Review

Knowledge Management in Society 5.0: A Sustainability Perspective

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Abstract: Organizations require the means to navigate Society 5.0. This is a knowledge-intensive society where a sustainable balance must be created for social good through a system that integrates cyberspace and physical space. With significant data, information and insight exchange based on knowledge in people and machines, organizations need to make sense of the notion that knowledge assets are the central structuring elements for sustainable development. By considering the key aspects of knowledge management (KM) in Society 5.0 as they relate to sustainable development, organizations may leverage their KM capability and learning agility to successfully address the unique requirements of the new society, environment and goals for sustainable development. In this research, automated content analysis was applied to identify key KM aspects using the Leximancer software. A total of 252 academic papers were analyzed, identifying 10 themes related to key KM concepts in Society 5.0 as they pertain to sustainability. The KM concepts identified were described and mapped to the sustainability triple bottom line. They comprised three primary and three intersecting dimensions, i.e., the environment (planet), society (people) and economic performance (profit) in the socio-economic, eco-efficiency and socio-environmental domains. The most significant themes included "knowledge", "human", "companies", "information" and "system". Secondary themes included "innovation", "development", "resources", "social" and "change".

Keywords: knowledge management; sustainability; Society 5.0; triple bottom line; automated content analysis; research agenda

1. Introduction

The world is experiencing radical advances in science and technology [1]. With the evolution of digital technologies comes a growing recognition that most workplaces are experiencing change [2,3]. Digital technologies, which are evolving at an exceptional rate, automate not only labor-intensive and repetitive work but also influence knowledge work [4,5]. This necessitates understanding and managing greater complexity [6,7]. Knowledge work relies, to a greater extent, on individuals' cognitive abilities, as opposed to when work consists primarily of the execution of known procedures and manual actions [8,9]. Furthermore, knowledge is now recognized as being central to sustained organizational success [10–12].

Knowledge workers drive knowledge management (KM) processes [13]. The evolution of digital technologies has also changed the landscape and nature of KM [14,15]. The growing use of digital technologies has created completely new business models and means to create value [14,16]. Some of these include control and monitoring through computer-based algorithms, the on-demand availability of computing power and data storage, cognitive computing and the rise of a connected world [17,18]. Maintaining a KM emphasis in this context is important, as intelligent machines, such as those that use artificial intelligence (AI) and machine learning, are altering knowledge creation and sharing in organizations [16,19]. A key contributor to the viability of AI applications and the maturity of AI technologies is the availability of data that may be applied in computer learning processes [20,21]. In addition, structured and unstructured big data structures are

used for the extraction of value [22,23]. Data-driven organizations consequentially base their decision-making evidence on data rather than intuition [24,25]. In light of the big technological changes that the emergence of intelligent machines and big data structures have brought about in every organizational facet, it becomes relevant to revisit assumptions about the nature of KM [19,25–28]. These assumptions are interrogated further based on the merging of cyberspace and the real world following the emergence of Society 5.0, the knowledge-intensive society [29].

Society 5.0, defined in the Japanese Government's Fifth Basic Plan for Science and Technology (2016–2020), represents a vision where humans, nature, economic advancement and technology create a sustainable balance for social good through a system that integrates cyberspace and physical space. This cyber–physical system is based on the proposition that significant amounts of data from the physical space are accumulated in cyberspace. These data are then analyzed with super-smart AI systems, which exceed human capabilities. Such results are fed back in various forms to humans in the physical space [29,30]. This knowledge exchange necessitates a better understanding of data-driven decision making while applying insight from both knowledge workers and intelligent machines [31]. As Society 5.0 focuses on the whole society, many socio-economic and socio-technical aspects, such as health, poverty, access to water and food, smart agriculture practices and gender equality, are addressed in accordance with the United Nations' Sustainable Development Goals [32].

Scholars report that organizations still exhibit inexperience and rudimentary knowledge regarding sustainability knowledge management [33,34]. The implementation of sustainability is significantly hindered by a lack of skills and knowledge among middle and senior management [35]. Furthermore, organizational actions to implement sustainable management solutions implicitly assume that the workforce is aware of and implements corporate sustainability policies and procedures [34,35].

The authors considered an approach that would enable them to analyze and categorize a large amount of data. This was performed to present coherent findings that would contribute to a better understanding of the different aspects of knowledge management in Society 5.0 as it pertains to sustainability. They applied an automated content analysis process to identify the key KM concepts and topics of interest [36–39] based on the research question: *What are the KM sustainability-related aspects in a Society 5.0 context?* The study emphasizes the importance for organizations to evolve their KM capabilities so that they can model the dimensions of social, economic and environmental sustainability. The organization that emerges in Society 5.0 needs to confront the shifting needs of a new environment, more demanding customers and smarter knowledge workers in highly integrated cyber–physical surroundings. By integrating multidisciplinary and heterogeneous knowledge, organizations may increasingly rely on their knowledge-generating resources and leverage KM as a means of development to enhance alignment with the guidelines of economic, environmental and social sustainability.

The remainder of this paper is structured as follows: Section 2 discusses the theoretical background and key concepts. Section 3 provides an overview of the research methodology. Section 4 presents the data analysis and findings. Section 5 contextualizes and discusses the findings. The paper is concluded in Section 6.

2. Background

In this section, a short introduction is given to knowledge management perspectives. This is followed by an overview of the knowledge-intensive nature of Society 5.0. This section ends with an overview of the literature related to sustainability knowledge.

2.1. Managing Knowledge

Knowledge is recognized as a primary source of competitive advantage and value creation for organizations [40,41]. It may be explicit (documented) [42] or implicit (people's experiences) [43]. KM is "a process of continually managing knowledge of all kinds and

requires a companywide strategy which comprises policy, implementation, monitoring and evaluation" [44] (p.374). It is recognized as an important capability for an organization to be successful [45,46]. The importance of KM and the intangible nature of implicit knowledge, in particular, often lead to employees not sharing knowledge with co-workers. This is especially problematic when the advantages of KM are considered [47]. Knowledge sharing refers to the exchange of information and know-how between individuals with the purpose of completing specific tasks in an organization [48]. Organizations must, therefore, proactively focus on collaborative and integrated approaches that enable an organization to create, capture, organize, access and use its knowledge assets for strategic advantage and long-term sustainability [49]. These integrated KM approaches in the context of sustainability facilitate better cooperation within organizations [50–52]. KM supports intra-organizational knowledge sharing across industries and sectors. It also aids long-term strategic gains [53,54]. This knowledge exchange is important on an organizational, national and global scale for the viability of sustainable development. In this context, KM can play an important role due to its ability to share information from different periods, experiences and places during the assessment of environmental, social and economic impacts [55].

Over and above these business capabilities, KM aids in the development of the organization's skills and capabilities. It increases the efficiency of decision-making processes and develops learning organizations [11,12]. This aspect is key for Society 5.0 as there is an increased need for learning organizations that place people at the center, emphasize differentiation and innovation in the solution of social problems and prioritize the welfare of society [56].

2.2. Society 5.0 and Its Knowledge-Intensive Nature

Society 5.0 is the vision of a super-smart, human-centered, knowledge-intensive society that produces sustainable solutions to differentiated needs and social problems through technological advances [56]. Cyberspace meets the physical world in this super-smart society to address deep-seated deterrents to sustainability so that people can lead a fulfilling and quality life [57]. Within Society 5.0, sustainability focuses on increasing the potential of the individual-technology relationships in promoting social good [58].

In 2015, the United Nations (UN) ratified 17 Sustainable Development Goals (SDGs) at the UN SDG Summit, which raised awareness of global challenges [59]. The purpose of the 17 SDGs is to guide sustainability policies in countries and regions around the world, to be achieved by 2030. The SDGs are ultimately designed to fulfill the UN's pledge that no one will be left behind, fostering close alignment with the vision of Society 5.0 to apply the cyber–physical world to the benefit of society as a whole [60,61]. The impact on organizations in this context is to share common goals and plan environmentally sound business activities with global perspectives from the outset. The purpose of this is to achieve sustainability in the true sense [59,60] and, in some instances, restructure the business [57,60]. The implementation of Society 5.0 might simultaneously yield social, economic and ecological benefits that enhance society's sustainability and stability [62,63].

Knowledge-based development (KBD) provides a vision of development that considers knowledge as the central structuring element of a development strategy for cities, regions and countries. This is "the collective identification and enhancement of the value set whose dynamic balance furthers the viability and transcendence of a given community" [64:416]. Therefore, the KBD methodology measures the value that takes many dimensions and aspects of life into consideration. It goes far beyond traditional assessment views [64] and provides a basis for sustainable development, emphasizing the relevance of the process of transforming knowledge resources into local development [65].

2.3. Sustainability

Scholars report an array of definitions of sustainability. The most often-used definition was proposed by the Brundtland Commission: "Sustainable development is development that meets the needs of the present without compromising the ability of future generations

to meet their own needs" [66:41]. This definition focuses on both economic and social development as they pertain to sustainability in all countries, developing or developed [66]. The Commission's premise was that knowledge shared globally would assure greater mutual understanding and create a greater willingness to share global resources equitably. Such willingness builds not only technical knowledge and capabilities but also creates new values to help individuals and nations cope with rapidly changing social, environmental and development realities. Legislation alone cannot enforce this common interest as it principally needs community knowledge and support. Greater public participation in the decisions that affect the environment must be fostered. Expanding knowledge increases the productivity of resources [66].

More recently, a different perspective of organizational sustainability was adopted. This is the triple bottom line, which comprises three components: the natural environment (planet), society (people) and economic performance (profit). The notion is that long-term profitability is best attained by balancing it with the planet and people [67]. Sustainable development is reinforced through this balance as consideration is given to profitably fulling human needs while conserving the ecology of the earth and alleviating poverty [68,69]. This concept is reflected in the SDGs as communities, regions and countries are assembled in their pursuit of environmental, economic and social prosperity, as well as wellbeing (the pursuit of sustainability). From an organizational perspective, it takes innovative and socially conscious leaders to balance the triple bottom line trifecta [70,71], as well as a detailed understanding of what sustainability means. With a comprehensive understanding of the required knowledge, its systemic nature and KM processes, organizations can institutionalize sustainability principles [72].

2.4. Sustainability and Knowledge Management

Knowledge management refers to the systematic management of all processes and activities associated with the generation, development, classification, storage, conveyance, sharing and application of knowledge [73]. The importance and application of KM in the context of sustainability have increased over the years [73,74]. Further to the extension of sustainability into various sectors and aspects of society, sustainability is now also a priority for organizations in achieving competitive advantage [74,75]. In order to realize and consolidate competitive advantage for organizations, KM has been applied as an essential resource for storing, finding, sharing and using knowledge [76]. In this context, KM plays a role in the optimization of approaches related to sustainability as a way to manage the complexity associated with sustainability [55,77]. Addressing sustainability incorporates multidisciplinary and heterogeneous knowledge and requires the acquisition of knowledge and skills (the learning organization), developing new behaviors and developing sustainability-oriented norms and values [77,78]. Some of the essential functions of KM processes in this context include the support of the acquisition and use of sustainable knowledge, the communication of sustainable practices, harnessing of community input and the facilitation of coordinated analysis and integrated assessment [55]. The application of KM in the context of sustainability and the concern with social and environmental responsibility now assume the same priority in an organization as economic viability. This organizational paradigm shift applies KM as a basis for sustainable development practices [79]. Therefore, organizations need to increasingly rely on their knowledge-generating resources and treat KM as a means of development that aims to enhance compliance with the guidelines of economic, environmental and social sustainability [65,80]. Furthermore, KM and its range of practices provide a means to manage the wide range of issues inherent in the concept of sustainability, the increasing volume of information related to this subject and its complexity and achieving the transdisciplinary concept of sustainability [50,81].

In order to capture the transdisciplinary nature of sustainability, Elkington [82] introduced the triple bottom line business concept of people (societal), profit (economical) and planet (environmental) [83,84]. The societal dimension of sustainability implores organizations to be concerned with the diverse stakeholders of their operations, such as

employees, customers and the community in which they operate. Environmental sustainability highlights the impact that organizations have on the environment as a result of their business activities and actions. Economic sustainability refers to organizational financial aspects and profitability [74]. Herciu et al. [85] proposed a behavioral management model that considers the triple bottom line components (people, planet and profit), as well as KM. This would enable one to discover, develop, utilize, deliver and absorb knowledge inside and outside the organization. In order to increase the organization's competitiveness and sustainability, they defined the dimensions of eco-knowledge (between economic and environment), socio-knowledge (between economic and society) and ecological knowledge (between environment and society) [85]. The knowledge assets defined here include both implicit and explicit knowledge [85].

3. Research Method and Data Collection

This section provides an overview of the data sources and data collection processes applied to this study, followed by an overview of traditional and automated content analysis.

3.1. Data Source and Data Collection

The aim of this study was to provide a better understanding of the different aspects of knowledge management in Society 5.0 as they pertain to sustainability. In order to achieve this aim, peer-reviewed academic articles were extracted via a Google Scholar search based on the Boolean keyword combination "Society 5" and "knowledge management" and "sustainability". Papers published since 2016 (following the Japanese Government's Fifth Basic Plan for Science and Technology) were considered. This resulted in an initial corpus of 508 papers, as shown in the preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework [86] in Figure 1. Twelve duplicates were removed from the corpus, and 147 non-English papers, master's dissertations, Ph.D. theses, training manuals and editorials were rejected. A corpus of 349 full-text articles had to be screened. These consisted of journal papers, conference papers and book chapters. These articles were reviewed manually based on the article title, abstract, conclusion and alignment to the research question. Papers that complied with the keyword search, as well as the inclusion and exclusion criteria, yet which contained incongruent content, were excluded (97 papers). This resulted in a corpus of 252 papers that had to be analyzed in detail.
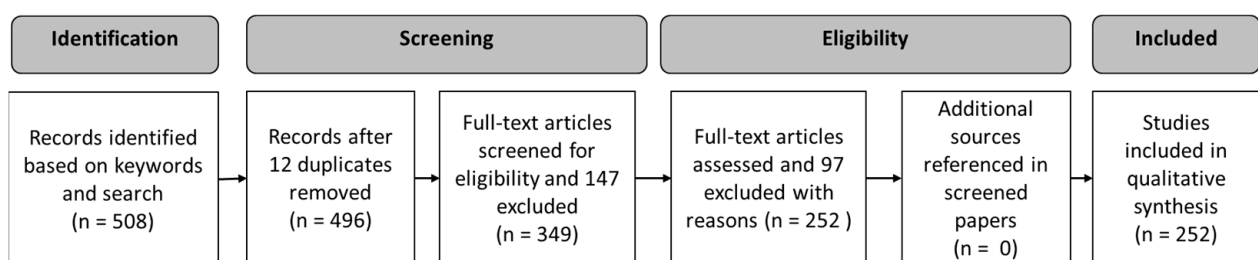

Identification	Screening		Eligibility		Included
Records identified based on keywords and search (n = 508)	Records after 12 duplicates removed (n = 496)	Full-text articles screened for eligibility and 147 excluded (n = 349)	Full-text articles assessed and 97 excluded with reasons (n = 252)	Additional sources referenced in screened papers (n = 0)	Studies included in qualitative synthesis (n = 252)

Figure 1. Preferred reporting items for systematic reviews and meta-analyses (PRISMA) framework [86] (Authors' work.).

3.2. Contemporary Content Analysis

Content analysis has a long history in research. Berelson [87] already defined content analysis in 1952 as "a research technique for the objective, systematic and quantitative description of the manifest content of communication" [87:18]. Krippendorff [88] extended Berelson's definition and distinguished content analysis from other methods of inquiry as "a research technique for making replicable and valid inferences from texts (or other meaningful matter) to the contexts of their use" [88:18]. Leedy and Ormrod [89] refer to content analysis as a method of "a detailed and systematic examination of the contents of a particular body of materials for the purpose of identifying patterns, themes or biases" [89:155]. These definitions clarify that content analysis is more than merely a counting

process. The aim of content analysis is to associate the results with their context or the environment in which they were produced [90].

The application of content analysis vacillates between quantitative semantics and the discovery of the content of symbolic communication [91]. Initially, researchers applied content analysis as either a qualitative or a quantitative method [87]. Later, content analysis was used primarily as a quantitative research method, with text data coded into explicit categories and then described using statistics. This process is referred to as the quantitative analysis of qualitative data [92]. The quantitative aspect of content analysis confirms the method as scientific, while the qualitative aspects of the research remain within the textual content, supporting relevance, especially when the number of units analyzed is too small for the application of statistical methods [91,93].

Contemporary content analysis has three distinctive characteristics [88]. Firstly, it is an empirically grounded method, exploratory in process and predictive or inferential in intent. Secondly, based on the impact of media and communication technologies on the concept of communication, as well as the role of culture in assigning significance to what is being analyzed, contemporary content analysis transcends traditional notions of symbols, contents and intents. Thirdly, due to content analysts and researchers now facing larger contexts and large volumes of electronically available data calling for qualitatively different research techniques, contemporary content analysis was forced to develop a methodology that enables researchers to plan, execute, communicate, reproduce and critically evaluate their analyses whatever the particular results [88,90].

The procedure for a content analysis study is designed to achieve the highest objective analysis possible and involves identifying the body of material to be studied, as well as the characteristics to be examined [89,94]. The examination may be of an exploratory or descriptive nature, based on deductive (concept-driven) or inductive (data-driven) reasoning [90,95]. Deductive reasoning searches for predetermined, existing subjects by testing hypotheses or principles. Inductive reasoning is the process of developing conclusions from collected data by weaving together information, identifying meaningful topics that answer the research question [96,97] and drawing conclusions about the patterns, themes or biases found in human communications and data collection [90,98]. Scholars report different numbers of process steps to perform content analysis [93–95]. However, the process of content analysis execution generally consists of four distinct stages: planning, data collection, data analysis and reporting [90]. The planning stage considers the aim, unit of analysis, data collection and analysis methods. The data collection stage entails deciding how data are collected for a specific project. The data analysis stage considers the analysis methods that best suit the project and data collected, e.g., categorization or compilation. The final stage involves creating a report of the results [37,88,90].

Traditional manual literature synthesis processes are often unable to take advantage of big literature due to the human limitations of time and cognition, creating the need for new literature synthesis methods to address this challenge [99,100]. The fact that researchers rank resources based on their interests may be another limitation associated with manual text analysis, as they may overlook other relevant findings [93,101]. Therefore, the concept of automated content analysis is discussed in the next section.

3.3. Automated Content Analysis

An alternative approach to contemporary, manual content analysis is automated content analysis. This is based on different software programs and is increasingly used in the scientific literature [95,101]. Automated content analysis refers to a suite of algorithms that uses probabilistic models (e.g., topic models and concept mapping models) [102] to discover the overarching themes in a body of literature, the frequency at which they appear and the relationships among them. The goal of these algorithms is to identify themes and categorize them according to their presence [99,101].

The automated content analysis encompasses a group of algorithms and models. The application process comprises three stages: concept identification, concept definition and

text classification [101]. During the first stage (concept identification), the concepts by which the literature is classified are determined. Single words that frequently occur in the literature and that are most likely to represent important concepts are identified as concept seeds, guiding the identification and definition of concepts from the literature. Depending on the purpose of the analysis and the features of the automated content analysis software, concept seeds may be extracted from the literature through unsupervised seeding or provided by the researcher through supervised seeding [99,100]. The second stage of automated content analysis (concept definition) builds the group of words that forms a concept, i.e., a thesaurus, through the application of a topic model or concept mapping algorithm. The output of the definition stage is a set of predominant concepts, each defined by its own thesaurus [99,100]. In the third and final automated content analysis stage (text classification), the literature is classified by the concepts identified and defined during the two previous stages. During text classification, a text segment is analyzed for evidence of the occurrence of each concept [99].

Once all three stages of the automated content analysis process are concluded, the final outputs allow further research exploration of the results. Depending on the features of the automated content analysis software, summaries of the results are visualized (e.g., social network maps, concept maps or quadrant reports). These summaries reflect the literature analyzed, the concepts it contains and the associations among these concepts [100]. Furthermore, automated content analysis tools provide statistical and concept co-occurrence data, such as records of concept and co-occurrence frequency between two concepts. This offers a quantitative illustration of the dominance of certain concepts and the strength of associations among concepts [38].

Apart from processing big literature quickly, automated content analysis software also processes textual material reliably, as opposed to humans who intuitively assign meanings to texts [39]. The reliability that automated content analysis software offers lies in character string processing, excluding unintentional human bias [93]. In addition, automated content analysis applications are suitable for a wide range of follow-up analyses, including comparisons of different bodies of literature and trend analysis in the literature [99].

The qualitative and quantitative data obtained from the automated content analysis is particularly useful for both targeted systematic and broad exploratory reviews [99]. The following section provides an overview of the automated content analysis software that was applied. The results of the analysis are shared as they contribute to a better understanding of the different aspects of knowledge management and the knowledge requirements of Society 5.0 in terms of supporting sustainability.

4. Analysis and Results

The authors conducted their automated content analysis with Leximancer software, version 5.00.140 2021/08/25, following the methodological procedure applied by Watson et al. [103], Smith and Humphreys [101], Kim and Kim [104] and Pucihar [37]. Leximancer is an advanced natural language processing software that utilizes Bayesian theory. It entails an unsupervised, iterative process to determine the frequency of concepts and their relationships without any preconceptions about the data. Leximancer identifies the main concepts in text based on the interdependence of words and automatically infers concepts, themes and patterns from the data [105]. Furthermore, Leximancer overcomes the limitations of the inherent biases and potential errors of researchers, especially in the manual coding of categories and in defining the rules of classification processes [101].

The outputs of Leximancer emphasize both the organization and detailed description of the data set. They theoretically inform the interpretation of meaning. The result is visualized through a concept map and topic guide, where concepts are denoted by circles based on prominence, i.e., based on the frequency of occurrence of certain words, but also on the number of connections that the word has with other identified concepts. The Leximancer software assigns the names of the most prominent themes in the group of connected concepts. Strong semantic relationships are conveyed through visual proximity [105].

This research project was executed based on the four stages of the Leximancer project control: select documents, generate concept seeds, generate thesaurus and generate results. For the first stage (select document), the 252 papers identified through the search process (Figure 1) were included. The second stage entailed the generation of concept seeds. Leximancer has a built-in, editable stop list of common words (e.g., "and", "an", "the", etc.) that are excluded from the concept seeds [105]. Once the concept seeds are generated, stop list words are added, such as "study", "figure", "table" and "paper" to ensure that these are not analyzed further. Upon completion of the third step (generate thesaurus), two compound concepts were identified. The first was "knowledge management", consisting of "knowledge" and "management". The second was "human capital", consisting of "human" and "capital". Compound concepts combine concepts using the specified Boolean operator "and". In this instance, it indicates that both concepts must appear in the same block of text analyzed [105]. Finally, the last step (generate results) could be executed to generate the concept map.

For the research project, Leximancer generated 50 concepts and 10 themes from the 252 papers identified (as shown in Table 1). The themes with the most significant number of hits were "knowledge", "human", "companies", "information" and "system".

Table 1. Themes and concepts identified in the papers analyzed. (Source: Authors' work.).

No	Themes	Hits	Concepts
1	Knowledge	859	Knowledge, management, design
2	Human	695	Human, capital, economic, digital, level, quality, financial
3	Companies	462	Companies, learning, role, sustainable, supply, sustainability, energy
4	Information	447	Information, process, data, business, manufacturing, software
5	System	420	System, use, value, services, production, environment, communication, AI
6	Innovation	268	Innovation, approach, work, strategy, industry, related
7	Development	219	Development, growth
8	Resources	186	Resources, support, performance, future
9	Social	170	Social, society, smart, people, global, project
10	Change	29	Change

Figure 2 depicts the concept map visualization of the concepts and themes identified, with cross-sections among themes denoted by overlapping circles.

Table 1 and Figure 2 are discussed in detail in the next sections.

Figure 2. Concept map of the papers analyzed. (Source: Authors' work.)

5. Discussion

The objective of this study was to contribute to a better understanding of the different aspects regarding KM in Society 5.0 as it relates to sustainability. In order to achieve this objective, 252 articles were analyzed via an automated content analysis process using Leximancer software to create themes and concepts related to the research question. The 10 themes identified are discussed in the next sections. For each section, the key sustainability-related KM concepts were extracted (refer to Table 1 and Figure 2), mapped to the sustainability triple bottom line (refer to Sections 2.3 and 2.4) and presented in a table.

5.1. Automated Content Analysis Results: Knowledge

Knowledge, which consists of the concepts of knowledge, management and design, was identified as the most significant theme. In terms of sustainability and learning, particularly related to the SDGs, KM, organizational learning and technology development are key enablers [106,107]. Organizational learning highlights the importance of integrative learning methods, creating new perspectives on sustainable development [108]. From a technology development perspective, as a wave of technologies is still evolving in the Society 5.0 cyber–physical world, the knowledge and techniques utilized for the adequate management of technology and its impact must be well matched and adaptable [106,109]. The development of technologies and the imperative to design new forms of KM, shifting from a multidisciplinary approach to a transdisciplinary approach, create a basis for continuous value creation [110]. It is, therefore, important for the organization to subscribe to active knowledge management and effective representations of operational information, as well as experience-based information [111,112]. KM techniques should focus on enhancing existing methods of knowledge acquisition and design by overlaying the data, big data and information layers with a knowledge layer [113–115]. Big data, in this context, presents great potential for organizations as it promotes data-driven decision making, generates higher revenue, improves productivity, provides a competitive edge and informs customer-relevant product design [107,116]. In addition, this knowledge layer informs

risk management through the automated identification of potential hazards (in the context of the particular organization) and applies safety-related knowledge pertaining to chemical processes, equipment, operability and product mechanisms, for example, over and above fostering differentiated management knowledge [40,107,117]. Moreover, the knowledge layer attracts diverse resources (human, environment, economic, financial, etc.) and integrates them [40].

The extract of the key relevant *knowledge* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 2.

Table 2. Key sustainability-related knowledge management concepts in Society 5.0: knowledge theme (Source: Authors' work).

Sustainability Triple Bottom Line	Theme: Knowledge Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Fosters organizational learning • Enhances existing methods of knowledge acquisition • Captures experience-based information
Socio-economic	• Applies techniques to adequately manage new or disruptive technologies • Applies insight from data to improve productivity • Applies data to inform customer-relevant product design
Economic sustainability (profit)	• Captures the effective representation of operational information • Overlays knowledge acquisition with data, big data and information layers • Captures differentiated knowledge • Applies insight from data to generate higher revenue • Attracts and integrates diverse resources (human, environment, economic, financial, etc.)
Eco-efficiency	• Focuses on continuous value creation • Promotes data-driven decision making
Environmental sustainability (planet)	• Matches and adapts the cyber–physical world to its impact • Informs risk management through the automated identification of potential hazards
Socio-environmental	• Creates and fosters a new perspective on sustainable development • Applies safety-related knowledge

5.2. Automated Content Analysis Results: Human

The second-most significant theme, *human*, contains the concepts human, capital, economic, digital, level, quality and financial. Key relevant aspects of this theme are that the development and creation of innovative, digital technologies drive economic development and collaboration, as well as institutional-level changes, such as appropriate legislative frameworks that are adapted to fast-changing conditions (e.g., a smart city as a tool to sustain economic growth), resulting in higher human capital and quality of life [62,118,119]. However, when utilizing a smart city such as a tool, adequate investment in information communication technology (ICT) infrastructure, as well as in human and social capital development, is required [120]. Therefore, in such a digital economy and knowledge-based economy, organizations need to understand and leverage factors to improve the quality of human capital. It is, therefore, necessary to understand exactly what factors of digitalization affect human capital [118,121]. Factors in this context are characterized by a high level of importance of digital skills and abilities, ICT literacy, electronic skills, the ability to adapt to new environments and digital literacy. These factors are expressed within the milieu of a special way of thinking that allows users to work intuitively, easily and effectively in the digital environment, as well as to display independence and creativity [118]. In Society 5.0, the premise of human capital is human potential [37], expressed primarily in the new competencies, knowledge and skills that meet the needs of the new knowledge-based economy as part of long-term socio-economic development [118,122]. Organizations must therefore ensure that humans (employees, customers, the community, etc.) are not excluded from the new economy due to an incapacity to develop the skills needed to prosper in

the knowledge-based economy [123,124]. Furthermore, the structure and intensity of international competition strongly influence skills requirements and consequently impact employee management practices [125]. These practices entice organizations to approach the complexity and ethical uncertainties in the process of sustainable, flourishing development with patience and to ground it in the existing social capital and structure. Policymakers must develop governance structures to ensure citizens' data privacy [119].

The extract of the key relevant *human* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 3.

Table 3. Key sustainability-related knowledge management concepts in Society 5.0: human theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: Human Key sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Improves the quality of human capital • Enhances digital skills and abilities • Develops user independence and creativity
Socio-economic	• Understands the impact of digitalization factors on human capital • Develops skills for the knowledge-based economy • Ensures the inclusive design of long-term socio-economic development • Develops governance structures to protect citizens' data
Economic sustainability (profit)	• Manages all aspects of the knowledge-based economy
Eco-efficiency	• Grows human capital and quality of life through the smart city as a tool to sustain economic growth
Environmental sustainability (planet)	• Has the ability to adapt to new environments
Socio-environmental	• Improves citizens' digital literacy • Invests adequately in ICT infrastructure, as well as in human and social capital development

5.3. Automated Content Analysis Results: Companies

The third-most significant theme, *companies*, includes the concepts of companies, learning, role, sustainable, supply, sustainability and energy. Organizations' sustainability efforts may not materialize if they lack internal KM processes to convert sustainability opportunities into innovation [109]. KM is multidisciplinary and includes socio-cultural, organizational, behavioral and technical aspects (IT) [126,127]. The competencies associated with such innovation do not necessarily entail abandoning more traditional approaches, but rather that organizations should focus on integrative methods for organizational learning [108,109]. Such methods are organized around daily routines, learning from experience and theoretical frameworks, and how the organization develops these paradigms to interpret its experiences. Knowledge management has facilitated learning, as well as being effective in achieving both individual and organizational goals and objectives; an organization that learns faster than its competitors can be one step ahead of the competition [128]. Through KM as a critical success factor of the new economy and an organization's long-term sustainability, management roles should have a good understanding of the knowledge, knowledge assets and knowledge flows in the organization while distilling the core competencies required for long-term sustainable organizational success [129,130]. Organizations enable timely, accurate and relevant knowledge for decision making and knowledge sharing in different ways: the implementation of enhanced communication and technology integration, joint structures and processes, improved supply performance (e.g., smart contracts), knowledge application in organizational performance measurement and collaborations in the scientific development of main areas of business (e.g., energy alternatives and energy management, open innovation, technological innovation management, knowledge management, risk management, information management, strategy and sustainability) [131–134].

The extract of the key relevant *companies* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 4.

Table 4. Key sustainability-related knowledge management concepts in Society 5.0: companies theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: Companies Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Focuses on integrative learning methods for organizational learning • Learns from experience • Optimizes daily routines
Socio-economic	• Applies the multidisciplinary nature of KM • Interprets learning experiences • Enables faster learning processes for a competitive edge • Creates joint organizational structures and processes
Economic sustainability (profit)	• Applies internal KM processes to convert sustainability opportunities into innovation • Obtains a good understanding of knowledge, knowledge assets and knowledge flows in the organization • Applies relevant knowledge for decision making • Implements enhanced communication and technology integration • Applies knowledge in organizational performance measurement
Eco-efficiency	• Applies the multidisciplinary nature of KM • Improves supply performance (e.g., smart contracts)
Environmental sustainability (planet)	• Collaborates in the scientific development of main areas of business (e.g., energy alternatives)
Socio-environmental	• Applies the multidisciplinary nature of KM • Distills the core competencies required for long-term sustainable organizational success

5.4. Automated Content Analysis Results: Information

The next theme, *information*, comprises the concepts of information, process, data, business, manufacturing and software. Organizations regard data and big data as "raw material" that must be converted into business insights through data analytics. This creates advanced knowledge of and insights into business processes and environments, such as manufacturing, as digitalization enables fast design processes with the potential to produce customized products and smart items without additional costs [135–137]. As the implicit and explicit knowledge of stakeholders must be shared, the organization should create a working environment and open culture where different thoughts are respected and delays are not penalized [138]. Developments in data and information management software improve speed and reliability in the collection, utilization and reporting of information at every stage of the operation in organizational and functional units, then transferring it to the decision-making units [139,140]. Such organizational adoption of software and hardware technologies enhances information communication and speed and, ultimately, competitive advantage [139]. KM techniques have gained sufficient momentum to elevate the meaning of the implicit knowledge coded into software code with the consequential application of software as a knowledge asset and commodity that is embedded in products, services or processes (e.g., manufacturing) [113]. This application helps to organize and streamline daily work, reduce mistakes and expenses and help manage the organization more efficiently through flexible and customizable features and quick and easy support [110,137,141]. Through KM, the rapid implementation of smart technologies in organizations requires people to enable continuous processes of sharing, storing, analyzing and transforming rough data into value-added information [39,142]. Furthermore, such value-added information supports organizational risk management programs as it consolidates scattered risk data, transcends organizational silos and shares data across the organization [142]. However, organizations must ensure access to the internet and relevant information technologies in all teams, regions and territories to achieve value-added information sharing [118].

The extract of the key relevant *information* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 5.

5.5. Automated Content Analysis Results: System

The next theme, *system*, consists of the concepts of system, use, value, services, production, environment, communication and AI. The development of internet-based communication and KM systems enabled the rise of digital platforms that enabled data collection and information sharing via networks and communication technologies [39,143–145]. These systems and platforms are perceived drivers for knowledge production and innovation in the organization and its adjacent ecosystems, as well as among different subsystems. Furthermore, in the context of the development of natural capital assets, the systems, platforms and system-driven perspective allow for a better adaptation of the business to the territorial prerogatives, favoring the optimal exploitation of the strengths present in the territory and the optimal management of the risks linked to the weaknesses of territory [143]. One particular focus of ambiguity in Society 5.0 relates to the exact role human beings play within it; human beings' emotional and intellectual capacity may be subject to the influence of other human beings [62]. Diverse types of robots, advanced AI, sentient computer networks, responsive smart environments and other non-human intelligent social actors are incorporated into Society 5.0. These not only perform work that was previously performed by human beings but, in some cases, may possess physical, intellectual, emotional and social capacities that exceed those of the human beings whom they are tasked to serve. This includes at least two distinct sources of sensing, deciding and acting: knowledge in people and knowledge in machines [31,62,144]. The evolution of human–technology interaction as a result of new devices or questions about the increase in complexity in autonomous programs through the use of AI services and conversational interfaces (e.g., chatbots, virtual reality and augmented reality) can enable new conclusions about optimized KM systems in the age of digital transformation for organizations [115,125,136]. Furthermore, added value to organizations is created by obtaining essential information from different platforms at the point of delivery of products and services based on the required information delivery process. KM encapsulates the process of generating organizational value as it promotes the sharing and retrieval of information by means of technology, thus adding value to the organization and increasing organizational performance [58]. Management decision making in this context is, in essence, bound by the ability of teams and individuals to reveal their contextual understanding through the interpretation of data sources, as well as through reflection, collegial interchange and the interpretation of reports. Such interchange may be based on collaboration with colleagues, exchange with customers and through *cobotics* (interaction with intelligent agents and robots, cyber–physical systems) [146,147]. Therefore, KM supports the creation of differentiated solutions derived from data and information, acknowledging the different organizational characteristics and organizational purposes [131,136].

The extract of the key relevant *system* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 6.

5.6. Automated Content Analysis Results: Innovation

The next theme, *innovation*, includes concepts related to innovation, approach, work, strategy and industry. Since innovation is perceived as an important feature of organizational, economic and social development, it represents a mechanism for economic growth, knowledge creation, increases in productivity, the formation of new professions and wealth proliferation [143]. The change in organizations to an open innovation vision required knowledge to be shared and transferred among organizations. It also promoted scientific–technological collaboration, paving the way for new technological innovations. In addition, the virtualization of work required transformation in format and method [108,133]. The change in format and method emphasized the requirement and importance of digital skills, abilities and knowledge supported by ICT literacy and the ability to adapt to new environ-

ments [118]. The ability to adapt, the human-centered nature required in the cyber–physical domain and the creativity of innovation induce the deliberate intention to create something new [40]. The intention of creating something new drives knowledge production and innovation, ultimately constructing a win–win relationship between the organization and its ecosystem [143]. Such a win–win relationship within the organizational ecosystem is significant as there is ultimately a limit to creating new economic and social value with own limited resources alone. Furthermore, in Society 5.0, natural capital development should enable an improved ecosystem as the organization optimizes territorial prerogatives and exploits territorial strengths with the optimal management of the risks linked to the weaknesses of the territory [148]. Some tasks of innovation development for economic growth in the territory may be delegated to the private sector or universities [118].

Table 5. Key sustainability-related knowledge management concepts in Society 5.0: information theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: Information Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Distributes information to operational, functional organizational units • Empowers decision making in organizational units • Applies knowledge assets to reduce mistakes and expenses • Creates a working environment and open culture where different thoughts are respected, and delays are not penalized
Socio-economic	• Enhances information communication and speed, and ultimately competitive advantage • Elevates the meaning of implicit knowledge coded into software code as a knowledge asset and commodity • Applies knowledge assets to organize and streamline daily work
Economic sustainability (profit)	• Converts data and big data into insight • Enables fast design processes to produce customized products and smart items without additional cost based on insight • Applies development in software to improve speed and reliability in the reporting of information • Applies knowledge assets to manage the organization more efficiently through flexible and customizable features • Consolidates scattered risk data and shares it across the organization for risk management
Eco-efficiency	• Enables conditions for the creation and development of human capital in regions and territories by ensuring access to the internet and relevant information technologies
Environmental sustainability (planet)	• Creates advanced knowledge and insights into business processes and business environments (e.g., green manufacturing)
Socio-environmental	• Harvests implicit and explicit knowledge from all stakeholders

The extract of the key relevant *innovation* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 7.

5.7. Automated Content Analysis Results: Development

The next theme, *development,* highlights two concepts: development and growth. It encompasses a number of interrelated aspects, such as human capital development, organizational development, socio-economic development and community development, that ultimately require accelerated KM [39,63]. The stock of human capital governs economic growth and improves the quality of human capital. It forms part of long-term socio-economic expansion [110,118]. Such collective intelligence requires organizations, regions and countries to gather and share their knowledge, data and skills to solve societal issues. For a country to thrive and achieve sustained success, it needs to transform and exploit its human capital, natural resources, political stability and a supportive infrastructure,

advancing creative trade with willing trade partners [118]. The aim of collective intelligence, in this instance, is to simultaneously create sustainable organizational development, as well as economic development and growth. It does this by integrating operating practices and models that are grounded in innovation, flexibility, knowledge, agility, adaptability and capability to transform intangible assets into tangible assets for the long-term well-being and prosperity of different stakeholder groups in the ecosystem [110,118]. In this context, organizations purposefully withdraw from a random pathway and predetermine the desired outcomes [40]. Social intelligence in community development implies that the development of a smart community does not rest on opportunistic public policy but rather requires the involvement of the community (the public) based on an awareness of the values behind the decisions taken [119].

Table 6. Key sustainability-related knowledge management concepts in Society 5.0: system theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: System Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Optimizes the KM system based on advanced human–technology interaction • Reveals contextual understanding through the interpretation of data sources through reflection, collegial interchange and the interpretation of reports
Socio-economic	• Optimizes two distinct sources of sensing, deciding and acting: knowledge in people and knowledge in machines • Promotes knowledge sharing and the retrieval of information by means of technology
Economic sustainability (profit)	• Applies new technology platforms for knowledge production and innovation • Understands the application of non-human intelligent social actors • Adds organizational value by obtaining timeous, essential information from different platforms • Creates differentiated solutions derived from data and information within the context of organizational characteristics and organizational purpose
Eco-efficiency	• Manages risks optimally that are linked to weaknesses of territory
Environmental sustainability (planet)	• Develops natural capital assets, allowing for better adaptation to the territorial prerogatives • Favors the optimal exploitation of strengths present in the territory
Socio-environmental	• Fosters engagement based on each human being's emotional and intellectual capacity that may be subject to the influence of other human beings

Table 7. Key sustainability-related knowledge management concepts in Society 5.0: innovation theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: Innovation Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Emphasizes the importance of ICT literacy, skills, abilities and knowledge
Socio-economic	• Updates the format and method of work to accommodate virtualization • Creates new value by driving knowledge production
Economic sustainability (profit)	• Creates knowledge through innovation • Shares and transfers knowledge among organizations for open innovation
Eco-efficiency	• Delegates tasks of innovation development for economic growth in the territory to the private sector or universities
Environmental sustainability (planet)	• Supports the elevation of strength and reduction in risk
Socio-environmental	• Creates value through win–win ecosystem relationships

The extract of the key relevant *development* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 8.

5.8. Automated Content Analysis Results: Resources

The next theme, *resources*, encompasses interconnected concepts such as resources, support, performance and future. The premise of this theme is seen through the lens of knowledge creation as it relates to human and intellectual capital improvement, ultimately securing future success for organizations [149,150]. Organizations, therefore, use their human resources strategically to attain their strategic objectives [40,151]. However, the knowledge lens is also concerned with some intangible assets in the form of data, information, knowledge and insight. By implementing advanced KM systems, organizations can ensure that these resources are utilized efficiently and meet the advanced requirements and competitive advantage of the organization, as well as enhancing their specific expertise, knowledge and competencies [116,152]. Resources in this context enable competent organizations to deliver rare and valuable outputs, differentiated products that may be difficult to imitate, or products that are eco-friendly and easy to recycle [149,153]. In this instance, knowledge sharing is linked to the opportunities delivered by technology—also for the future of KM—as substantial and particular knowledge may also be shared across geographical barriers or harnessed to use nature to provide a sustainable living to residents and visitors [136,154,155]. Future KM tools must therefore be able to contend with heterogeneity and discontinuity in knowledge [146].

Table 8. Key sustainability-related knowledge management concepts in Society 5.0: development theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: Development Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Accelerates KM for human capital development
Socio-economic	• Accelerates KM for socio-economic development
	• Accelerates KM for organizational development
Economic sustainability (profit)	• Integrates operating practices and models grounded in innovation, flexibility, knowledge, agility, adaptability and capability
Eco-efficiency	• Advances creative trade with willing trade partners by transforming and exploiting human capital, natural resources, political stability and a supportive infrastructure
Environmental sustainability (planet)	• Transforms intangible assets into tangible assets for the long-term wellbeing and prosperity of different stakeholder groups in the ecosystem
	• Accelerates KM for community development
	• Creates collective intelligence by sharing knowledge, data and skills with regions and counties for the purpose of solving societal issues
Socio-environmental	• Transforms and exploits human capital, natural resources, political stability and a supportive infrastructure, advancing creative trade with willing trade partners
	• Applies social intelligence by involving the community in the creation of a smart community

The extract of the key relevant *resources* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 9.

5.9. Automated Content Analysis Results: Social

The next theme, *social*, includes concepts such as social, society, smart, people, global and project. This theme considers the role that humans play in Society 5.0, together with diverse technologies within it. Although non-human intelligent social actors may perform work that was previously accomplished by people as social beings, they may, in some cases, exhibit capabilities traditionally held by humans. Such a smart society harnesses dynamic capabilities (sensing, seizing and transforming [132,156]) based on the human source provided by people (referred to as "bio-agency") and the artificial source provided by technology (referred to as the "cyber-agency") [57,62]. These sources materialize in urban development where technological devices are incorporated for the

benefit of the people (citizens) towards improving or solving socio-economic problems and lifestyle issues [57,119]. KM plays an important role within this social, economic and information sphere in establishing a sustainable competitive advantage, along with the smart community developments accomplished on a global scale [56,118]. Therefore, the implementation of strategies for KM development, which are intensified in this social phase, is essential for the realization of the vision of Society 5.0 [40,150]. The evolution of KM, therefore, contributes to establishing a society modeled on the dimensions of social, economic and environmental sustainability [157]. Such a model may then be implemented through projects and project management, with innovation at its core, as KM provides an understanding of management practices in the knowledge economy and society, as well as perspectives for sustainable development [40,108]. In this instance, KM adopts a critical approach to the adoption of new ideas and the support of innovation with different ideas, as it is considered within the frame of society and individual welfare. This is important in the next social phase, Society 5.0 [56].

The extract of the key relevant *social* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 10.

Table 9. Key sustainability-related knowledge management concepts in Society 5.0: resources theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: Resources Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Creates knowledge as it relates to improving human and intellectual capital and ultimately securing future success for organizations • Uses human resources strategically to attain strategic objectives
Socio-economic	• Implements advanced KM systems to manage intangible assets in the form of data, information, knowledge and insight. • Facilitates and enhances specific expertise, knowledge and competencies
Economic sustainability (profit)	• Enables competent organizations to deliver rare and valuable outputs that may be difficult to imitate • Ensures that KM tools can contend with heterogeneity and discontinuity in knowledge
Eco-efficiency	• Enables delivery competency to deliver rare and valuable outputs, differentiated products that may be difficult to imitate, or products that are eco-friendly and easy to recycle
Environmental sustainability (planet)	• Harnesses knowledge of nature in providing sustainable living for residents and visitors
Socio-environmental	• Applies technology to enable substantial and particular knowledge sharing across geographical barriers

5.10. Automated Content Analysis Results: Change

The final theme, *change,* entails organizational capabilities, such as strategic vision and outcome anticipation, information and KM, as well as decentralized and responsive decision making, which enhance an organization's ability to offer an immediate reaction to change and its demands [108,158]. The improvement of these change capabilities requires the development of higher levels of knowledge and skill, human capital development and effective change management [108,159]. In turn, the change in the traditional human capital of the individuals, regions and countries is exacerbated by the eminent digital transformation of the economic and social life of society [117,160]. This digital transformation is driven by changes in markets and market demands, changes in the workforce, technology and globalization, as well as the emergence of new competitors. It seeks fit-for-purpose learning interventions [152]. Organizations that understand the significance of this change, and the knowledge and learning required at all organizational levels, invest time and effort in KM and learning organization integration, as this strengthens the organization. Therefore, the organization should not waste human capacity but rather embrace it for its creativity and

problem-solving and harness these uniquely human qualities to transform and change in Society 5.0 [127,133,146]. From a product perspective and to foster sustainability, organizations consider the ecosystem to consist of multiple interconnected systems (e.g., climatic, cultural conditions, natural resources, political system, religion, etc.) and change, plan and control products needed by the human race [161]. Buy-in from shareholders must support such a balancing of human demand and nature [159].

Table 10. Key sustainability-related knowledge management concepts in Society 5.0: social theme. (Source: Authors' work.)

Sustainability Triple Bottom Line	Theme: Social Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Evolves KM to contribute to establishing a society modeled on the dimensions of social, economic and environmental sustainability • Combines the role of humans with diverse technologies to add organizational value
Socio-economic	• Implements KM development strategies to establish sustainable competitive advantage along with the smart community developments accomplished on a global scale • Gains an understanding, through KM, of management practices in the knowledge economy and society, as well as perspectives for sustainable development • Adopts KM approaches to implementing new ideas and supports innovation with different ideas
Economic sustainability (profit)	• Harnesses dynamic capabilities (sensing, seizing and transforming) for a smart society • Evolves KM to contribute to establishing a society modeled on the dimensions of social, economic and environmental sustainability
Eco-efficiency	• Gains an understanding, through KM, of management practices in the knowledge economy and society, as well as perspectives for sustainable development
Environmental sustainability (planet)	• Evolves KM to contribute to establishing a society modeled on the dimensions of social, economic and environmental sustainability
Socio-environmental	• Incorporates technological devices in the urban environment to the benefit of the people (citizens) towards improving or solving socio-economic problems and lifestyle issues • Gains an understanding, through KM, of management practices in the knowledge economy and society, as well as perspectives for sustainable development

The extract of the key relevant *change* concepts in Society 5.0, as they pertain to the sustainability triple bottom line, is shown in Table 11.

The next section summarizes the findings of the automated content analysis as it pertains to the objective of this study, i.e., to investigate the different aspects of KM in Society 5.0 as they relate to sustainability.

5.11. Summary of Research Findings

Across the ten themes identified through automated content analysis, 120 key sustainability-related KM concepts in Society 5.0 were identified. For each sustainability-related KM theme, the key aspects (Tables 2–11) were identified for the six perspectives of the triple bottom line of sustainability (refer to Sections 2.3 and 2.4). An integrated dataset was visualized in Figure 3, denoting the concepts of the triple bottom line, with the number of key KM aspects identified for each presented in square brackets.

Table 11. Key sustainability-related knowledge management concepts in Society 5.0: change theme. (Source: Authors' work.)

| Sustainability Triple Bottom Line	Theme: Change Key Sustainability-Related KM Concepts in Society 5.0
Social sustainability (people)	• Develops higher levels of knowledge and skill, human capital development and effective change management • Pursues fit-for-purpose learning interventions for all organizational levels to address digital transformation requirements • Strengthens organizations through learning organization integration • Embraces human capacity for creativity and problem solving and harnesses these uniquely human qualities to transform and change
Socio-economic	• Invests time and effort in KM in support of digital transformation
Economic sustainability (profit)	• Applies organizational capabilities such as information management, KM and responsive decision making to enhance an organization's ability to offer immediate reaction to change and its demands
Eco-efficiency	• Obtains shareholder support to balance human product demand and nature
Environmental sustainability (planet)	• Plans and controls the manufacture of products needed by humans to ensure sustainable development
Socio-environmental	• Considers the entire ecosystem, which consists of a number of interconnected systems (e.g., climatic, cultural conditions, natural resources, political system, religion)
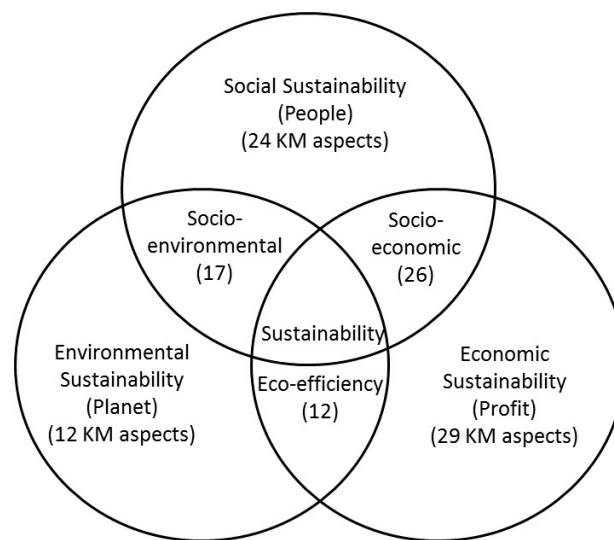
Figure 3. Contribution of key concepts of sustainability-related KM. (Source: Authors' work).

For social sustainability (people), 24 key KM concepts in Society 5.0 were identified, 12 for environmental sustainability (planet) and 29 for economic sustainability. For the socio-environmental concept, which represents the overlap between people and planet, 17 key KM aspects in Society 5.0 were identified, 26 for socio-economic (overlap between people and profit) and 12 for eco-efficiency (overlap between planet and profit).

The aim of this study was to identify the key KM concepts in a Society 5.0 context as they relate to sustainability. Key KM concepts in Society 5.0 related to social sustainability (people) emphasize the requirement to foster organizational learning by enhancing knowledge acquisition, capturing experience-based information and enhancing digital skills, ICT literacy and abilities. Such accelerated improvement of the quality of human capital may be achieved by focusing on integrative learning methods for organizational learning (e.g., learn from experience, optimize daily routines), developing user independence and creativity and creating a working environment and open culture where different thoughts are respected, and delays are not penalized. Furthermore, by harnessing unique human

qualities to transform and change (e.g., creativity, problem solving) and by creating knowledge as it relates to human and intellectual capital improvement, an organization may secure future success as it, in fact, utilizes knowledge assets strategically to attain strategic objectives and address digital transformation requirements. Information distributed to operational and functional organizational units empowers decision making and develops higher levels of effective change management. The KM system in support of social sustainability may be optimized based on advanced human–technology interaction.

Socio-economically, organizations should implement advanced KM systems to manage intangible assets in the form of data, information, knowledge and insight. By elevating the meaning of implicit knowledge as a knowledge asset and commodity, organizations may combine knowledge in people and in machines to add organizational value, as well as create new value by driving knowledge production. Such produced knowledge may guide techniques to manage new or disruptive technologies adequately, apply data to inform customer-relevant product design, apply insight from data to improve productivity, and better understand the impact of digitalization factors on human capital. By applying the multidisciplinary nature of KM and adopting a KM approach to implementing new ideas and supporting innovation with different ideas, organizations may invest time and effort in KM in support of digital transformation. Ultimately, organizations should develop skills for the knowledge-based economy and apply knowledge assets to organize and streamline their daily work, enhance information communication and speed and ultimately gain a competitive advantage.

For economic sustainability, organizations should manage all aspects of the knowledge-based economy by capturing effective representations of operational information; overlaying knowledge acquisition with data, big data and information layers; capturing differentiated knowledge; and applying insight from data to generate higher revenue. Organizations, therefore, apply relevant knowledge for decision making to measure their performance and create differentiated solutions derived from data and information within the context of organizational characteristics and purpose. Furthermore, by accelerating KM for organizational development, organizations can integrate operating practices and models that are grounded in innovation, flexibility, knowledge, agility, adaptability and capability. This enables organizations to deliver rare and valuable products and services that may be difficult to imitate. Additionally, by applying organizational capabilities such as information management, KM and responsive decision making, an organization's ability to offer immediate reaction to change and its demands is enhanced. Essentially, knowledge is created through innovation.

From an eco-efficiency perspective, organizations should focus on continuous value creation with a strong emphasis on developing capabilities to deliver rare and valuable outputs, differentiated products that may be difficult to imitate or products that are eco-friendly and easy to recycle. Organizations should gain an understanding of human capital and quality of life (e.g., smart cities) through KM as a tool to sustain economic growth, improve supply performance (e.g., smart contracts) and enable conditions for the creation and development of human capital in regions and territories by ensuring access to the internet and relevant information technologies. In this instance, organizations may consider delegating tasks of innovation development for economic growth in the territory to the private sector or universities.

Some strategies that organizations may follow to achieve environmental sustainability include using technology to inform risk management through the automated identification of potential hazards, planning and controlling the manufacture of products needed by humans to ensure sustainable development, to collaborate in the scientific development of main areas of business (e.g., energy alternatives) and to create advanced knowledge and insights of business processes and business environments (e.g., green manufacturing). The development of natural capital assets allows for a better adaptation to the territorial prerogatives. By transforming intangible assets into tangible assets for the long-term

wellbeing and prosperity of different stakeholder groups in the ecosystem, knowledge of nature to provide sustainable living for residents and visitors may be harnessed.

For socio-environmental sustainability, organizations should create and foster new perspectives on sustainable development, such as creating value through win–win ecosystem relationships by accelerating KM for community development, improving citizen digital literacy and investing adequately in ICT infrastructure, as well as in human and social capital development. The application of social intelligence by involving the community in the creation of a smart community requires the application of technology to enable substantial and particular knowledge sharing across geographical barriers. KM supports the distilling of the core competencies required for long-term sustainable organizational success and for the harvesting of implicit and explicit knowledge from all stakeholders with the aim of creating collective intelligence by sharing knowledge, data and skills with territories for the purpose of solving societal issues. Organizations gain an understanding, through KM, of the entire ecosystem, which consists of a number of interconnected systems (e.g., climatic, cultural conditions, natural resources, political system, religion), by incorporating technological devices into urban environments to the benefit of the people (citizens) towards improving or solving socio-economic problems and lifestyle issues.

The organization that emerges in Society 5.0 need to possess greater knowledge, flexibility, speed, power and learning ability to better confront the shifting needs of a new environment, more demanding customers and smarter knowledge workers. Evolving KM contributes to establishing a society modeled on the dimensions of social, economic and environmental sustainability.

6. Conclusions

The objective of this study was to identify the key KM concepts in a Society 5.0 context as they relate to sustainability. In Society 5.0, the knowledge-intensive society, a sustainable balance must be created for social good through a system that integrates cyberspace and physical space. With significant data exchange in this cyber–physical world, KM is required as insight regarding the sustainable balance to be applied from both knowledge workers and intelligent machines.

In order to investigate the key KM concepts in Society 5.0 as they relate to sustainability, the authors analyzed a corpus of 252 peer-reviewed academic publications through automated content analysis using the software tool Leximancer. The findings, consisting of 10 themes and 50 concepts, were mapped and presented in terms of the three main components of the sustainability triple bottom line: the natural environment (planet), society (people) and economic performance (profit), including the overlap areas of these three components. By considering the key KM aspects in Society 5.0 for each of the triple bottom line concepts, organizations will be able to confront Society 5.0 with the required and increased knowledge, agility and learning ability to better address the requirements of the new environment and balance social, economic and environmental sustainability. In terms of the SDGs and their close alignment with Society 5.0, the key KM concepts enable organizations to share common goals and plan according to global perspectives, with the aim of yielding social, economic and ecological benefits that enhance a society's sustainability and stability.

A potential next step in this research study is to analyze the data and findings based on KM frameworks and strategies [162], with the aim of providing organizations with guidance to define a KM strategy within the unique contexts of sustainability and Society 5.0.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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