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Review

Knowledge Management in Startups: Systematic Literature Review and Future Research Agenda

Piera Centobelli [1], Roberto Cerchione [2,*] and Emilio Esposito [1]

[1] Department of Industrial Engineering, University of Naples Federico II, P.le Tecchio 80, 80125 Naples, Italy; piera.centobelli@unina.it (P.C.); emilio.esposito@unina.it (E.E.)

[2] Department of Engineering, University of Naples Parthenope, Centro Direzionale di Napoli, Isola C4, 80143 Naples, Italy

* Correspondence: roberto.cerchione@unina.it; Tel.: +39-081-768-2490

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Abstract: This paper conducts a systematic literature review on knowledge management (KM) in the context of startups in order to analyze the state of the art, identify research gaps and define a future research agenda. The main findings highlight that, even though there is an increasing number of papers on the topic of KM in startups, several issues are still neglected. Specifically, the paper identifies four main gaps in the body of literature. The first gap deals with the environmental and socio-political factors influencing the adoption of KM in startups. The second gap regards the lack of a comprehensive taxonomy of knowledge management systems (KMSs) that may support the processes of knowledge creation, acquisition, storage, transfer, sharing and application. This second gap allows us to identify a third gap concerning the level of alignment between startup's strategies and technologies adopted. Finally, the fourth gap deals with the issue of the impact of KM on startup's performances with regard to economic, financial, market, technical, technological, organizational, human and relational performance. From these four gaps, six research questions (RQs) have been proposed. These RQs allow us to identify possible areas of analysis to define a future research agenda. Neglecting these issues means underestimating all the possible advantages of KM adoption for a startup to achieve efficiency, effectiveness and scalability goals.

Keywords: entrepreneurship; factors affecting KM; KMSs; knowledge management; performance; start-up firms; scalability

1. Introduction

In recent years, many papers highlight that knowledge management (KM) is acquiring a pivotal role in the global economy and a crucial importance for the competitiveness of both large firms and small and medium enterprises [1–7]. In fact, nowadays, an increasing number of contributions are showing how firms can leverage KM to promote significant innovations and cultural changes that influence positively organizational sustainability [8,9] across business, environmental and social justice contexts [10]. Knowledge sharing processes with customers and other stakeholders allow firms to achieve sustainable business goals [11], sustainable environmental goals [12,13], and sustainable social goals [14]. More specifically, managing the impact of industrial firms' operations on the environment could be supported by the adoption of innovative collaborative technologies for KM [15–19]. Therefore, this literature demonstrates how KM has an integrated impact on the three perspectives of sustainability: economical perspective, environmental perspective and social perspective.

Nevertheless, even though there are many contributions that analyze the processes of creation, storage and transfer of KM in both large firms and small and medium enterprises (SMEs), as concerns

startups, the body of literature is still unstructured. Specifically, while the literature proposes different approaches with regard to established enterprises, analyzing the success factors and barriers affecting KM adoption, the knowledge management systems (KMSs) used, and the relationship between KM and firm's performance, only in recent years several contributions have been focusing on KM in the context of startups [20–22].

The importance of this topic is demonstrated by the definition of startup provided by Blank (2012) [23] as an "organization formed to search for a repeatable and scalable business model". Due to the scarcity of resources characterizing a startup, it should necessarily leverage on intangible assets like knowledge and human capital to achieve scalability goals. Therefore, it emerges the necessity to adopt knowledge management strategies focusing on the issues related to the epistemological and ontological perspectives of knowledge [24]. As for the epistemological dimension, knowledge created in organizations is mainly tacit [25]. Concerning the ontological dimension, there is a kind of common knowledge shared among the organization's members in the knowledge creating cycle [26]. These contributions suggest that in startups the processes of creation, storage, transfer of knowledge should leverage on knowledge nature that is mainly human embedded. In addition, even knowledge management systems supporting the spread of KM practices should be aligned with the nature of knowledge of startups.

Based on the above described scenario, the aim of the present systematic review on KM in startups is to identify the main factors influencing positively or negatively the adoption of KM in startups, the main knowledge management systems adopted by startups and the impact of knowledge management on startup's performance (RQ). In addition, the main findings of this paper will allow us to identify research gaps to be explored, and to provide a research agenda for future researchers.

The paper is structured in four sections. After the introduction, in the second section the methodology is illustrated. The third section presents the content analysis of papers selected in the review process. The final section includes conclusions and implications.

2. Methodology

In this paper, we propose a systematic review dealing with knowledge management in startups. A systematic review is an overview of scientific contributions on a topic adopting replicable methods [27]. According to Greenhalgh, Pittaway et al. (2004) [28] define a systematic methodology organized in ten steps, starting from identification of keywords until the validation of papers selected through the citation method. Petticrew and Roberts (2006) [29] propose a conceptualization of systematic review as a "review that strives to comprehensively identify, appraise and synthesize all relevant studies on a given topic" and suggest a review organized into 12 steps. Easterby-Smith et al. (2012) [30] identify two main processes in conducting a systematic review. The first consists in defining the review protocol and the relevance of studies in the research field under investigation. The second describes the main findings to identify research gaps in the existing body of knowledge.

Summarizing the above contributions and according with Cerchione and Esposito (2016) [31], our literature review is organized into two main phases that in their turn are divided into two steps.

1. Phase of papers acquisition and selection:
    (a) Material search: This step includes the identification of keywords and the choice of databases to be investigated (Scopus, Web of Science, etc.).
    (b) Selection: This step includes the definition of criteria for inclusion/exclusion and the process of selection according to the criteria of inclusion/exclusion.
2. Phase of descriptive and content analysis of the selected papers:
    (a) Descriptive analysis: The papers are aggregated according to different perspectives to give a summary view of the selected papers.

(b) Content analysis: Papers are reviewed and studied in deep. The analysis of papers highlights strengths and weaknesses in the body of literature, evidences research gaps and define a future research agenda on the topic.

2.1. Phase of Material Search

The papers are selected using the databases Scopus and Web of Science, searching the ones published from 1990 to 2016, as knowledge management related to startups is a quite new topic of research. The keywords set used is: "Knowledge Management" or "KM", combined with "startup*", "start-up*", "entrepr*", in which the use of the asterisk allows us to select papers containing the words "startup", "startups", "start-up", "start-ups", "entrepreneur", "entrepreneurship", and "entrepreneurial".

A total of 947 papers are initially found in the two databases (Table 1).

Table 1. Material search.

Keywords Used	**("Knowledge Management" or "KM*") and ("Startup*" or "Start-Up*" or "Entrepr*")**
Date range	Published from 1990 to present
Scopus database	678 hits
Web of Science database	291 hits
Total hits retrieved in two databases	969
Duplicates	22
Number of hits excluding duplicates	*947*

2.2. Phase of Selection

In order to focus on the research products closer to the topic under investigation, three selection criteria for research papers were identified as reported in Table 2.

Table 2. Criteria for inclusion/exclusion.

Criterion	**Definition**
First criterion: focus of the abstracts	Abstracts focusing on startups and knowledge management have been included
Second criterion: focus of the papers	Papers focusing on startups and knowledge management have been included
Third criterion: cited references	Papers not included in Scopus and Web of Science but cited in the literature on knowledge management have been included

The first criterion allows us to select only those papers whose abstracts deal with the topic of KM in the context of startups. With this aim in mind, the abstracts of the selected papers were analyzed by three reviewers. Therefore, the 947 papers were categorized into the following three lists as shown in Table 3:

- List A includes papers with a focus on both startups and knowledge management;
- List B includes papers with a prevalent focus on knowledge management, but scarce or insignificant reference to startups; and
- List C includes papers with a predominant focus on startups, but scarce or inconsiderable reference to knowledge management.

Table 3. First step selection.

List	Description	Number of Papers
A	Papers with a focus on both startups and knowledge management	32
B	Papers with a prevalent focus on knowledge management but scarce or insignificant reference to startups	757
C	Papers with a predominant focus on startups but scarce or inconsiderable reference to knowledge management	158
Total		947

The papers contained in List C (158 papers) and List B (757 papers) were excluded as they were out of the scope of the research. The 32 papers contained in List A were fully considered and subjected to the second criterion to be analyzed in detail. The second criterion regards the focus of the paper. For this objective, papers have been analyzed a second time. The third criterion concerns references cited in the literature analyzed but not included in Scopus and Web of Science. No additional papers were identified and this aspect validates the proposed review process. Therefore, the papers selected for the subsequent phase of descriptive analysis are 32.

2.3. Phase of Descriptive Analysis

The aim of the descriptive analysis is to give a preliminary analysis of the papers focusing on the issue of KM in the context of startups. For the descriptive analysis of the 32 selected papers, four perspectives are defined:

1. Papers over time;
2. Papers across journals;
3. Papers by methodology; and
4. Papers by topic area.

2.3.1. Papers over Time

According to distribution over time (Figure 1), a significant number of contributions have been published in 2015 (nine papers). In addition, there is only one paper written before 2000, precisely in 1995. The majority of papers are published between 2008 and 2015 (27 papers), and only four papers from 2000 to 2007. The trend of contributions on this topic is therefore increasing in recent years.

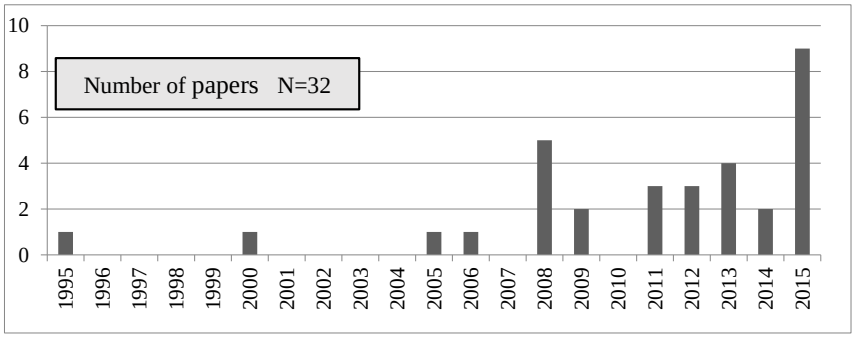

Figure 1. Paper distribution over time.

2.3.2. Papers across Journals

Using the functionalities provided by the platform SCImago Journal Rank (SJR), eleven journal subject areas are identified (Table 4): "Business, Management and Accounting", "Computer Science", "Decision Sciences", "Economics, Econometrics and Finance", "Engineering", "Environmental Science", "Materials Science", "Psychology", and "Social Sciences".

Table 4. Paper distribution by journals.

	Journal	Psychology	Business, Management and Accounting	Decision Sciences	Engineering	Computer Science	Economics, Econometrics and Finance	Environmental Science	Materials Science	Social Sciences
APMR	Asia Pacific Management Review		X							
CEP	Control Engineering Practice				X	X				
FBJ	Future Business Journal									
HFEMSI	Human Factors and Ergonomics in Manufacturing and Service Industries		X					X		
IJPM	International Journal of Project Management		X					X		
IM	Information and Management		X	X		X				
ISBJ	International Small Business Journal		X							
ISISE	International Symposium on Information Science and Engineering				X					
JBM	Journal of Business Management		X							
JBR	Journal of Business Research		X							
JCMC	Journal of Computer-Mediated Communication					X				
JHTMR	Journal of High Technology Management Research		X	X		X				
JKMP	Journal of Knowledge Management Practice		X							
LRP	Long Range Planning		X				X			X
PFVO	Processes and Foundations for Virtual Organisations		X							
PSBS	Procedia Social and Behavioural Sciences	X								X
SBE	Small Business Economics		X				X			
SEJ	Strategic Entrepreneurship Journal		X				X			
TFSC	Technological Forecasting and Social Change	X	X							
TV	Technovation		X		X					

Table 4 highlights an important aspect. Although most papers focusing on knowledge management in startups are placed in the subject area of "business, management and accounting", it is evident that this is a crossroad research topic, which involves a variety of journals focusing on different subject areas, including also humanistic studies like psychology.

2.3.3. Papers by Methodology

As concerns the methodology adopted by the papers, the majority of papers are based on quantitative methodologies, with fewer papers using qualitative, conceptual or mixed approaches (Figure 2).

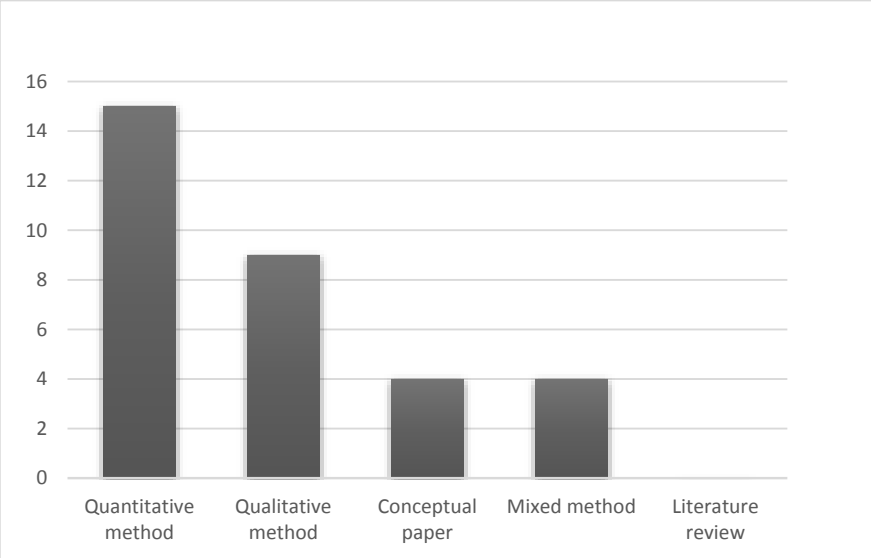

Figure 2. Paper distribution by methodology.

The fifteen papers based on quantitative methods are divided into 12 surveys, two mathematical models and a simulation model. Regarding the 12 surveys, there are four different ways of collecting data: e-mail (1); online form (2); face-to-face (8); and telephone (1). The high percentage of face-to-face mode identifies a significant literature attention for qualitative topic as knowledge management in startups.

The nine papers based on qualitative methods are single (4) or multiple (5) case studies.

The four conceptual papers are based on previous theoretical approaches and do not use empirical data but secondary data and information. The four papers based on mixed methods combine qualitative and quantitative methodologies.

2.3.4. Papers by Topic Area

Papers are clustered according to three topic areas identified to get a full overview of the body of literature:

1. "Factors influencing knowledge management in startups", in which main critical success factors (CSFs) and barriers related to the introduction of knowledge management in startups are identified;
2. "Knowledge management systems adopted by startups", in which appropriate knowledge management tools (KM-Tools) and knowledge management practices (KM-Practices) facilitating knowledge management in startups are analyzed; and
3. "Impact of knowledge management on startup's performance", in which it is shown the relationship between KM and different types of performances.

Table 5 highlights that "knowledge management systems adopted by startups" is the topic area with the highest number of papers (13), "impact of knowledge management on startup's performance" includes 10 papers, and "factors influencing knowledge management in startups" includes nine papers.

Table 5. Papers by topic area.

Topic Area	References	Key Findings
1. Factors influencing knowledge management in startups	Acs et al. (2008) [32]	**CSFs:** Technological factors
		Barriers: Intellectual property protection
	Bengoa (2011) [33]	**CSFs:** Relational factors
		Barriers: Knowledge protection
	Burger-Helmchen (2008) [34]	**CSFs:** Relational factors, technological factors
	Csaszar et al. (2005) [35]	**CSFs:** Strategic factors
	De Clerq and Arenius (2006) [36]	**CSFs:** Human and cultural factors, relational factors, startup specific factors
	Gibbs et al. (2013) [37]	**CSFs:** Managerial and organizational factors, technological factors
	Lu and Sexton (2009) [38]	**CSFs:** Relational factors, technical and technological factors
	Mathew et al. (2012) [39]	**CSFs:** Human factors, managerial and organizational factors
	Presutti et al. (2011) [21]	**CSFs:** Geographical factors
2. Knowledge management systems adopted by startups	Alvarez et al. (2015) [40]	**KM-Practices:** Collaborative teams
	Antlova (2008) [41]	**KM-Tools:** Customer relationship management (CRM) system
	El Said (2015) [42]	**KM-Tools:** Forum, enterprise portal, mobile app
	Hu and He (2008) [43]	**KM-Tools:** Project knowledge management system
	Lisanti et al. (2014) [44]	**KM-Practices:** Class diagram, use case diagram, user interface prototyping
		KM-Tools: Database
	Liu et al. (2012) [20]	**KM-Tools:** Social network
	Menaouer et al. (2015) [45]	**KM-Practices:** Critical knowledge mapping practices, method for analyzing and structuring knowledge (MASK), theory of inventive problem solving (TRIZ)
	Midler and Silberzahn (2008) [46]	**KM-Tools:** Project knowledge management system
	Steinfield et al. (2010) [47]	**KM-Tools:** Collaborative technologies, intranet, learning management system, online database
	Trögl and Maier (2011) [48]	**KM-Tools:** Enterprise knowledge infrastructure (EKI), data warehouse
	Yan and Assimakopulos (2013) [49]	**KM-Practices:** Community of practice (CoP), project management techniques, system design process, project teams
		KM-Tools: Social network
	Yazdi et al. (1995) [50]	**KM-Tools:** Decision support system (DSS)
	Zheng and Mai (2013) [51]	**KM-Practices:** Collaborative teams
		KM-Tools: Transactive memory system (TMS)
3. Impact of knowledge management on startup's performance	Calvo-Mora et al. (2015) [52]	**Economic and financial** performance, **relational** performance
	Chen and Fong (2015) [53]	**Economic and financial** performance
	Chica (2014) [54]	**Economic and financial** performance
	Debrulle et al. (2013) [55]	**Environmental** performance, **human** performance, **relational** performance
	Krumina et al. (2015) [56]	**Economic and financial** performance
	Nowacki and Bachnik (2015) [57]	**Economic and financial**, **organizational** performance, **relational** performance
	Oe and Mitsuhashi (2012) [58]	**Economic and financial** performance
	Rubin et al. (2015) [22]	**Economic and financial** performance, **market** performance, **technical and technological** performance
	Teece (2000) [59]	**Economic and financial** performance, **organizational** performance
	Wang and Yang (2016) [60]	**Economic and financial** performance, **organizational** performance, **relational** performance

3. Phase of Content Analysis

The content analysis of the 32 papers allows us to provide a detailed overview of the issues covered by the literature on KM in the context of startups. The three content perspectives identified allow us to categorize the selected papers into three content areas: Area 1, factors influencing KM in startups; Area 2, KMSs adopted by startups; and Area 3, impact of KM on startup's performance. These areas are presented in the following paragraphs.

Area 1. Factors influencing knowledge management in startups

The first area includes nine papers and deals with the factors that might positively or negatively influence knowledge management adoption in startups. Csaszar et al. (2005) [35] suggest a decision support system with the purpose to support venture capitalists in their decision-making process with a methodology which integrates strategic and cognitive criteria. The authors highlight that predictive frameworks are very important for the development of startups. The methodology used has been subdivided into three main steps: (1) data collection; (2) strategic evaluation; and (3) cognitive evaluation.

De Clerq and Arenius (2006) [36] carry out a survey in Belgium and Finland to examine the effects of individual's education, skills and contacts with the existing entrepreneurial community on the ability to launch a startup. These latter are critical success factors with a strong impact on the individual's decision process to become an entrepreneur. The results show how the likelihood to engage in startup activity is positively correlated to the individual's current knowledge base and the individual's exposure to external knowledge. Therefore, these findings demonstrate the crucial role of knowledge management in explaining nascent entrepreneurship. More specifically, the authors suggest that individual's differential possession of knowledge as well as their differential exposure to external knowledge has an impact on the decision to pursue an entrepreneurial career.

Acs et al. (2008) [32] highlight that the theory of economic growth has its roots in knowledge spillover theory of entrepreneurship, as it allows startuppers to catch business opportunities. The authors support the thesis that startups base their entrepreneurial activities on knowledge application in order to achieve incremental innovation and product improvements. According to numerical experiments, they prove that the entrepreneurial activities are more efficient and effective in knowledge-based startups, because the continuous knowledge creation processes allows startups to catch new technological opportunities. Finally, the authors analyze how an inappropriate use of intellectual property protection in startups could represent a potential barrier hindering knowledge sharing processes, and therefore innovations and scalable growth.

Burger-Helmchen (2008) [34], basing his research on single longitudinal case study analysis of a startup operating in the high-tech industry, investigates how different forms of entrepreneurship allows a knowledge-based startup to create an innovative dynamics leveraging on technological innovation. The results highlight that that knowledge sharing processes among the startup's members affect positively entrepreneurial activities during the launching and expansion phases.

Lu and Sexton (2009) [38] discuss about the establishment and growth of a high-tech startup, studying the concrete case of a startup funded on construction knowledge exchange. The results show how the five principal components of a startup are influenced by knowledge: (1) technical know-how, brought as knowledge from the founders; (2) product idea; (3) personal contacts, in which the networks are both sources of knowledge and sources of legitimacy for the firm; (4) physical resources; and (5) customer orders.

Bengoa (2011) [33] focuses the attention on the importance of relationships and trust as facilitators of knowledge sharing in startups. An open and trustful attitude allows startups to support knowledge sharing processes among people of different cultures. On the contrary topic of trust, knowledge protection attitude represents a barrier hindering business cooperation. With these premises in mind, the author shows how trust must be taking care, and ignoring this care or abusing from it represents a high risk of both business relationship and profitability. This trust will be the basis to solve problems

or to overcome difficulties in adverse times. Therefore, in order to develop trust, companies must be committed to provide the ground in terms of having opportunities for people to meet and interact.

Presutti et al. (2011) [21] propose a decision support system to evaluate the impact of geographical proximity on the processes of knowledge acquisition and exploitation of startups operating in high-tech industries. The authors evaluate in their research the role of both the social and cognitive dimensions of geographical proximity. The findings highlight how startups belonging to an industrial cluster acquire knowledge from their customers and this aspect shows the importance of geographical proximity between business partners.

Mathew et al. (2012) [39] analyze the effects of post globalization in the IT sector related to the "people" dimension of knowledge management initiatives in the information technology industry. Varying dynamically the human dimension of knowledge management, the authors study their influence on knowledge management system performance in conjunction with the other success factors. The results of the simulations underline how the support of the top management represents a critical success factor for the adoption of knowledge management strategies.

Gibbs et al. (2013) [37] explore the ways through which knowledge sharing processes could led to covert behavior and dialectical tensions for distributed workers that must be communicatively managed. The authors highlight that engineers operating in a high-tech startup face tensions in their work due to technological factors that allow for both overt and covert behavior. Specifically, they identify three dialectal tensions affecting knowledge sharing processes across different geographical locations: (1) visibility vs. invisibility; (2) engagement vs. disengagement; and (3) sharing vs. control. These findings highlight the productive role of tensions in enabling startups to achieve multiple aims.

In summary, the literature that focuses on this first area highlights a variety of critical success factors and barriers that affect KM adoption; these factors may be classified into seven main categories: (1) human and cultural factors (individual's education, skills and current knowledge base; (2) geographical factors (geographical proximity between business partners); (3) managerial and organizational factors (organizational tensions, support of top managers); (4) relational factors (trust, sharing processes among members, individual's exposure to external knowledge); (5) startup specific factors (contacts with the existing entrepreneurial community); (6) strategic factors (predictive frameworks); and (7) technical and technological factors (technical and technological know-how of founders). Nevertheless, the literature does not consider other categories of factors that affect the adoption of knowledge management in startups, such as environmental factors, in terms of product technology transfer effectiveness and/or uncertainty, and socio-political factors, in terms of socialization, partner's power, opportunistic behavior, institutional orientation.

In addition, content analysis of this area shows that the literature on the topic focuses on some specific critical success factors or on some specific barriers (namely, intellectual property and knowledge protection), but it does not emerge an interpretive framework for CSFs and barriers affecting KM adoption. Specifically, no distinction emerges between "pure CSFs" (i.e., factors whose presence would have a positive impact on KM adoption, but their absence would not hinder KM adoption), "pure barriers" (i.e., factors whose presence would hinder KM adoption, but whose absence would not positively affect KM adoption), "contextual CSFs/barriers" (i.e., factors whose presence would affect positively/negatively KM adoption, but whose absence would positively hinder/affect KM adoption).

This last point highlights the need for a clear definition of CSFs and barriers, a consequent identification of a set of factors that drive or hinder KM adoption, a contextual classification and a more comprehensive empirical investigation in startup context.

Area 2. Knowledge management systems adopted by startups

The second area includes 13 papers focusing on knowledge management systems to support knowledge management adoption in startups. This is the most explored area. In our approach and according to Cerchione and Esposito (2017) [3], a KMS is an information system and/or a

managerial practice adopted to support companies in creating, storing, transferring, sharing or applying knowledge.

The first researchers who studied the introduction of knowledge management in a startup were Yazdi et al. (1995) [50]. The authors present a knowledge-based method to investigate how the complexity and the non-linear behavior of a startup necessitates the continuous application of entrepreneurs' knowledge and experience. Using the fuzzy-logic the authors develop a decision support system (DSS) to identify the tracking control tasks. The results show that startups adopting the proposed DSS could reduce more than 25% in loss of time and energy.

Antlová (2008) [41] investigates how customer relationship management systems support startups in knowledge sharing process with customers. Through the alignment of knowledge management strategies, long term business goals and efficient using of information and communication technology startups could be successful.

Hu and He (2008) [43] propose a project knowledge management system to support the processes of knowledge capturing, knowledge sharing and knowledge reusing for startups in managing the complexity of multiple projects. According to these authors, a project knowledge management system is based on five main functions: (1) capture; (2) digitization; (3) validation; (4) share; and (5) reuse. The proposed web-based system allows project teams of startups to manage knowledge reuse in multiple project environment.

Midler and Silberzahn (2008) [46] develop a project-learning-based system to manage knowledge in startups. Specifically, this system allows startups to integrate three different bodies of knowledge: project management, organizational learning and entrepreneurship.

Steinfield et al. (2009) [47] conduct a survey on a sample of 58 Danish and Swedish startups belonging to the Medicon Valley biotech region to explore the use of specific ICTs supporting knowledge management, i.e., collaborative tools to connect with off-premise researchers, intranets to enhance employee access to information and education, online databases for recruitment.

Trögl and Maier (2011) [48] analyze how the adoption of enterprise knowledge infrastructure (EKI) supports startups in the processes of knowledge creation and sharing using active documents. The authors show that these systems allow startups to handle semi- or unstructured data, whereas data warehouses allow handling structured data. Therefore, EKIs are often central server based solutions and give the possibility to store metadata linked to the corresponding decontextualized information. In addition, EKIs integrate additional functionalities (e.g., communication functionalities), which will support startup's member in their KM strategies.

Liu et al. (2012) [20] conduct a survey on a sample of 91 Chinese startups to investigate the impact of startup's social network on knowledge transfer process. The results highlight that a high density and centrality of start-up's social network improve the process of knowledge transfer from the social network to start-up firm.

Yan and Assimakopoulos (2013) [49] explore the role of social network and community of practice (CoP) as a knowledge sharing tool and knowledge sharing practice based on interpersonal interaction among the engineers operating in a digital Chinese startup. The main findings of the paper highlight that the majority of problems affecting startups are associated with specific knowledge management practices and project management techniques embedded in the system design process. In fact, each part of a complex system may have different kind of relationships with other parts that are not formalized but easy to understand within project teams.

Zheng and Mai (2013) [51] analyze the use of founding teams' transactive memory systems (TMS) to influence the way through which startup's members acquire, store and share knowledge. The authors conduct a survey data involving 137 Chinese startups to show that in emerging countries where market supporting institutions are deficient, founding teams with strong TMSs are less inclined to acquire external knowledge but are more prone to improvise in response to surprises than founding teams with weak TMSs.

Lisanti et al. (2014) [44] investigate how the implementation of a knowledge management system in startups and small and medium enterprises operating in Jakarta allows entrepreneurs to grow their business. The authors highlight that selecting the right implementation approach for a KMS (e.g., involving enterprises association, vendors/suppliers and professional to develop the content and encourage startups and small and medium enterprises to participate) has a pivotal role for the success of KM strategies. In order to develop the KMS, they designed a knowledge management system model consisting on KMS cycle, class diagram, database, use case diagram and user interface prototyping.

Alvarez et al. (2015) [40], basing on 22 Basque startups grouped into industrial clusters, investigate the relation between formality in knowledge management practices and the size of the organization. The main findings of this contribution highlight that informal knowledge management practices in startups are not formalized and standardized, but they are performed by the collaborative work between startup's members. In addition, the size of the startup impacts on the level of formality in knowledge management process and this aspect supports startup's managers to understand where the organizational knowledge is found within organizations and, consequently, to not neglect the importance of personal knowledge.

El Said (2015) [42] contributes to knowledge management system research by extending task technology fit (TTF), a model which is widely employed to study knowledge management systems, with the intention to share knowledge construct, in investigating the determinants of knowledge management system impact. Among the key factors, intention to share knowledge is found to be especially important as it positively and significantly affects perceived TTF, utilization and knowledge management system impact. The author finds that the enterprise portal created in this way should be able to accommodate some technological gap issue in order to easily use the system and contribute to share information in the forum, eventually accessing the Internet with mobile phones.

Menaouer et al. (2015) [45] present an innovative approach to support startup's innovation guided by critical knowledge mapping practices. This approach is based on the method for analyzing and structuring knowledge (MASK), and on the exploitation of capitalized knowledge for innovating the production processes using the TRIZ (Russian acronym for "Theory of Inventive Problem Solving") method. The main findings of this contribution show the possibility of generating paths of innovation and/or innovative products from the trades knowledge of startup's actors formalized and capitalized according to the formalism of the MASK method.

In summary, the papers that focus on this second area analyze specific knowledge management practices (i.e., class diagram, use case diagram, user interface prototyping, critical knowledge mapping practices, method for analyzing and structuring knowledge, theory of inventive problem solving, community of practice, project management techniques, system design process, project teams, and collaborative teams) and knowledge management tools (i.e., customer relationship management system, forum, enterprise portal, mobile app, project knowledge management system, database, social network, collaborative technologies, intranet, learning management system, enterprise knowledge infrastructure, data warehouse, decision support system, and transactive memory system) influencing the process of knowledge management adoption in startups. Nevertheless, they do not offer an exhaustive framework for the set of KMSs (i.e., both tools and practices) that may support methods and techniques of KM in startups in order to support the different phases of knowledge management process (e.g., creation, acquisition, storage, transfer, sharing, application). With these premises, the content analysis of "knowledge management systems in startups" highlights the need of a systemic approach to analyze a taxonomy of different tools and practices, implemented by individual companies to improve both the efficiency and the effectiveness of knowledge management adoption in startups.

This gap addresses an issue of great interest in the literature on management: the analysis of the level of alignment between managerial strategies and the technologies used [61,62]. In startup context, the issue of alignment between the nature of firm's knowledge and the knowledge management systems (KMSs) used to support knowledge management is extremely relevant for the following three reasons: (1) an alignment between the nature of knowledge and the KMSs used is a critical success factor

that could drive the KM process; (2) a misalignment between the nature of knowledge and KMSs creates problems of inefficiency and inefficacy; and (3) the information and communications technologies (ICTs) have been offering over the last twenty years new opportunities in terms of new knowledge management tools that are low cost, easy to use and present an improved performance/price ratio [63,64].

Area 3. Impact of knowledge management on startup's performance

The third area dealing with the relationship between knowledge management and startup's performance includes 10 papers. Teece (2000) [59] investigates how the adoption of KM strategies affects startup's organizational performance. Knowledge assets integrate tacit and codified knowledge, both technological and organizational, which can be easy to transfer and use inside the firm, but difficult for the external members to acquire and/or reuse. The thesis of the authors is that competitive advantage in startup's environmental performance flows from the processes of knowledge creation, storage and application of difficult-to-imitate knowledge assets.

Oe and Mitsuhashi (2012) [58] carry out a survey involving 382 American nascent entrepreneurs using data from the Panel Study of Entrepreneurial Dynamics (PSED). The main findings of the study show that entrepreneurs' knowledge and experience sharing in the same industry impact positively on startup's performance.

Debrulle and Maes (2013) [55] investigate how a business owner's human and social capital affects startup's performance in terms of absorptive capacity under different environmental conditions linked to the emergence of the knowledge-based economy, which made external information processing a central point in a firm. The results confirm that for industry experience to remain valuable to organizational information processing, an owner needs to keep his industry-related knowledge up-to-date.

Chica (2014) [54] analyses the effects of knowledge economies on startup's performance related to metropolitan employment growth. The aim of their research is to understand and model how knowledge economy externalities affect metropolitan employment density growth, and how the inter-municipal distances to the metropolitan core and the other largest metropolitan cities encourage that process. Studying the metropolitan regions of Barcelona and Helsinki, the author finds that the cities, especially the larger ones and their surrounding areas of both metropolitan regions, have a high value of knowledge economy activity concentrations due to the agglomeration economies found in them. Hence, the proximity to these large cities becomes the main factor that explains employment density and new enterprises growth.

Calvo-Mora et al. (2015) [52] analyze the potential of the excelled model designed by the European Foundation for Quality Management (EFQM) to implement a knowledge management project (KMP) in order to improve the startup's performance. Furthermore, the adoption of process methodology and the involvement of customers, suppliers and partners have a significant impact on the key results of the business.

Chen and Fong (2015) [53] conduct a survey on a sample of 143 startups to evaluate their KM performance using a system dynamics approach.

Krumina et al. (2015) [56] investigate a cluster of rural startups located in Latvia to analyze the relationship between knowledge management adoption and startup's sustainable growth. Their paper analyses statistical data, considers theory on knowledge management and explores recent trends and recommendations contained in literature. The results highlight that the majority of rural startups investigated are not adopting KM strategies and this issue impacts negatively on their performance.

Nowacki and Bachnik (2015) [57] highlight the relationship between knowledge management and startup's performance in terms of revenues, competitiveness, business partners' satisfaction, and buyers' satisfaction.

Rubin et al. (2015) [22] analyze how incubators allow startups to improve their performance considering the interrelationships through which the incubator stakeholders share knowledge. Authors

show that startups tend to fail because they lack managerial experience and ability to raise capital in early stage. The incubators can support startups by offering experienced monitoring skills and by enhancing access to capital at a firm's early stage. Providing evidence from Australian and Israeli incubators, they find that collaborations between incubates, graduated incubates and incubator management increase the incubates' knowledge of technology and market in both countries; collaboration between incubates and incubator management also increase incubates' financial knowledge and their likelihood of raising capital; universities played a modest role as a source of new ideas for incubates, but a more important role in later stages of incubates' new product development processes.

Wang and Yang (2016) [60] conduct a survey in Taiwanese startups to investigate the importance of knowledge management adoption to improve startup's organizational performance. This study was the first empirical test of an adoption of a knowledge management success model, considered a better way to describe knowledge management success due to its strong theoretical grounding to analyze the influence of KM and interactions on workers' productivity in startups. Additionally, in line with their knowledge management success model, the authors propose that a combination of system quality, knowledge quality and service quality determines the level of knowledge management use and overall user satisfaction. The results of this paper validate the following nine empirical hypotheses: (1) system quality is correlated positively with KM adoption; (2) knowledge quality is correlated positively with KM adoption; (3) service quality is correlated positively with KM adoption; (4) system quality is correlated positively with user satisfaction; (5) knowledge quality is correlated positively with user satisfaction; (6) service quality is correlated positively with user satisfaction; (7) KM adoption is correlated positively with user satisfaction; (8) KM adoption is correlated positively with net benefit; and (9) user satisfaction is correlated positively with net benefit.

In summary, the literature highlights that the process of knowledge management can have a positive impact on seven different startup's performances: (1) economic and financial performance; (2) environmental performance; (3) human performance; (4) market performance; (5) organizational performance; (6) relational performance; and (7) technical and technological performance. Nevertheless, it emerges the necessity to provide a systemic evaluation of the impact of knowledge management on startup's performance, considering a comprehensive taxonomy of performances including the above seven categories.

In this context, this issue of the relationships between knowledge management and startup's performance cannot neglect to consider in an integrated manner the impact of KM on the variety of performances identified by the different contributions. Neglecting this issue means to underestimate all the possible advantages of KM adoption for the startup in order to achieve scalability goals.

4. Conclusions

This paper has proposed a systematic review on the topic of KM in the context of startups, which allowed providing a comprehensive framework and identify some gaps in literature from which derive a research agenda to improve the body of literature.

In relation to the research question identified, the present review aims to identify the main factors influencing positively or negatively the adoption of KM in startups, the main knowledge management systems adopted by startups and the impact of knowledge management on startup's performance.

The descriptive analysis offers an overview of the papers included in the literature review. It has allowed providing a summary view of the papers on the topic of knowledge management in startups. In particular, the descriptive analysis has highlighted that the trend of papers on the topic is increasing in recent years and it is a crossroad research area that involves a variety of journals that focus on different issues. The majority of contributions are based on quantitative methodologies, with few papers using qualitative, conceptual or mixed approaches (quantitative and qualitative).

The content analysis of the papers included in the literature review has given us a detailed overview of the main issues covered by research on knowledge management in startups and has allowed us to identify the principal research gaps characterizing the literature on the topic.

As for the first area dealing with factors affecting KM in startups, the literature considers a variety of seven main categories of factors: (1) human and cultural factors; (2) geographical factors; (3) managerial and organizational factors; (4) relational factors; (5) startup specific factors; (6) strategic factors; and (7) technical and technological factors. However, the literature does not consider other categories of factors that affect the adoption of KM in startups, such as environmental factors (e.g., product technology transfer effectiveness and/or uncertainty) and socio-political factors (e.g., socialization, partner's power, opportunistic behavior, and institutional orientation). Furthermore, content analysis of this area shows that the literature on the topic focuses on some specific critical success factors or on some specific barriers (namely intellectual property and knowledge protection), but it does not emerge an interpretive framework for CSFs and barriers affecting KM adoption. Specifically, no distinction emerges between "pure CSFs" (i.e., factors whose presence would have a positive impact on KM adoption, but their absence would not hinder KM adoption), "pure barriers" (i.e., factors whose presence would hinder KM adoption, but whose absence would not positively affect KM adoption), "contextual CSFs/barriers" (i.e., factors whose presence would affect positively/negatively KM adoption, but whose absence would positively hinder/affect KM adoption). This last point highlights the need for a clear definition of CSFs and barriers, a consequent identification of a set of factors that drive or hinder KM adoption, a contextual classification and a more comprehensive empirical investigation in startup context. Starting from this gap, it is possible to formulate the first two research questions:

RQ1: *What are the critical success factors and barriers affecting KM adoption in startups?*
RQ2: *How do environmental and socio-political factors affect KM adoption in startups?*

With regard to the second area focusing on KMSs adopted by startups, according to the definition of KMS provided by Cerchione and Esposito (2017) [3] the literature analyses specific knowledge management tools and knowledge management practices influencing the process of KM adoption. KM-Practices analyzed include class diagram, use case diagram, user interface prototyping, critical knowledge mapping practices, method for analyzing and structuring knowledge, theory of inventive problem solving, community of practice, project management techniques, system design process, project teams, and collaborative teams. KM-Tools comprise customer relationship management system, forum, enterprise portal, mobile app, project knowledge management system, database, social network, collaborative technologies, intranet, learning management system, enterprise knowledge infrastructure, data warehouse, decision support system, and transactive memory system. Nevertheless, from the literature, a comprehensive taxonomy of KMSs (i.e., both tools and practices) does not emerge that may support methods and techniques of KM in startups in order to improve the different phases of KM process (creation, acquisition, storage, transfer, sharing, and application). Therefore, the content analysis of papers included in this area highlights the necessity to develop a systemic framework for the set of different tools and practices that could be implemented by individual startups to increase both the efficiency and the effectiveness of KM adoption. This gap allows us to identify another gap: the analysis of the level of alignment between managerial strategies and the technologies used. In startup context, the issue of alignment between the nature of firm's knowledge and the knowledge management systems (KMSs) used to support knowledge management. This issue is extremely relevant for a startup to achieve both its efficiency and effectiveness aims by leveraging on innovative technologies. In fact, within this scenario information and communication technologies (ICTs) are playing a pivotal role to reduce the weight of the human and financial barriers hindering the spread of knowledge management [65,66]. Nowadays, the technological and innovation trend in ICTs is driving the development and the introduction of new collaborative systems (e.g., social media, cloud computing) [67], which are creating new opportunities for both start-up companies and established

companies as they are low cost, easy to use and present an improved performance/price ratio [63,64]. These literature gaps allow us to identify the following research questions:

RQ3: *How do KMSs support KM adoption in startups?*
RQ4: *What is the level of alignment between KMSs used by startups and knowledge embedded in their entrepreneurial processes?*

As concerns the third area on the relationship between KM and startup's performance, the literature highlights that the process of knowledge management can influence positively seven different types of performance: (1) economic and financial performance; (2) environmental performance; (3) human performance; (4) market performance; (5) organizational performance; (6) relational performance; and (7) technical and technological performance. However, from the content analysis of this area, it emerges the necessity to conduct more empirical investigation to analyze in a more systemic manner the impact of KM on the variety of startup's performances identified by the different contributions. Neglecting these issues means to underestimate all the possible advantages of KM adoption for the startup in order to achieve scalability goals. From this gap, the following two research questions may be formulated:

RQ5: *How are startup's performances affected by KM?*
RQ6: *How does KM influence startup's scalability?*

The above proposed research agenda allows us to provide guidance for future research and draw implications for both academicians and practitioners. As for academicians, the research gaps identified and the consequent research questions proposed represent some possible areas of investigation to improve the body of knowledge in the field of knowledge management in the context of startups. These research areas need to be investigated analyzing not only the behavior of single startups in relation with KM, but taking into consideration also the spread of knowledge within startup networks. In fact, the variety of gaps emerging from this literature review points out that the framework of knowledge in the field of KM in networks populated by startups is still fragmented and many areas are still unexplored. Nevertheless, the proposed research agenda should offer to future researcher the opportunity to draw a comprehensive framework about the ways through which knowledge is acquired, stored and shared across networks populated by startups.

As for practitioners, this literature review has shown that knowledge management contributes to overall sustainable growth of startup by improving its performances simultaneously. Nevertheless, startups could further improve the impact of knowledge management exploring the technological opportunities offered by innovative knowledge management tools (e.g., cloud computing, collaborative filtering, crowdsourcing, etc.).

From the point of view of KM-Tool providers, this literature review has stressed that startups usually do not have specific resources to monitor and follow the innovation processes affecting knowledge management. However, startups could represent a significant niche market. To catch this opportunities, it emerges the necessity to develop a new market segment dedicated to startups, reduce the cultural distance between startups and KM-Tool providers, and support them in the decision-making process about the choice of appropriate knowledge management tools. These findings highlight that we are witnessing an evolving process for startups. Today, they increasingly have access to new knowledge management tools, which do not need significant human and financial investments. Therefore, although startups are usually characterized by scarce human and financial resources to achieve their scalability goals, they are able to overcome the barriers preventing the spread of knowledge management. In fact, the growing trend of contributions on the topic and the findings of this systematic literature review show that the framework of knowledge in the field of collaborative platforms for KM in startups is in evolution and this result provides guidance for future research. Thanks to the technological innovation in the field of KM, cheaper and very easy to use knowledge

management tools are available posing reduced financial, technical and cultural barriers. This aspect stresses that the scenario is evolving and is offering startups new frontiers to explore in the field of KM.

Finally, empirical evidence analyzed in the literature on the topic points out that the impact of the use of practices of KM on startups' performance can be extremely significant and at the same time improves a variety of performances. In particular, it emerges that KM contributes positively to the overall sustainable growth of startups by enhancing economic and financial, environmental, human, market, organizational, relational, technical and technological performance.

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