspectives to ensure business continuity (Nascimento & Oliveira, 2022).

Information and knowledge are essential tools for implementing, maintaining, and learning about sustainability in organizations. These resources provide models, practices, and support for decision-making, a crucial factor in adopting organizational sustainability. As Choo (2003, p. 27) states, 'information is an intrinsic component of almost everything an organization does.'

Santos and Cândido (2022) suggest that managing structured information requires the involvement of people, leaders, and professionals who are part of the organizational processes. Additionally, they propose that information technology should be directed towards achieving organizational objectives. Nascimento and Oliveira (2022) argue that organizations that aim for success must recognize knowledge and information as fundamental resources for monitoring and understanding social, environmental, and technological aspects. These elements can support the execution of organizational objectives, whether in the process of adaptation, competitive strategy, or performance in the global market (Nascimento & Oliveira, 2022).

Information and Knowledge Management should be focused on achieving results. This can be accomplished by establishing performance indicators to effectively manage information, facilitate learning, and conduct research (Loon, 2019).

These fields are subject to ongoing debate across various sectors. It is important to identify the demands and how the academic community presents them. This research aims to investigate how academic research is discussing Sustainability in the fields of Information Management (IM) and Knowledge Management (KM), given the possible links between these fields. This research aims to investigate how academic research is discussing Sustainability in the fields of Information Management and Knowledge Management.

2 SUSTAINABILITY IN INFORMATION MANAGEMENT AND KNOWLEDGE MANAGEMENT

The concept of sustainability has gained attention from civil society, business, and academia, particularly since the publication of the Brundtland Report's definition of sustainable development (Elkington, 2012). Boff (2017) defines sustainability as the methods used to ensure the Earth and its biomes remain alive, protected, nourished, and supplied, and can achieve conservation.

According to Nascimento and Oliveira (2022), sustainability has gained notoriety since the 1980s. However, its exact origin and concept remain undefined, resulting in different interpretations depending on the field of action, such as ecological sustainability, environmental sustainability, social sustainability, and organizational sustainability, among others (Nascimento & Oliveira, 2022, p. 283).

Boff (2017, p. 17) defines sustainability as aligning human practices with the limited potential of each biome and the needs of present and future generations. Sustainable progress worldwide depends on economic, social, cultural, and technological advancements. Therefore,

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it is crucial to preserve the Earth's natural resources. The methods employed by sustainable development are linked to the accountability of the involved parties (Law; Breznik; Ip, 2021).

The term 'Sustainable Development' was coined during the 1972 UN conference on Man and the Environment in Stockholm (Boff, 2017). This concept originated from Maurice Strong's presentation of Ecodevelopment in the same city in 1972 and was further popularized by Ignacy Sanches in 1974 (Oliveira & Monteiro, 2015). According to Boff (2017), the term 'sustainable development' was also used by Norwegian Prime Minister Gro Harlem Brundtland in 1987 in the Brundtland Report. This led to a United Nations conference on sustainable development in Rio de Janeiro in 1992, which resulted in the production of Agenda 21. This event popularized the concept of sustainable development. which has since been used in official government documents, business projects, environmentalist speeches, and the media (Boff, 2017).

According to Boff (2017), Sustainable Development is an ideal to be achieved in which artifacts can be manufactured within sustainability criteria during the production process. Boff (2017) states that a company's sustainability is generally understood as its ability to maintain itself and grow without analyzing the social and environmental costs it causes (p. 38-39). Sustainability refers to actions and ideas that benefit nature while balancing social demands through ecologically sound attitudes (Nascimento & Oliveira, 2022).

Sustainability has been widely discussed, and the Information Society has enabled new ways of thinking and acting about human activities in relation to information and knowledge (Marchi; Valentim; Botega, 2021, p.44). Organizations operate in the Information and Knowledge Society, where a significant portion of a company's value is linked to its intangible resources (Barbieri, 2014, p. 21).

Choo (2003, p. 31) states that knowledge organizations possess information and knowledge that enable them to be well-informed and capable of perception and discernment. Organizational actions are based on an understanding of the environment and its needs, which are fostered through information sources and the skills of its components. This gives knowledge organizations a special advantage, as they act with intelligence, creativity, and cleverness (Choo, 2003).

Organizations often use information to gain a competitive advantage in their strategic plans. Information results from the interaction between social systems and individuals and can be defined as 'a collection of coherent ideas that can support the behavior of individuals' (Huang et al., 2022, p. 3). Companies benefit from information and knowledge in developing their activities, organizing their planning, and evaluating objectives and management control indexes (Barbieri, 2014, p. 21).

Knowledge Management (KM) is a set of systematized processes that can contribute to creating, collecting, organizing, and sharing strategic information and knowledge. It serves for decision-making in promoting organizational sustainability.

According to Conklin (2001) and Sena Neto (2019), KM is a management model that can improve processes affecting the company's quality and production, as understood by Cazane and Valentim (2021). According to Cazane and Valentim (2021), knowledge and learning in organizational subjects are fundamental to the evolution of business. Uniyal et al. (2021) suggest that by bringing together people, processes, and collaborating with the planet, organizations can develop sustainable operations that benefit stakeholders and the organization itself.

Fonseca, Mota, and Santos Júnior (2022) identify meeting points between KM and sustainability. Both fields use information and knowledge as input, requiring intellectual capital to promote organizational cultural change with a social, environmental, and economic focus. This necessitates the elaboration of strategies.

Santos and Valentim (2014, p. 30) state that the interconnections between IM and KM are evident and independent of the organization's category. They explain that IM focuses on formal flows, while KM focuses on informal flows. By managing these flows, organizations can benefit from improved understanding of internal or external changes, certainty when

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making decisions, capacity to manage knowledge (especially knowledge aimed at innovation), ease of access, use, and reuse of data, information, and knowledge, and the creation of environments conducive to learning and knowledge sharing (Santos & Valentim, 2014).

Fonseca, Mota, and Santos Júnior (2022) argue that modern organizations must manage the knowledge generated in both their internal and external environments, leading to investment in sustainable knowledge management practices. According to Nascimento and Oliveira (2022), knowledge management (KM) can play a crucial role in promoting sustainability within organizations. KM involves managing and applying knowledge as a resource to achieve sustainable progress and a holistic, integrative worldview.

The interest in KM has been sparked both in organizations and academic research due to the global context of organizations. Successful organizations are responsible for creating new knowledge and growing competitiveness, which fosters advances in technology and constant transformation. Innovation in this context is seen as a response to competitiveness, but it can only be generated by people who create and disseminate knowledge in organizations (Cazane; Valentim, 2021).

According to Nascimento and Oliveira's (2022) studies on KM and sustainability, organizations recognize the necessity of implementing sustainable practices and culture through training and development. This creates opportunities for building more conscious corporate environments (Nascimento & Oliveira, 2022).

Given the current prominence of both fields, it is apparent that they can mutually support and complement each other in the pursuit of efficient and effective information and knowledge management for decision-making processes, ultimately promoting sustainability across various organizational sectors.

3 METHODOLOGY

According to Prodanov and Freitas (2013), this research is an exploratory and bibliographic study, as the materials investigated were identified from already published bibliographic sources. The approach is qualitative as it considers the relationships between the real world and the subject, which cannot be interpreted using numbers or statistical methods. Therefore, the researcher analyzes and interprets the data inductively. (Prodanov & Freitas, 2013).

To achieve the research objective of investigating how academic research discusses Knowledge Management, Information Management, and Sustainability, two methods were utilized: a) PRISMA - to aid in the search and selection of materials used in the study (PRISMA, 2015); b) Content Analysis (CA) based on Laurence Bardin's (2016) guidelines.

The study followed Bardin's (2016) three chronological poles. The research methodology involved pre-analysis, exploration of the material, and treatment of the results. Figure 1 illustrates the application of the content analysis method.

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Figure 1. Description of the phases and procedures adopted.
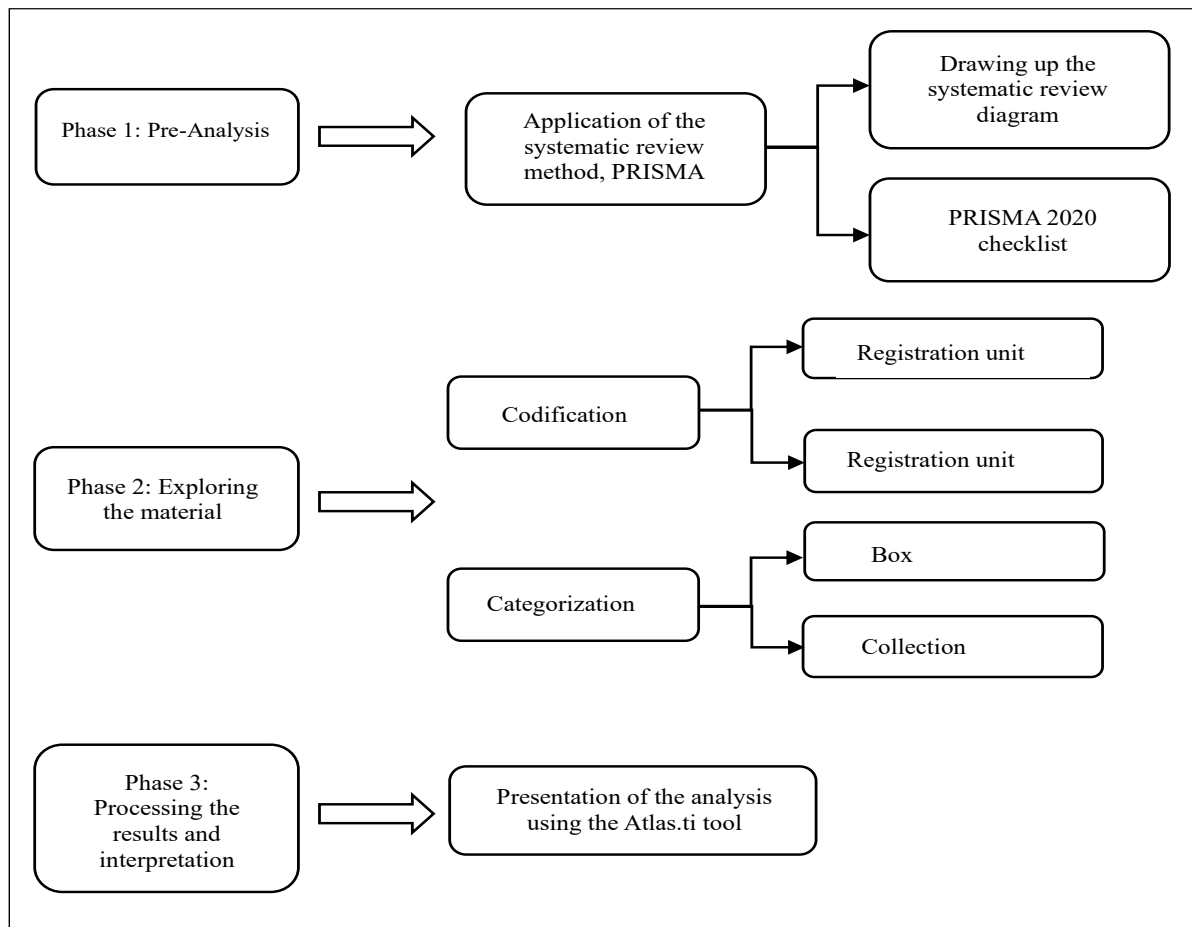
The first stage of content analysis is pre-analysis, described by Bardin (2016, p. 125) as "the organization phase", but it is also the phase of optimizing and systematizing the ideas that will be addressed in the research. This phase involves choosing the documents to be analyzed and formulating the objectives and hypotheses that will be addressed during the final interpretation (Bardin, 2016). Considering Bardin's instructions, this research used the PRISMA (Principal Reporting Items for Systematic Reviews and Meta-Analyses) review method to fulfill the first phase of content analysis. PRISMA has a checklist with 27 items that help in the search and selection of material. Its aim is "to help authors improve the reporting of systematic reviews and meta-analyses" (PRISMA, 2015, p. 336). In addition, PRISMA has a flowchart that helps interpret and present information on the identification, screening and inclusion of texts/articles for the review process, as can be seen in Figure 2 below.

Figure 2. Diagram of the PRISMA method in this research.
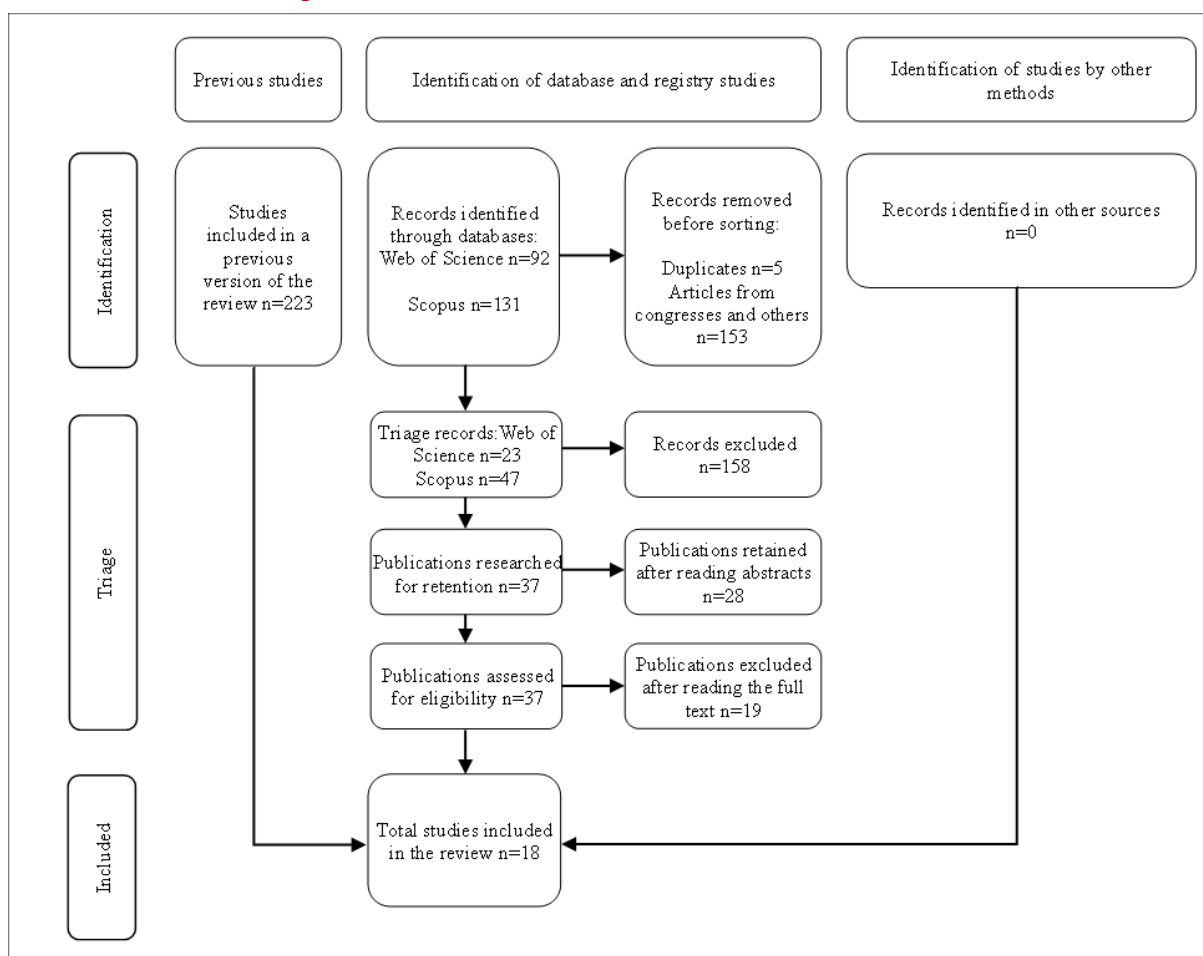
Source: Research data (2023).

A systematic literature review aims to analyze primary articles and find an objective answer to a problem (Souza, et. al., 2023). In this research, two databases, Web of Science and Scopus, were searched in December 2022 using the English terms 'Knowledge management', 'Information management', and 'Sustainability'. These terms were searched for in article titles, abstracts, and keywords. The initial data collection yielded 223 items, with 92 located on the Web of Science database and 131 on Scopus. After applying the first filter, which only included articles published in journals, the number of papers found decreased to 23 documents in Web of Science and 47 in Scopus, for a total of 70 articles, with 5 found in both databases.

After reviewing the abstracts of 65 articles, 27 were excluded as they did not meet the study's objective. This left 38 articles that were potentially relevant to the research. However, upon reading the full text, 19 articles were excluded. Of these, 7 required payment to access and the other 12 were not compatible with the scope of this research. This systematic review utilized 18 articles for content analysis.

In the second phase of content analysis, we explored the material through coding and categorization. During coding, we described the content by analyzing the characteristics of the texts based on two units: registration and context. For this research, the analysis of the recording unit involves the field of Knowledge Management and/or Information Management in the discussion of sustainability. The context unit includes information such as the year of publication, indexed base, and language of publication.

In the second phase of the CA, procedures were also adopted to fulfill the categorization, which can be considered as "(...) headings or classes that bring together a group of elements (registration units, in the case of content analysis) under a generic title, a grouping

made due to the common characteristics of these elements" (Bardin, 2016, p. 147). At this stage, the simplified raw data of the research was identified as a category of boxes. The elements were provided as they appeared in the initial records, as observed during the pre-analysis.

However, it is important to note that some of the articles may be more than 5 years old. The analyzed material includes articles published in scientific journals, without a specific time frame stipulated. Papers presented at conferences or in non-article format were excluded. It is also worth mentioning that the documents retrieved from both databases were in English. These are the context units that Bardin (2016) used for content analysis in this research.

The Atlas.ti software was used to organize the documents and perform analyses following Bardin's (2016) guidelines, which include material exploration phases (coding and categorization) and result treatment. After conducting a pre-analysis and thoroughly reading the texts, we identified three main categories for our research. These categories were then further subdivided into codes for the purpose of content analysis.

From this point forward, we utilized a content analysis tool. The Atlas.ti software was specifically designed for analyzing large quantities of qualitative data (Klüber, 2014, p.12). This program is valuable for researchers in various fields, as it offers resources that can be applied to a wide range of knowledge areas. Its interface allows for the analysis of different types of data. It is important to note that Atlas.ti does not work independently. The researcher is responsible for carrying out the analyses through their understanding and interpretation, while the program serves to optimize their work (Silva Junior & Leão, 2018). The final phase of content analysis involves processing the results, which Atlas.ti assists with and provides support for analysis and interpretation.

4 ANALYSIS AND DISCUSSION OF RESULTS

The study conducted a survey of texts in two databases, Web of Science and Scopus, using the PRISMA method. The articles that were most relevant to the research scope were selected after reading the full documents. The list of studies that have already been published and could contribute to the discussion presented in this article was justified following the PRISMA proposal.

Chart 1 presents a list of identified articles. The chart displays the authors' names, publication year, article title, and abstract, along with the previous analysis of the systematic review. Each article is also assigned an identification number (ID) for easy recognition as the analysis progresses.

Chart 1. Articles considered in this research.

ID Article	Author/s Year	Title of the Article	Reason for entering the study sample
2006.1	Shelbourn, M., Bouchlaghem, D., Anumba, C., Carillo, P., Khalfan, M. and Glass, J. (2006)	*Managing knowledge in the context of sustainable construction*	It describes tools that enable the development of practices to promote knowledge creation in the construction sector. The C-SanD project mapped the sustainability theme, identifying actions to meet sustainable goals. Through this mapping, the SMAZ (Sustainability Management Activity Zone) tool was developed, something that can help direct sustainable construction practices.

2007.1	Walker, D., Pitt, M. and Jha Thakur, U. (2007)	*Environmental management systems: Information management and corporate responsibility*	Based on a literature review of works published between 1994 and 2004, they present the actions of environmental management (EM) systems to achieve sustainability, which occur through the crucial link in the development of knowledge and information management systems, which are necessary to achieve success and sustainability.
2007.2	Godfrey, L. (2007)	*Facilitating the improved management of waste in South Africa through a national waste information system*	Development of an information system to assist the South African government in waste management and the promotion of sustainability. Waste management and information can be used in the public manager's decision-making process, with a view to sustainability. The idea is to have a Waste Information System that collects and stores data to help with the challenges of waste management.
2011.1	Kraines, S. and Guo, W. (2011)	*A system for ontology-based sharing of expert knowledge in sustainability science*	It creates a comprehensive network of specialized knowledge related to sustainability science, accessible to all users, from researchers to individuals in society without specific scientific training. To this end, four components were developed: ontologies; a repository; an algorithm and software to analyze the knowledge network. Both were integrated into a platform called EKOSS, which allows knowledge to be shared and created.
2011.2	Zhu, Q., Sarkis, J. and Lai, K.-H. (2011)	*Internationalization and environmentally-related organizational learning among Chinese manufacturers*	It discusses the need to examine the relationship between internationalization and environmentally-oriented Organizational Learning through environmentalist pressures to alleviate ecological modernization concerns. The results provide information for the Chinese government on how to balance economic growth and environmental protection from the perspective of internationalization.
2012.1	Muñoz, E., Capón-García, E., Laínez, J., Espuña, A. and Puigjaner, L. (2012)	*Considering environmental assessment in an ontological framework for enterprise sustainability*	It makes an environmental and sustainable assessment based on the ontological framework of IM and KM. It proposes a semantic model to represent an integrated business structure that considers the environmental system at the various decision-making levels. Through a case study, the usability of the ontology for environmental decision-making is demonstrated. The ontology serves as a tool that supports decision-making by evaluating organizational environmental performance.

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2015.1	Kruckenberg, L.

(2015) | *North-South partnerships for sustainable energy: Knowledge-power relations in development assistance for renewable energy* | It reports on the power issues between the North-South knowledge-power cooperation relationship. The results are from a case study of a partnership between a renewable energy NGO in the North and one in the South. The study presents a tool that can be used by professionals and researchers involved in sustainable energy partnerships. |
| 2016.1 | Goddard, J., Glass, J., Dainty, A. and Nicholson, I.

(2016) | *Implementing sustainability in small and medium-sized construction firms the role of absorptive capacity* | It investigates the gap between sustainability certifications and Organizational Learning. The study points out that Sustainability is seen as a key point in generating business, but is not responsible for creating and sharing knowledge between company sectors. To solve this problem of adapting employees to certifications, it would be interesting to invest in training programs to share knowledge. And also in strengthening communication and information channels. |
| 2016.2 | Sánchez, L. and Mitchell, R.

(2016) | *Conceptualizing impact assessment as a learning process* | It seeks to find out how project developers and their consultants, government regulators and stakeholders can learn throughout the Impact Assessment (IA) process, potentially improving its effectiveness, with arguably more sustainable results. The research argues that to achieve the necessary conditions for sustainable projects, learning must be treated as an intentional action, with clear learning outcomes and goals linked to stakeholders. |
| 2016.3 | Schröpfer, V., Tah, J. and Kurul, E.

(2016) | *Mapping the knowledge flow in sustainable construction project teams using social network analysis* | It understands how knowledge about sustainable construction is transferred and adopted by project teams delivering new buildings to sustainable construction standards in Germany and the UK. The networks in the two countries are all relatively low and are spread out in relation to Knowledge Transfer (TC). Tacit knowledge is transferred through strong ties spread throughout the network. The most cited source of information and knowledge is 'a colleague', confirming that the main form of KT is tacit. |
| 2017.1 | Bruyn, L., Jenkins, A. and Samson-Liebig, S.

(2017) | *Lessons learnt: Sharing soil knowledge to improve land management and sustainable soil use* | It reports on the sharing of soil knowledge in the 21st century based on KM and KM for soil sustainability. The article argues for the need to invest in communication channels for sharing knowledge (both scientific and tacit), involving different audiences and providing a dynamic, virtual learning environment. In this way, users can be encouraged to find sustainable solutions. |

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2017.2	Cavicchi, C. and Vagnoni, E. (2017)	*Does intellectual capital promote the shift of healthcare organizations towards sustainable development? Evidence from Italy*	It investigates sustainability planning in the Italian public health system. Intellectual capital contributes to the implementation of sustainability projects. The study also revealed higher relevance values for the implementation of sustainability projects through ICTs (Information and Communication Technologies), since information technology is claimed to promote changes towards sustainability.
2017.3	Xu, Y., Boh, W., Luo, C. and Zheng, H. (2017)	*Leveraging industry standards to improve the environmental sustainability of a supply chain*	It focuses on environmental sustainability in the context of the supply chain. The study took place at a RosettaNet standards consortium in China. From Vertical Information Systems and based on a technological innovation. It found that the use of industry standards is related to inter-organizational knowledge sharing and process integration, something that also interferes with environmental collaboration. Vertical information can support environmental sustainability in supply chain management processes.
2020.1	Mangla, S., Raut, R., Narwane, V., Zhang, Z. and Priyadarshinee, P. (2020)	*Mediating effect of big data analytics on project performance of small and medium enterprises*	It deals with the analysis of "Big Data Analytics" BDA for the procurement of sustainable inputs from small and medium-sized enterprises. Organizations in developing countries must focus on uniform planning and information systems, making BDA responsible for improving the overall system. Since it is able to collect and store information, it helps to achieve short- and long-term goals for manufacturers in a context of sustainability and project management.
2020.2	Nazam, M., Hashim, M., Baig, S., Abrar, M. and Shabbir, R. (2020)	*Modeling the key barriers of knowledge management adoption in sustainable supply chain*	GC adoption for a more sustainable supply chain in Pakistan's food sector, investigating the types of barriers linked to GC implementation and how they are analyzed in the production chain. The analysis identified that the barriers are: managerial, governmental and organizational, innovation and technological, socio-economic and soft skills. According to the importance of knowledge-based production chains for the dissemination of information. It is easy to increase the success rate of adopting KM in sustainable supply chains.
2021.1	Law, K., Breznik, K. and Ip, A.	*Using Publicized Information to Determine the Sustainable*	It investigates the management of public information for decision-making aimed at sustainable actions and investigates how third-party logistics companies are concerned about sustainability and what

	(2021)	*Development of 3-PL Companies*	dimensions of sustainability are included in their mission statements. The data collected was taken from the mission statements of the 50 largest logistics companies. Sustainability is not just a concern for companies, but a goal that most of them are striving to achieve. These actions have generated results for IM, since communication and information sharing within an organization generate innovation and the construction of a sustainable culture.
2021.2	Uniyal, S., Mangla, S., Sarma, P., Tseng, M. and Patil, P. (2021)	*ICT as "Knowledge Management" for Assessing Sustainable Consumption and Production in Supply Chains*	It lists and evaluates factors based on Information and Communication Technologies (ICTs), which are responsible for the implementation of Sustainable Consumption and Production in the industrial context, since they have a notable effect on the environment, the economy and society. With clear guidelines from the government, producers and consumers could understand the importance of ICTs in the adoption of Sustainable Consumption and Production. Technological advances are a way forward for the implementation of ICTs, as it is through up-to-date innovative technology that the consumption of sustainable products can be achieved.
2022.1	Huang, W., Chau, K., Kit, I., Nureen, N., Irfan, M. and Dilanchiev, A. (2022)	*Relating Sustainable Business Development Practices and Information Management in Promoting Digital Green Innovation: Evidence From China*	It assesses the uncertainties surrounding the IM process and the application of sustainable development practices. The research sought to evaluate the acquisition of information; the dissemination of information; and the application of information, within the processes of IM. Sustainability was assessed from its social, economic and environmental dimensions. Corporate green innovation is gaining strength as an instrument for applying sustainable development practices. However, this practice can be a problematic and information-intensive undertaking, full of complications. Because information is considered a critical component in the development of sustainable products through new technologies.

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The codes were applied to the software in English because, as mentioned above, the articles used in this systematic review were in English. For this reason, the images and tables that will be presented throughout this research will present information in English.

To obtain the results, coding in the Atlas.Ti software took place through a manual selection, in which the codes were related to the citations identified in each of the 18 texts. After this classification, the frequency with which the codes were highlighted in the selection of excerpts from the articles was detected, as can be seen in Figure 3 below.

Figure 3- Frequency graph of the codes of the articles analyzed.
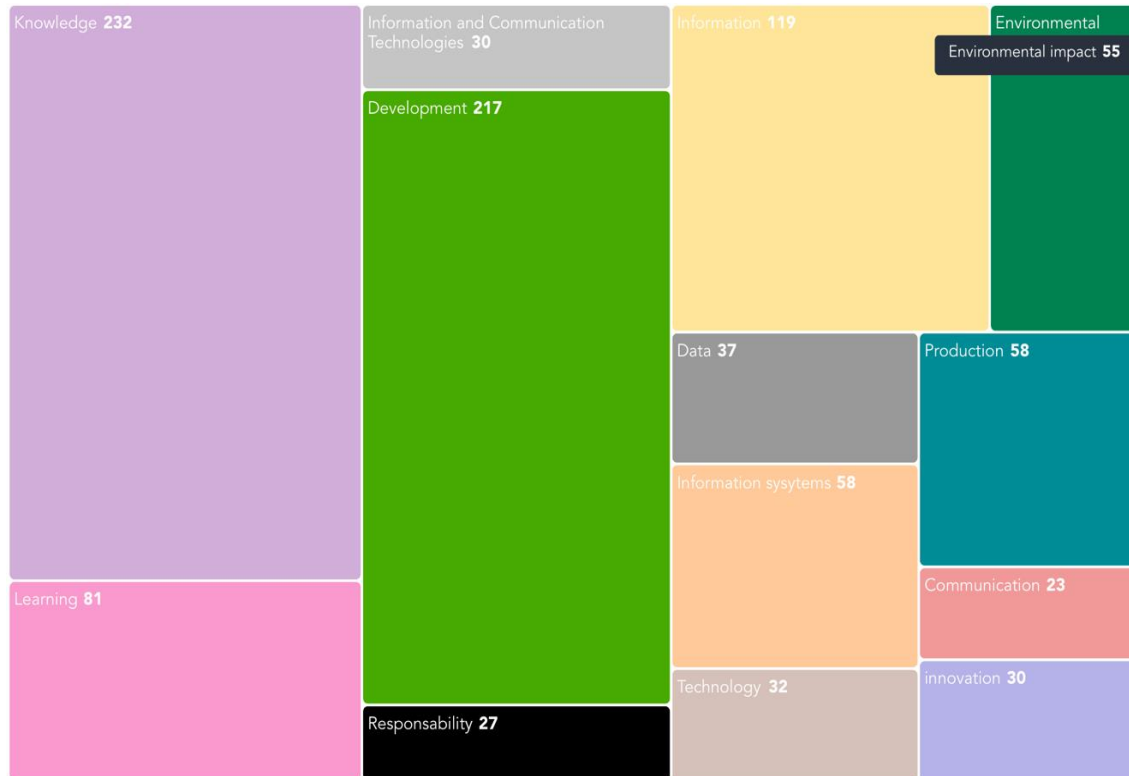
The analysis reveals that the term 'Knowledge' was emphasized in 232 instances throughout the articles, followed by 'Development' with 217 occurrences. Additionally, 'Information' was featured in 119 excerpts.

During the analysis, it was determined that the concept of knowledge provides benefits to organizations in terms of people, products, and processes. This is why Knowledge Management (KM) is defined as the conversion of data and information into intellectual assets with sustainable value that can be utilized in management actions, resulting in a competitive advantage (Nazam, et. al., 2020).

Shelbourn et al. (2006) address the concept of development, highlighting its significance in the 21st century due to the growing awareness of the sustainability agenda. This has led to increased pressure to consume more sustainable products. The authors define sustainable development as meeting the needs of the present without compromising the ability of future generations to meet their own needs (p. 57). According to Shelbourn et al. (2006), organizations must overcome obstacles to become more sustainable through knowledge management. This requires making knowledge available and accessible to individuals, multidisciplinary teams, and the organization itself.

Walker, Pitt, and Jha Thakur (2007) argue that effective decision-making processes require a fundamental focus on information management, including the communication and analysis of information. They emphasize the importance of clear and concise language, avoiding biased or emotional language, and using precise technical vocabulary when appropriate. The impact of information on sustainable development is often linked to the financial community, including customers, shareholders, employees, investors, and regulators (Walker; Pitt; Jha Thakur, 2007).

Figure 4 shows a word cloud generated by Atlas.ti. By associating the concepts of KM, IM, and sustainability and interpreting their relationship, it is evident that the key terms are information, knowledge, sustainability, learning, development, sharing, and management. These terms suggest that sustainable development necessitates the use of IM and KM, which is

facilitated through the sharing of information and knowledge, and reinforced through organizational learning.

Figure 4- Cloud of the most frequently cited words in the analysis highlights

According to Shelbourn et al. (2006), sustainability goals can be achieved through information activities and the acquisition of new knowledge, particularly through experience. These actions can be implemented through good practices, improved process models, and established standards. However, the adoption of these attitudes can be facilitated by analyzing the sustainability goals of local, organizational, and professional practices.

According to Walker, Pitt, and Jha Thakur (2007), corporate governance (CG) ensures strategic planning of environmental management when carried out in an informed and qualified manner. This is similar to the study by Kraines and Guo (2011), which proposed a platform linking engineering concepts and sustainability science to share knowledge between interested parties.

The process of contributing to sustainability also involves learning, as it requires information and knowledge to be applied effectively. According to Sánchez and Mitchell (2016, p. 196), learning is a goal-oriented process that involves acquiring new knowledge, skills, behaviors, and values. It is possible to create a network that enables knowledge sharing oriented towards sustainable development (Xu et al., 2017). Correlating these issues.

Figure 5 shows the relationships between the documents and codes.   The categories KM, IM, and Sustainability are connected through the analyzed articles' codes. The codes for Knowledge, Development, and Information are strongly related, indicating mutual support and influence between the fields.

The relationships seen in Figure 5 reveal that the themes of knowledge and sustainable development are present in all the documents analyzed. Information, on the other hand, is perceived less frequently in these relationships. However, by looking at the other codes presented in Figure 5, it is possible to identify a strong relationship between the various fields, which, despite not dealing explicitly with the fields of KM and IM, can have their components identified in these relationships.

Figure 5 also makes it possible to analyze the correlations between the codes and the documents that were selected, based on the guidelines of the PRISMA method. From these observations, it was possible to comprehensibly relate how the central fields of this research,

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which were categorized and coded using Atlas.ti, present associations. This can be seen by identifying how each of the articles, listed on the left of the figure, have links with the codes, which are shown on the right-hand side of the image. When analyzing these links, it is noticeable that some documents show links with at least one code from each of the three main categories.

The codes presented link IM, KM and sustainability and this relationship is evident after reading all the documents, something that emphasizes the demand for research into how science is discussing these issues. This shows that these approaches are indeed happening and that the links between these three fields of study are subjects of intense debate in academic circles. It can be seen that there is a greater intensity between knowledge and sustainability, but when checking the codes belonging to the information category, it can be seen that there are also significant mentions of these concepts among the documents.

Figure 5 - Correlation of codes
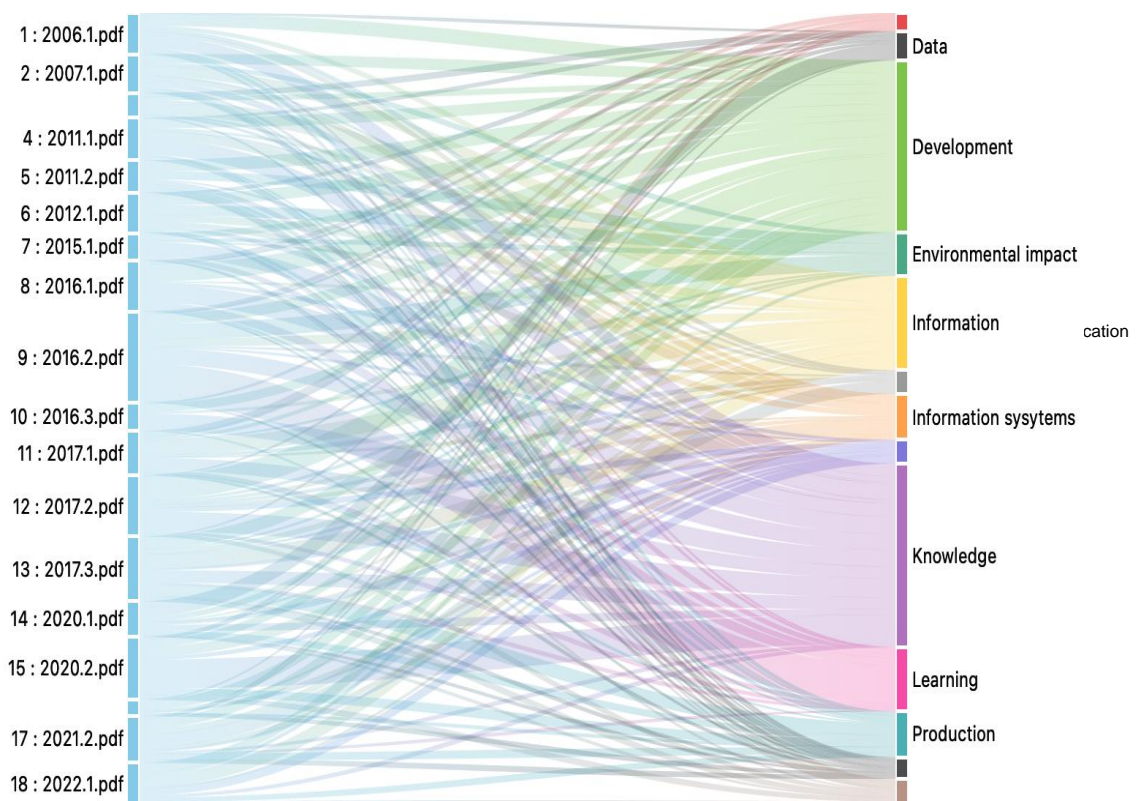
Source: Research data (2023).

These relationships can also be seen when the network of code connections is drawn, as can be seen in Figure 6. Through the analysis of this research, it was possible to trace a network with the codes and categories that were previously established. The red lines, represented by the XX sign, show the relationship between CG, IM and Sustainability. The green lines, represented by two brackets, [], show the connections between the categories and codes. The blue lines, represented by the == symbol, refer to the link between the codes.

Figure 6 shows the relationships between the concepts in general and complements the analysis and interpretation explained in Figure 5.

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Figure 6 - Map of the network of categories and codes.
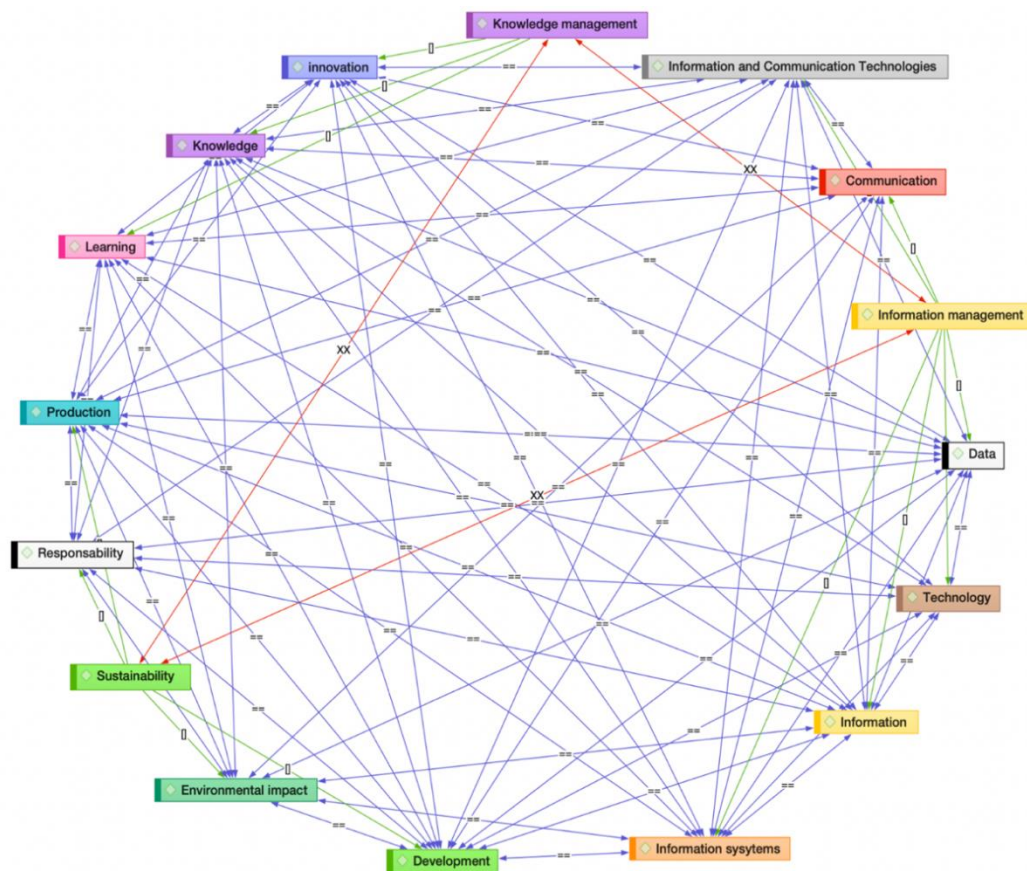
The articles reviewed did not treat the fields of Knowledge Management, Information Management, and Sustainability equally or together. However, these fields can be related through specific concepts such as intellectual capital, green innovation, sustainable supply chain, knowledge transfer, sustainable culture, and stakeholders.

Nazam et al. (2020) found that knowledge management is necessary for achieving sustainable goals in the supply chain through good practices, improved process models, and contextual embedding of sustainability goals. This process involves Knowledge Management, which includes the creation of new knowledge (Shelbourn et al., 2006).

Walker, Pitt, and Jha Thakur (2007) argue that in a globalized and competitive world, learning is essential for companies to survive. Upstill-Goddard et al. (2016) researched the relationship between knowledge management and learning.

They found that companies that incorporate learning into their management activities have a greater capacity to absorb good practices, which can lead to sustainability. However, creating an environment that fosters these practices is crucial for their implementation. Bruyn, Jenkins, and Samson-Liebig (2017) argue that dynamic learning results from a balance between new technologies and traditional methods. However, personal interactions are irreplaceable, as they occur throughout one's life and cannot be replicated online. The authors suggest improving information literacy to enable individuals to access and recognize relevant and accurate information based on their needs (Bruyn; Jenkins; Samson-Liebig, 2017).

Uniyal et al. (2021) argue that designing and implementing information systems that enable a rapid response to potential issues in sustainable business activities is crucial given the significance and impact of information. Currently, environmental impact assessments

necessitate data and information on business activities involved in producing goods or services. The inclusion of a system that covers environmental issues within the corporate structure can facilitate the management of data and information, being an ally in decision-making (Muñoz, et. al., 2012). Furthermore, information sharing has a positive impact on sustainable growth through green management and technological innovation (Huang, et. al., 2022, p. 5).

Considering the above, it is understood that knowledge and information hold significant value within an organization. Effective management of these elements generates a demand for managing other components, such as learning and employee training. The organization is investing in new technologies and management models aimed at sustainability. It is evident that the individuals involved in these processes possess the necessary skills to carry out the activities with excellence. Employee training and development regarding the implementation and benefits of sustainable consumption and production through ICT are crucial in helping industries produce and consume sustainably (Uniyal, et. al., 2021, p. 173).

The motivations for organizations to implement sustainability in their production processes are varied and can stem from different sources such as approaches, objectives, values, competitive strategies, legislation, regulations, and social pressures (Law; Breznik; Ip, 2021). Conversely, companies that have incorporated sustainable practices have gained an advantage by attracting new customers (Huang, et al., 2022). Organizations have found that investing in green technologies is a way to move towards sustainability. Managers are aware of this importance and are working on incorporating sustainability into their production chains (Uniyal, et. al., 2021).

At the end of this analysis, it is evident that integration is the most suitable action for CG, IM, and Sustainability within the examined studies. Additionally, there is potential for growth and intensification in these fields, both in academic research and organizational practices in production chains.

Regarding the topics discussed in the research, organizations perceive the need to adopt sustainable practices differently. Therefore, they seek tools, models, and strategies through knowledge and information management to support decision-making towards sustainable practices in their production chains.

Regarding the research comments, it is evident that the primary focus of investigation is on civil construction and large-scale factory production, including automobiles, food, and health. The discussions predominantly occur in countries that are considered to be in the development phase, with China being the most frequently cited, followed by India and Pakistan. The language used in the text has been made more objective and concise, and technical terms have been explained where necessary. The sentence structure has been simplified, and grammatical errors have been corrected. No changes in content have been made. Research has targeted countries including the United States, Australia, the United Kingdom, and Canada. Some studies have focused on implementing ontology-based tools and systems, while others have described processes for creating information-sharing networks that contribute to knowledge about sustainability.

5 CONCLUSION

This study aimed to investigate how Knowledge Management and Information Management have addressed Sustainability in academic research. A systematic literature review was conducted using Scopus and Web of Science databases to find relevant articles. To this end, Scopus and Web of Science databases were examined to find articles that were in line with the research proposal. PRISMA and Bardin's Content Analysis (2016) were used as selection methods. The articles were also analyzed using Atlas.ti software.

After reading the pre-analyzed 18 English-written articles, codes associated with the documents in Atlas.ti were listed and subdivided into three categories: knowledge management, information management, and sustainability. By analyzing the documents in the software, relationships between the codes and their categories were established, and a network was mapped out.

It can be seen that the three major fields investigated are related in various ways and that, above all, KM and IM tools are used to ensure that the process of production chains is sustainable and efficient and for this reason they become the main object of the works analyzed.

The analysis reveals how the academic community has investigated studies in KM, IM, and Sustainability. These studies have contributed to the literature of these fields and to the application of techniques, concepts, tools, and systems that enable efficient practice.

The investigated articles predominantly focus on research related to construction and large-scale industries. The studies were conducted in developing countries such as China, India, and Pakistan, as identified by the respective researchers. The research methodology involved interviews, questionnaires, and case studies to seek answers. The studies used in this research acknowledge that they cannot address the issues of CG, IM, and sustainability in a unified manner. This is due to the fact that they exist in different contexts, with varying production activities, cultures, and legislation. The time interval between them can also be an indicator of disparity.

It is important to note that the limitations of this study lie in the choice of database and the keywords investigated. As a recommendation for future work, it is advisable to apply another systematic review method. Additionally, it would be worthwhile to investigate how these fields interact, taking into account the units of record and context identified by Laurence Bardin (2016). This could lead to extensive and profound discussions about the three fields in the academic community.

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After analyzing the selected material, it is evident that KM, IM, and Sustainability are fields of study discussed in the academic community. The content analysis revealed links between these three fields. The studies demonstrate the significance of the relationship between these themes. The investigations were based on case studies and the application of tools in large and medium-sized industries in developing countries. The studies also focused on sectors with a greater sustainable impact and used quantitative methods in their investigation.

However, it is important to consider additional avenues of research and inquiry for these three scientific fields. This may include qualitative investigations, comparative analyses of regions with higher socio-economic development, or studies comparing activities across organizations in different sectors, regardless of whether they are supported by public policies that could potentially impact these issues. Investigating networks for the exchange of scientific information between partners, including networks of benefactor institutions related to the fields, can contribute to advancing the relationship between them. Additionally, reflecting on other ways and methods of disseminating scientific knowledge to society can also be beneficial.

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