

## Article

# Knowledge Management Practices for Sustainable Supply Chain Management: A Challenge for Business Education

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**Abstract:** In the last decades, business competition has been increasingly among supply chains (SCs) rather than individual firms. Today, considering the challenges of environmental, social, and economic sustainability, it is becoming even more vital to coordinate and co-manage company resources, activities, and innovative efforts at the SC level. Consequently, knowledge, which is a critical resource for companies, needs to be managed properly not only in single firms but also across SCs. For the education of business managers, this implies a double challenge: first, to make students and future executives become aware of the knowledge management (KM) practices that can be adopted; second, to facilitate the assimilation of these practices for the effective management of SCs, to ensure higher economic and environmentally sustainable performances. Standard definitions and classifications can be of great help, but the current studies are very fragmented. This study contributes by exploring the literature and examining the KM practices that are proposed and defined by the different authors. A systematic review and a descriptive analysis of selected papers showed the trend and focus of papers in the KM and SC fields. In addition, based on the definitions and classifications drawn from the literature, this paper discusses a possible systematization of the key KM practices in SCs. The major contribution of this paper is the effort of re-definition and re-classification of KM practices and their potential importance for effective and sustainable SC management. This analysis can be especially useful for organizing KM courses targeted to current and future business managers.

**Keywords:** knowledge management; business education; KM courses; KM practices; literature survey; classification; supply chain management



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## 1. Introduction

In the recent decades, it has become evident that competition is more among supply chains (SCs) than between individual firms [1–3]; therefore, managers should focus not only on the planning and operations of internal activities, but also on how the different capabilities, resources, and processes of all the firms in an SC can be profitably integrated and coordinated. Today, with the emerging goals of environmental, economic, and social sustainability, the complexity of SC management is even growing, and new competencies are becoming necessary. All companies must improve their practices with a higher awareness of environmental issues. To survive in global markets where the demand for green production is increasing, the effectiveness of SC management must grow [4]. In addition, it is necessary that companies and managers reach a high level of maturity in their SC management practices, to reduce risks of disruptions [5]. Managing sustainable SCs extends beyond classic approaches, based for instance on performance metrics of cost, time, and flexibility of supplies and deliveries, and requires collaboration and expanded transparency across all companies in SCs, for ensuring integrated “moral, economic, legal, social and technical” performances that are required under a sustainability perspective [6].

To face these complex challenges, there is increasing awareness that knowledge is a strategic resource. Knowledge is a fluid mix of framed experience, values, contextual data,

and expert insights that need to be integrated and managed properly to enhance a firm's organizational performance and its capability to introduce innovations and face changing conditions [7]. How companies should plan their knowledge management (KM) activities is a debated issue [8], and recognition of KM as a strategic element of today's competitiveness is increasing. The adoption of appropriate KM approaches is also recognized to be a way to achieve sustainability goals [9,10].

This leads to an increasing necessity of KM capabilities and, therefore, for education and training courses where existing and future business managers can learn the fundamental elements of KM [11]. For a sustainable management in the future economy, business managers must learn how to effectively manage not only their own knowledge but also the knowledge of all those that are involved in their business. As companies in SCs are strictly interconnected to one another, techniques and technologies to manage knowledge become integrated with SC management systems to monitor operational and environmental performances [9] as well as to produce innovations that are economically fruitful and environmentally respectful.

In the last two decades at least, KM programs have been introduced in universities around the globe. However, recent surveys [12] highlight that the picture is quite fragmented: there is no "standard" approach to KM education nor a formal accreditation of KM programs. Curricula often change to address contingent requirements coming from industries and societies.

The application of KM can be seen at either an intra-organizational or an inter-organizational level [13,14]. Intra-organizational KM focuses on KM methods, processes, activities, and technologies within the boundaries of an organization, while inter-organizational KM refers to the application of KM to manage the relationships with external partners (i.e., suppliers, customers, service providers, etc.). Since sustainable growth issues affect every company in an SC, it is important to address solutions from a collective rather than an individual point of view. For sustainable growth, the effort of the single individual or isolated organization, although important, is insufficient. Therefore, KM between different companies is even more important than that of each company internally, for achieving sustainable growth that adds value to the entire community. In this vein, there has been a progressive shift of focus to inter-organizational KM, which has become increasingly relevant [13–15]; knowledge is a critical resource that must be managed properly not only in single companies but also across SCs.

In substance, knowledge generated in any part of an SC and flowing through inter-company connections must be managed properly for achieving higher business value [16,17], for example by adopting proper processes and technologies to acquire and absorb knowledge from suppliers and customers, undertaking effective activities for joint knowledge creation and problem solving with business partners, using approaches to sharing knowledge among the appropriate SC members with the adequate level of protection, and so on.

Increasingly, scholars see the development of "knowledge-based SCs" as an opportunity to achieve better value for customers [18,19], to promote better use of resources in knowledge-intensive and multi-cultural enterprises [20], and to improve the sustainability of business activities [21]. In addition, as the current economic and societal environment strongly affected by the COVID pandemic clearly shows, for a sustainable business, companies must take appropriate countermeasures to possible disruptions in operations and logistics. KM can help to reduce the knowledge gaps that are key in the management of purchases, supplies, and sales, to ensure a traceable and transparent environment.

In short, it is vital for current and future managers of SCs to learn how to implement and apply appropriate KM practices, not only in their organizations but also in their relationships with external partners. The design of a KM course for SC management requires that students achieve, among other things, an awareness and effective understanding of the possible KM practices that can be adopted for better SC performance, to facilitate the creation, delivery, sharing, and protection of knowledge across SC partners (manufacturers, suppliers, customers, service providers, etc.) for common strategic goals. A

“catalogue”—or, at least, an easy-to-understand classification—of KM practices, based on both KM conceptual models and practical implementations, can be of great use for course design or textbook writing.

SC management and KM are two important research streams, but few works have treated the link between them [20]. During the past 20 years, important contributions have been published and some studies [22–24] support that there is a growing interest in applying KM to SCs. The literature is, however, fragmented, and the research has sometimes taken diverging directions. There is still a lack of shared definitions or classifications, especially as regards the notion of KM practice, in general and with reference to SCs. There are limited studies on this issue [25–28], and they sometimes take diverging views. A unified vision or perspective has not emerged so far.

This article aims to contribute to filling this gap. Based on a selection of the literature, the state-of-the-art of the current research on KM for SCs was examined, with the purpose to identify the most important concepts, definitions, and taxonomies that can be relevant to SC management and, also, to sustainable SC management. Especially, notions and classifications of KM practices whose adoption is proposed in SCs were examined and systematized, with the goal to introduce a new consistent categorization. This was done by means of a systematic survey of the recent scientific literature, based on a combination of a quantitative and a qualitative approach.

The next sections are structured as follows. Section 2 describes the methodology. Section 3 summarizes the quantitative analysis of the selected articles, by means of a trend analysis and a content analysis. Section 4 illustrates the qualitative analysis of the main issues of KM in SCs as they emerge from the papers and discusses the main classifications and definitions of KM practices applied to SCs as they are proposed. Section 5 advances the proposal of a new systematic classification into three categories. The final section summarizes the main usefulness of the study, the implications for research and practice, and the future directions of research. In particular, this paper contributes to the literature on KM in SCs by making a step towards a systematic conceptualization of KM practices and by highlighting the gaps that may need to be filled in future studies. In practical terms, this study proposes a structured and synoptic reference, useful for the design and implementation of KM courses for business managers.

## 2. Materials and Methods

The approach of a systematic literature review (SLR) is adopted. SLR is an overview of primary studies that uses explicit and reproducible methods [29] following a rigorous procedure of searching, which includes [21,30]: formulation of the research question(s), studies location (searching papers via keyword definition and database selection), selection and evaluation of studies using inclusion/exclusion criteria, analysis and synthesis of the selected articles, and reporting and use of results for further action. In coherence with these typical SLR steps, the research strategy is described below.

### (A) Formulation of research questions

Based on the research goals and literature gaps mentioned in Section 1, the following three research questions are addressed in this SLR.

RQ1: How does the trend of KM for SC look, and which issues are most importantly covered (or not covered)?

RQ2: What are the definitions and classifications of “KM practice” in the literature?

RQ3: Based on these studies, what KM practices are mainly used or proposed for application to SCs?

### (B) Keywords selection, construction of search strings, and choice of databases

Since the general focus of the study is to see the KM issue in the SC perspective, the articles considered for this study must contain both KM and SC issues. Accordingly, the selected keywords include: “knowledge management”, “knowledge creation”, “knowledge acquisition”, “knowledge storage”, “knowledge sharing”, “knowledge transfer”, “knowl-

edge application”, and “knowledge protection” in combination with “supply chain”. Web of Science and Scopus are used as they are popular and authoritative citational databases and collect a great number of publication sources of all disciplines.

#### (C) Inclusion/exclusion criteria of papers

The retrieved papers were further selected based on some criteria:

- Focus of the paper on one or more KM practices, or on KM adoption, development factors, technologies, methods/tools, and strategies from an SC perspective.
- Articles in peer-reviewed journals indexed in the Scientific Citation Index or Social Sciences Citation Index (Web of Science database), and the Scimago index (Scopus).
- Articles in business and economics, management, operations research and management sciences, industrial engineering, information system, and related fields.
- Articles written in the English language.
- Articles published from January 2000 to December 2019 (to see the research trend over the last two decades).

According to the above-mentioned search strategy and inclusion/exclusion criteria, a total of 831 papers went through the evaluation process (i.e., article title reading, abstract reading, and full paper reading), and finally, 65 papers were considered for further descriptive and content analysis.

Analysis and synthesis of the selected papers was the next step, where descriptive and content analyses were conducted. In the descriptive analysis, the papers were categorized according to the following three perspectives, to give a summary view of the selected papers and the research field:

1. By publication year (to see the trend of the research field)
2. By unit of analysis (firm level, SC level, or network level)
3. By the types of KM processes covered in the studies

In the content analysis, papers were reviewed and studied thoroughly, and important points regarding KM practices and associated issues were extracted and analyzed, with the main goal of singling out the application context, definition, and classification of KM-related practices for SC management.

### 3. Results: Quantitative Analysis

#### 3.1. Analysis of Papers by Publication Year and the Trend

From the distribution of papers by publication year, the graph in Figure 1 shows that, for the past 20 years, there is a general increasing trend of research on KM in SC. Specifically, in the last decade, a fast increase appears: only 18.5% of the papers were written from 2000 to 2010, while the remaining 81.5% were published after 2010, which is three times the number. Thus, the trend displays a significant growth and reveals that there is increasing interest in this field. It also shows that this area of research is promising, and there may still be a lot to discover.

#### 3.2. Classification of Papers by Unit of Analysis

Papers were also classified by the unit of analysis of studies (i.e., firm level, SC level, or supply network level). In this respect, most papers (54%) adopt a firm-level unit of analysis (Figure 2). Indeed, the analysis of KM issues at an SC or supply network level is clearly more difficult, as it is not easy to detect and examine the KM practices in an SC across all the possible firms involved; therefore, this can be seen to be a point of weakness of many studies. However, it may also reveal that KM practices in an SC may be adopted by trading partners (suppliers or customers) under the encouragement or pressure of a key company in the SC (for example, a large manufacturer with its suppliers). This is important for researchers (i.e., by analyzing the practices of these key companies, it is often possible to learn the KM practices that are used in the SC) and for practitioners (namely, the initiative taken by the predominant firm can be essential for the application of KM practices in the SC).

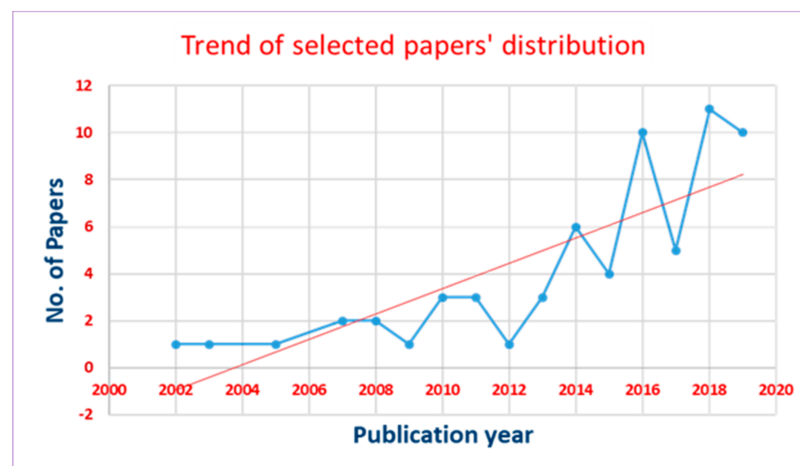


Figure 1. Distribution of papers by publication year.

### 3.3. Analysis of Papers by KM Processes

This analysis aimed to identify the main KM processes that are often considered from the “KM in SC” perspective, and to learn which processes are mostly covered/not covered by the studies. To do so, a pre-compiled list of “generic” KM processes was necessary. In the literature, different directories of KM processes have been published [31,32]. Based especially on authors who focus on KM in SCs [25,33,34], six key KM processes can be considered, which are the following: knowledge acquisition, creation, storage/retrieval, transfer, sharing, and application. In addition, due to the need for knowledge protection in inter-company knowledge exchanges [28,35], a further KM process must be included in the KM-SC perspective: “knowledge protection”.

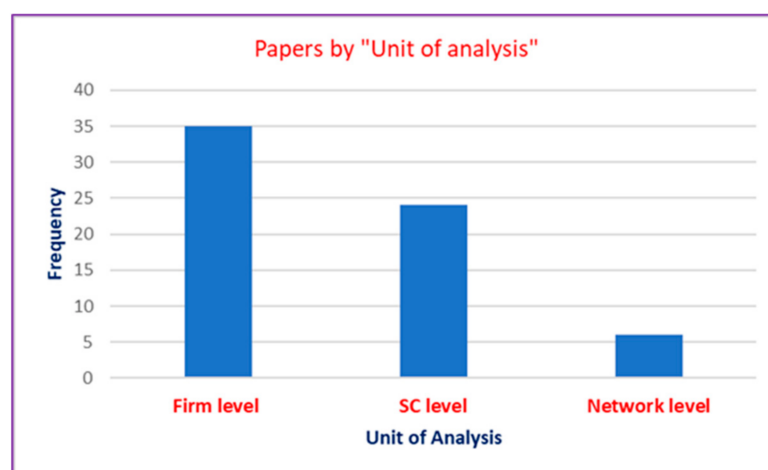


Figure 2. Classification of selected papers by unit of analysis.

According to this list, the selected papers can be classified as shown in Figure 3. Knowledge sharing (namely, collaborative exchange of knowledge between individuals that boosts mutual learning and new interpretations) and knowledge transfer/dissemination (i.e., the process whereby a “piece” of knowledge is passed from a source to a receiver) together cover around 45% of all KM processes considered in the studies. The prevalence of these distinct but correlated processes signals that how to exchange knowledge effectively in SCs and what methods or tools to adopt for that are still considered key questions.

On the other hand, knowledge protection (3%) has received very little coverage. This may signal that the risk of “leakages of precious knowledge” in SCs is not considered critical, or that researchers still must do more research on this topic. Knowledge acquisition



(i.e., how firms can assimilate and integrate different knowledge resources from each SC member) is also not considered as a crucial process.

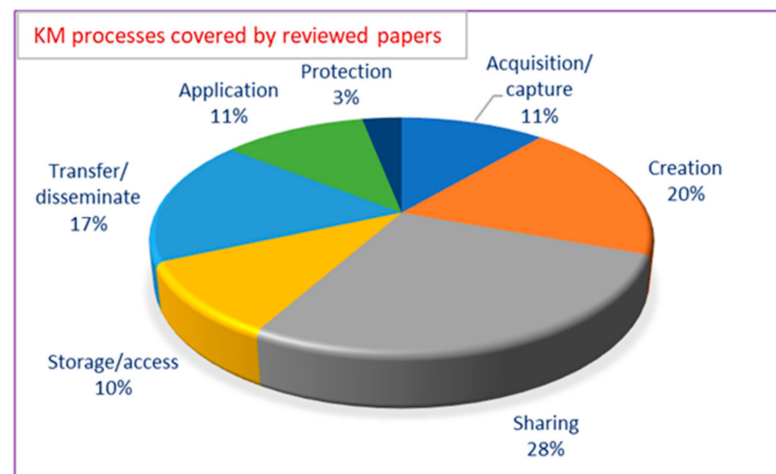


Figure 3. Coverage of KM processes in SCs.

#### 4. Results: Qualitative Analysis

After a thorough reading of the selected papers, in this section it is highlighted that KM practices are defined and categorized by different authors in a fragmented way, and that an effort at systematization is necessary. As mentioned, the design of a KM course for SC management in business needs a reference definition of KM practice and a consistent classification. This is greatly important for helping students and future executives to select and apply the proper practices in the different practical situations they will face in their profession.

While, as was shown in the previous section, it can be affirmed that the literature is increasingly putting an emphasis on the application of KM in SCs, a significant limitation is that many different notions and categorizations regarding KM practices are proposed. According to some studies [26,36–38], KM practices are generically defined as a set of organizational and managerial activities intended to achieve organizational goals through the efficient and effective management of a firm’s knowledge resources. Centobelli et al. [39] and Cerchione et al. [40] define KM practices as a group of methods and techniques for supporting KM development. Some authors define KM practices as enablers [41] or critical success factors for KM [42,43]. Others [44–46] simply consider KM practices to be the same as generic KM processes (like knowledge creation, sharing, application) that can also be applied to the specific case of inter-firm collaboration in SCs [47].

For some authors, IT-based KM activities [26,48] or other managerial activities, which can be important for handling knowledge resources [26,36,49] and can highly support the introduction and development of KM programs, are not considered as (part of) KM practices. Others [27,39,40] adopt the term “KM system”, which consists of “KM practices”, defined as a set of methods and techniques for supporting KM development, and “KM tools”, namely the specific IT-based systems for KM. In short, the use of IT-based technologies is considered as a separate case from KM practices, even though the use of technologies is generally considered [32] an integral part of KM activities.

Furthermore, there is no standard consensus concerning the different typologies of KM practices [38]. A useful classification is provided by Inkinen et al. [37]. They divide KM practices into ten categories: supervisory work, strategic KM, knowledge protection, learning mechanisms, IT practices, organizing work, and four HRM practices (recruitment, training and development, performance appraisal, and compensation practices). This categorization is important because, unlike others, it encompasses many of the core KM aspects [32] and draws a distinction between KM practices and KM processes, by affirming that these make different contributions to performance management. However, this classification has some limitations. For example, it remains at an overall level, and it may

be difficult to apply it in practice, as can be of use in the case of business education. In particular, its application to SCs is not evident.

In general, the analysis highlights that the literature does not yet offer a complete picture of the set of KM practices that can specifically be used in SC management. The examined papers do not often go deeper into the specific application or importance of KM practices to SCs. Another critical point of the current literature is that the emphasis on KM applied to sustainable SCs is still weak. The issue of sustainability is of growing importance in business, and although it can be argued that a well-managed SC can more easily fit the goals of sustainability anyway, nonetheless, a specific and direct connection of KM to environmentally or socially sustainable SCs still needs to be developed [50,51].

## 5. Discussion

To summarize, the existing literature shows some critical points:

- While the term “KM practice” is often used, there is no consensus about a standard definition. This is the case of both KM in general, and its application to SCs. In addition, although this selection of papers explicitly focuses on KM in SCs, the notion of KM practice is often treated in a general way, and not necessarily with an emphasis on SCs.
- There is often confusion between KM practices and KM processes. The latter notion is important in the KM literature [32] and is useful to distinguish between different basic activities of knowledge handling (for example, knowledge creation is different from knowledge transfer), but has little practical usefulness from a managerial viewpoint because it does not necessarily clarify how to perform each of these activities.
- While IT applications are generally considered an essential part of KM [32], their role in KM practices is often controversial and unclear.
- Comprehensive and clear classifications of practices with concrete meanings and applications in business are still lacking.
- The topic of KM practices for “sustainable SCs” is treated by only few studies.

The lack of standard definitions and classifications of KM practices may reflect the different perspectives in the specific application and is not necessarily an obstacle to training or education in this field. However, to design KM courses that are not restricted to a specific and contingent business case, have a more general applicability, and can address larger categories of management students and professionals, a common and comprehensive framework for the definition and categorization of KM practices can greatly help. This is especially true in the case of SCs (which is the focus of this paper).

To face these problems, a first step is providing a definition of KM practice in the context of business. Based on the analysis of the literature, this study proposes the following notion: “KM practices are a group of organized activities regarding practical methods to manage knowledge, applications of IT tools for KM, and the use of other supporting management measures that can also support the fruitful adoption and development of KM for better performance of firms.” KM practices in SCs can be defined in the same way, but adding that, in these cases, they explicitly focus on “KM for collaboration between different companies and trading partners, involving the various stakeholders in an SC”, and not just on the management of knowledge in the single company under an internal-oriented perspective.

This definition underlines that KM practices:

- are explicitly organized activities, and not simply intuitive or indirect ways to handle knowledge resources;
- must have a concrete relationship with the real problems of KM in business and the solutions that can be adopted for them, and cannot simply be an abstract reference;
- must integrate all of the different approaches that are important for the management of knowledge, in line with a holistic view of KM that encompasses business goals and performances, people, processes, technologies, and organizational contexts [32,52];
- in the case of SCs, they explicitly refer to practices to support KM in inter-firm collaboration.

A further second step is building a classification of KM practices that considers all of the different typologies that must be included. Here, practices are divided into three main categories: KM methods, KM applications of IT, and KM-enabling management measures.

“KM methods” refer to practices that are explicitly and directly targeted to the management of knowledge resources in a company, such as the following: approaches to learning and exchanging knowledge contents; practical or mental toolboxes for favoring the systematization of and access to knowledge resources; organizational arrangements which can be employed to facilitate knowledge sharing among people, and so on. “KM applications of IT” refer to the use of IT systems that can support the management of knowledge contents in some form—for example, explicit knowledge in the case of database repositories and automatic analysis, or tacit knowledge in the case of communication-enabling systems. “KM-enabling management measures” are purposeful KM-related managerial activities that may not directly refer to the management of knowledge but, anyway, can help to set the appropriate organizational context that facilitates the application of KM—for example, appointing KM officers, rewarding KM initiatives, providing leadership and top management support to KM programs, and so on. According to this classification, the analysis of the literature detected 12 “KM methods” in 8 papers, 22 “KM applications of IT” in 14 papers, and 23 “KM-enabling management measures” in 15 papers. After a cross-analysis and revision of these lists to eliminate substantial replications and to highlight the focus on SCs (which is the main topic of this paper), there is a total number of 10 KM methods, 13 KM applications of IT, and 19 KM-related management measures. The detailed results, which show the list of practices along with the categorization, definition, and potential application to KM in SC, are presented in Tables 1–3. Table 1 reports conventional names of KM methods, Table 2 presents names of IT tools that can be applied to KM, and Table 3 shows names of KM-enabling management measures.

**Table 1.** “KM Methods”-related practices and their application to SCs.

KM Methods	Overall Definition	Source	Application to SCs
Community of practice	Group of people sharing common interests, problems, or passions, and discussing issues on an ongoing basis	[27,34,53–55]	Used for collaboration, knowledge creation, and sharing between representatives of SC partners through inter-company communities/groups
Knowledge domain mapping	Charting, mining, analyzing, sorting, enabling, displaying, and browsing an organization’s knowledge	[34,39,54]	Easier knowledge access, revealing knowledge structures in knowledge flows; ensuring that knowledge reaches right people in SC processes
Lessons learnt	Documenting knowledge, learning from experience in a project	[27,54,56,57]	Past experience helping joint project managers to reuse knowledge and avoid repeated mistakes
Knowledge cafes	Frank exchange of ideas or views on a specific issue in groups to attain mutual understanding	[27,54,58]	Helping joint project teams to create and exchange knowledge and improve SC innovation performance
Peer assist	Feedback/clarifications/lessons on a problem/issue among peers	[40,54,58]	Facilitating knowledge sharing, participatory learning, and collective SC problem-solving
Mentoring and coaching for knowledge retention	Guidance and learning between two individuals (mentoring) and developing specific skills (coaching)	[27,39,58]	Boosting knowledge transfer from coach/mentor to junior individuals in SC processes; retaining knowledge of leaving employees
Enterprise social network analysis	Analyzing a company’s social networks as an input for decisions	[25,27,54]	Collected information used to identify knowledge gaps as an input to support integration efforts between SC partners
Case-based reasoning	Problem-solving method to capture and reuse experience in the field for new needs	[59,60]	Solving new SC problems by retrieving past “cases” describing similar prior problem-solving episodes; improving knowledge transfer in supply networks.



Table 1. Cont.

KM Methods	Overall Definition	Source	Application to SCs
Online knowledge searches	Searching for knowledge on alternative online sources	[34,61]	Knowledge acquisition method from different online sources to solve SC problems
Brainstorming	Encouraging individuals to generate creative ideas through group discussion	[27,39,58]	Generating ideas through joint team discussion of experts among SC partners; improving knowledge creation in collaborative partnerships

Table 2. “KM applications of IT tools”-related practices and their application to SCs.

KM Applications of IT	Overall Definition	Source	Application to SCs
Data mining	Searching large data sets for patterns and trends that can't be found with simpler analysis	[27,62–64]	Extracting usable knowledge from different data sources across SCs and developing smart market or production decisions for the benefit of the entire SC
Video conferencing	Platform for remote meetings with integrated data-sharing applications	[27,34,57,62]	Knowledge sharing in joint project teams for co-design, collaboration between SC partners and customers, reducing travel expenses and project times, improving communications of remote teams
Intelligent agents	Software for automatic decisions or information services, by learning from environment and user analysis	[59,62,64]	Helping to capture and preserve tacit knowledge, discover knowledge, generate solutions by data analysis in a complex environment such as SC operations and joint project teams
Simple knowledge organization system (SKOS)	Semantic web technology to manage knowledge across SC in a machine-understandable way	[65]	Ontologies and Web-based platforms facilitate KM among partners for reducing coordination costs in procurement and operations
Database systems and shared folders	Shared collection of interrelated data to meet varied needs of firms	[34,39,66]	Facilitating knowledge storage, retrieval, and sharing internally in a company and across SCs
Enterprise resource planning (ERP)	Structured information systems to manage workflows in operational processes	[27,56,63]	Integrating information systems and processes, standardizing knowledge for operations and logistics in SCs, increasing online access to structured knowledge and decision-making in SCs
Wikis	Corpus of knowledge in linked web pages, based on collective process of creation and editing	[34,48]	Integrating different elements of knowledge collectively created for transferring/sharing knowledge and improving learning and project management among SC partners
Online forums	Online discussion site where people hold conversations via posts	[34,48]	Improving knowledge sharing among SC partners and joint project teams by means of conversations and informal language
Supplier relationship management (SRM)	Systems to assess suppliers' contributions to the business (in operations, and projects)	[24,67]	Helping companies and suppliers to work collaboratively, by means of joint knowledge creation and sharing, and enhancing the value created in the entire SC
Cloud computing	Infrastructure for shared networks of storage, servers and applications over the internet.	[27,40,63]	Facilitating access to data and applications from any location and device with cost savings; providing a more strategic approach for inventory deployment, operations monitoring and prioritization, etc.

Table 2. Cont.

KM Applications of IT	Overall Definition	Source	Application to SCs
Chat rooms and bulletin board systems (BBS)	In chat rooms people engage in real-time textual conversations; in BBS users share contents electronically	[34,57,68]	Helping SC partners to get or give immediate advice, to brainstorm, or get advice from experts; sharing public contents from a huge number of sources
Email and voice mail	Standardized asynchronous system for multiple format messaging	[27,34,62]	Easily sharing rich knowledge contents with internal employees and/or external SC partners
Enterprise social media platforms	Web-based Internet platforms implemented within an organization for a rich content exchange	[39,69]	Improving visibility of business activities in the SC, building social relations between individuals across companies, facilitating informal knowledge exchange, mutual assistance of suppliers, customers, etc.

Table 3. “KM-enabling management measures”-related practices and their application to SCs.

KM-Enabling Management Measures	Overall Definition	Source	Importance for SCs
Knowledge strategy planning	Using knowledge strategy as explicit part of its business strategy internally and/or regarding external partners	[70,71]	Knowledge and KM become key elements of SC strategies
Joint projects	Having joint projects with practices to facilitate knowledge creation and exchange between participants	[47,72]	Joint teams in SCs are designed around KM goals
Top management support	Having strong “top management support” for KM programs, activities, and practices	[19,73]	Strong leadership at company and SC level facilitates knowledge sharing in SCs
KM officers	Assigning roles of Knowledge Management Manager/officer	[74,75]	KM becomes a service provided to a company and its partners
Collaborative KM	Giving strong strategic focus and commitment for collaborative KM with trading partners, advisors, and consultants	[47,56,76,77]	SC implies collaboration and knowledge sharing; knowledge can be acquired from cooperation with external partners
Strategic partnerships	Developing KM-based strategic partnership for managing knowledge resources between SC partners	[77,78]	Strategic alliances in SCs are built based on knowledge resources
KM investments	Allocating adequate resource for knowledge creation, storage, sharing and application activities	[74]	KM becomes a central investment for SC management
KM training	Providing KM-related training, education, and information programs	[50,56,71]	KM becomes integral part of SC management training
Open sharing	Ensuring an organic structure supportive of open communication flows in all directions	[74,79]	SCs become an environment for knowledge sharing
KM assessment	Having knowledge and/or information managers with strategic or action-based missions and regular assessments	[54]	SC relationships are (also) assessed based on KM performance

Table 3. Cont.

KM-Enabling Management Measures	Overall Definition	Source	Importance for SCs
Knowledge networking	Supporting existing networks for knowledge sharing following existing common interests	[74]	Informal networking is favoured as a way of improving SC collaboration
KM recognition	Incentive and recognition of knowledge workers	[28,74,80]	Knowledge workers become key roles in SCs
Knowledge development	Systematic and planned knowledge acquisition or development through training and continuous education	[25,50,56]	Training programs are not restricted to a company but increasingly involve SC partners to acquire or disseminate knowledge about innovations, markets, etc.
Trust building	Building trust for favoring knowledge sharing	[28,35]	Trust as foundation of SC performances
Reducing knowledge leaking	Appropriate governance structure to reduce risk of leaking confidential knowledge internally or with external partners	[28]	Recognition of the value of knowledge in SC relationships
Knowledge protection	Using sound knowledge safeguard/protection measures to encourage knowledge sharing in SCs	[35,81]	Recognition of the value of knowledge in SC relationships
Knowledge communication	Timely and accurate knowledge communication to appropriate managers for strategic decisions	[73,82]	SC management is based on a capability to acquire and use knowledge effectively
Rewarded knowledge sharing	Considering knowledge-sharing practices as a part of regular staff development & performance reviews	[19,74]	Knowledge sharing as a recognized ingredient of SC management
Knowledge retention	Focus on employees leaving/retiring for retention of their knowledge of internal activities and/or external partners	[71]	Recognition of senior managers' knowledge as a key element of SC management

## 6. Conclusions

This paper emphasizes the importance of KM in SCs and highlights that, consequently, KM must become an integral part of the education of future business executives. However, while the literature shows that there is a growing interest in these issues, especially in the last decade, there is a lack of basic definitions and classifications, as in the case of the notion of KM practice and its application to SCs.

Based on this, the contributions of this study are twofold. First, it underlines that the application of KM in SCs is recent, and there is a need for a systematization of concepts and categories for their effective inclusion in business education programs. Second, by performing a thorough analysis of the recent literature, an initial attempt is made to provide a consistent definition of KM practices and to propose their classification into a group of primary categories. In addition, based on a review of the existing studies, a characterization of each practice—both in general terms and specifically for its application to SCs—is initially developed.

For researchers, the major significance of these results is that they can represent a starting point of further studies aimed at facilitating the inclusion of concepts and methods of KM into business education. In particular, there is a necessity to transform generic concepts and ideas developed in KM research into concrete definitions, so that they can be more easily understood by business students and managers. The main argument is that systematically defined and classified KM practices in SCs may be more appropriate for wide

recognition and acceptance than fragmented and highly localized approaches. Another important lesson for researchers is that the link between KM in SCs and sustainability is still underexamined in the current literature. Although the list of KM practices proposed here can have significance (by assuming that a properly managed SC can also more easily become a sustainable SC), this point still deserves specific analysis.

As for a practical application, these classifications can provide an initial reference for the design of KM courses for business management students or professionals. Particularly significant is the categorization of the potential usefulness of the various KM practices for their adoption in SC management; indeed, as mentioned, competition is more and more among SCs and networks of firms rather than single companies, so managers must learn methods to manage knowledge at the level of SCs. The current economic and societal environment, strongly affected by the COVID pandemic, makes it more and more evident that, to face the risk of exposure to disruption in operations and logistics, companies need to take measures with the aim of having a resilient SC management. In doing so, the KM practices described above make it possible to reduce the key knowledge gaps in the management of purchases and supplies, since they provide the management with a transparent end-to-end vision of a traceable and integrated relationship at every level of the SC. Consequently, a capability to implement and effectively handle KM practices must become central in business education.

Being an initial exercise, this study has some clear limitations, which can also be starting points for a future research agenda. Firstly, there is a need for further conceptual and empirical validation for assessing the applicability and relevance of the proposed classification. As mentioned, it is especially essential to go into deeper detail about the specific application of KM practices to SCs, because, as revealed by this analysis, the current literature still remains at a too general level. In addition, some specific points that can be important (for example, the impact of different organizational cultures in SCs and how KM practices can help to reduce it) were not addressed in the literature analyzed in this paper but may be the objects of further analysis. Finally, a clearer focus on KM practices for sustainability is necessary, because these are insufficiently considered in the current literature. This can open new prospects for future research.

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