

Knowledge Management for the Micro Enterprise: A Taxonomy

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Abstract: Knowledge Management Systems enhance innovation, increase operational efficiency, and improve decision-making in business organisations. The administrative and resource overheads required to implement and maintain such systems, however, inherently exclude the smallest of firms from reaping these benefits. This paper aims to identify, evaluate, and summarize the distribution of research on knowledge management and supporting systems across business size classifications with a particular focus on micro-enterprises. It also seeks to establish if existing knowledge management models, practices, and systems have invested due consideration in their design to cater for the limited resources typically found in the micro-enterprise. It contributes new insight into the applicability of knowledge management systems to micro-enterprises and stimulates a possible re-think of how such systems can cater for the specific constraints of this prolific business type. This taxonomy provides a thorough analysis of 168 research papers from a total of 10511 papers published in reputable conference proceedings since 2012. It focuses on key knowledge management themes covered, including the size of the enterprise, the adoption challenges, the potential benefits, the technologies used, and the aspects of the knowledge management cycle that are being employed. Furthermore, it draws on this analysis to highlight the appropriateness of existing knowledge management systems to the distinctive risk and opportunity characteristics of the micro-enterprise.

Keywords: Knowledge Management, Micro-enterprise, Small and medium business, KM Cycle, KM Adoption Challenges, Taxonomy

1. Introduction

Since Karl Wiig's keynote address 'Management of Knowledge' in 1986, a steady flow of milestone implementations on knowledge management (KM) in the industry have been studied and recorded. KM brings particular benefits to enterprises by registering a lowered incidence of repeated mistakes, enhanced personal knowledge base, improved organisational competence and a saving in operating costs and expenses (Cheng and Kuan Yew, 2015). These benefits are attained through the adoption of a cyclic approach that manages knowledge from the point of its creation, dissemination, throughout its application, and eventual destruction. The motivators for KM system (KMS) adoption are diverse, and "in an economy where the only certainty is uncertainty, the one sure source of lasting competitive advantage is knowledge" (Nonaka, 2007). Strengthening the collective expertise of staff and partners contributes to increased success in the marketplace (Fred *et al.*, 2016). KM "continues to be a critical strategy for an organization to achieve a sustainable competitive advantage, and consequently survive in today's knowledge-based economy" (Halawi, Mccarthy and Aronson, 2017). A reduction in project timings, an improvement in the quality of products, and a higher level of customer satisfaction have all been attributed to effective KM, particularly when used for guiding the firm's actions in these areas (Rhem, 2018). Recent studies established that micro-enterprises largely employ personalization strategies that depend heavily on the tacit recollection of memories and experiences rather than explicit knowledge (Alvarez, Cilleruelo and Zamanillo, 2016; Sadat, 2018). Despite their ability to rapidly adapt to market changes, the limited resources available to the micro-enterprise constrain this size of firm from leveraging the benefits and strategically applying a KMS to their often-incongruent IT systems. The "existing KM tools seem too difficult to use for micro-companies due to their lack of available time and resources" (Camille, Huret and Segonds, 2017), a position reaffirmed by Michna, Kmiecik and Brzostek, (2018) who state that given their particular characteristics of "limited human, financial and material resources and a lack of time for creativity development" a different approach in terms of tools and resources to those appropriate to large organisations is necessary. KM literature often assumes the micro-enterprise to be sufficiently similar to a 'start-up' or 'small to medium-sized enterprise' (SME). This has led to the general perception that the micro-enterprise is sufficiently catered for in this domain. Although a start-up may, particularly in its early existence, classify as a micro-enterprise, its primary survival objective is to secure the largest market share in the shortest possible time. SMEs have similar objectives but use significantly more resources to satisfy market demands. The micro-enterprise is different, it typically serves a niche market without necessarily warranting an increase in resources for its survival (Gherhes *et al.*, 2016). However, the

enduring resource limitations that characterize the micro-enterprise present unique challenges to its adoption of KM.

This taxonomy paper aims to identify, evaluate, and summarize the distribution of research on KM and KMS across business size classifications with a particular focus on that specific to, or in its absence, relates closely to micro-enterprise. It also seeks to establish if any existing KM models, systems, and practices, have catered for the limited resources of the micro-enterprise. It contributes new insight into the applicability of KMS to micro-enterprises and stimulates a possible re-think of how KMS can cater for the specific constraints of this prolific business type. The next sections present the methodology used, the findings and a discussion of the results to further research.

2. Methodology

This research investigates whether the micro-enterprise needs a different approach to KM by seeking evidence of ‘organizational size’ factors as pivotal to the realization of KM utility, i.e., it questions whether due consideration needs to be applied to the size of an organisation when designing, implementing, and operating a KM system to realize maximum benefit. This research takes a bottom-up approach and is divided into two main phases. The first is a preliminary selection based on search criteria applied to the advanced search facilities of selected databases. It results in a set of shortlisted peer-reviewed academic papers that form the basis for this study. The second phase conducts a content analysis on the shortlisted papers, and through a series of structured queries addresses the research question and yields the taxonomic hierarchy. A taxonomy needs to be concise, robust, comprehensive, extendible, and explanatory (Bailey, 1994). In a recent review of 33 taxonomy articles used in Information Systems Research, Lösser et al. (2020) observed that most taxonomies that took an ad hoc approach lacked these essential aspects. In search for a more structured form, Nickerson proposes an iterative seven-step method (Nickerson, Varshney and Muntermann, 2013). Therefore, to ensure that this taxonomy is explicit, transferrable and reproducible, an adaptation of the Nickerson et al. (2013) seven-stage approach is used.

For this first phase, the IEEE Xplore and ACM databases have been purposefully selected to ensure that the output yields empirical primary research data about KM that is rooted within the field of information systems and computer science. This selection avoids the inevitable influences from the predominant ‘business management’ perspective of KM which can misrepresent the intended focus and results. The “Full-Text Collection” of the ACM database is being used to limit results to articles that are sponsored or published by the ACM rather than the ‘ACM Guide to Computing Literature’ since this would dilute the scope through the inclusion of other third-party publishers. The data collected from this phase is intentionally constrained by date range, initially excluding papers that had been published before the establishment of the term ‘Micro-enterprise’ by the European Union (EU) in May 2003 and further still to papers published within the last 10 years. This further constrained date range allows the use of the term to have become well understood and applied within its new EU context.

A sequence of three exclusion filters, illustrated in Figure 1, are applied to the databases to ensure the relevance and intended scope of the resulting papers. This phase will produce the set of shortlisted papers on which the second phase is conducted. The first filter looks for the presence of the phrase “Knowledge Management” or any variant key phrases such as KM, KMS, or Knowledge Acquisition, within the abstract part of the paper. This initial filter serves to exclude papers where KM is not the main topic of discussion. The second filter searches for the presence of the word “business” or any variant key phrases or words such as Firm, Company and Organisation, within the abstract part of the paper. This second filter serves to exclude papers that do not discuss KM within the context of business activity. The third filter searches for the presence of the word “size” or any variant key phrases such as SME, Small or Micro, that indicate the size of the business is a relevant point of discussion. This third filter serves to exclude papers that disregard business size as a factor that impacts KM.

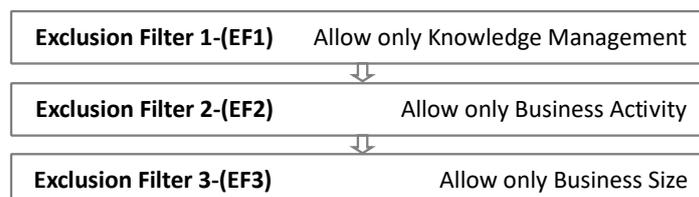


Figure 1: DB Exclusion Filters of Phase 1

The second phase consists of three stages, a preliminary manual screening stage for establishing paper eligibility, a series of close-ended questions that address the research question, and a concluding set of open-ended questions that serve to complement the data collected from the close-ended questions toward constructing the taxonomy. This three-stage process is represented in Figure 2.

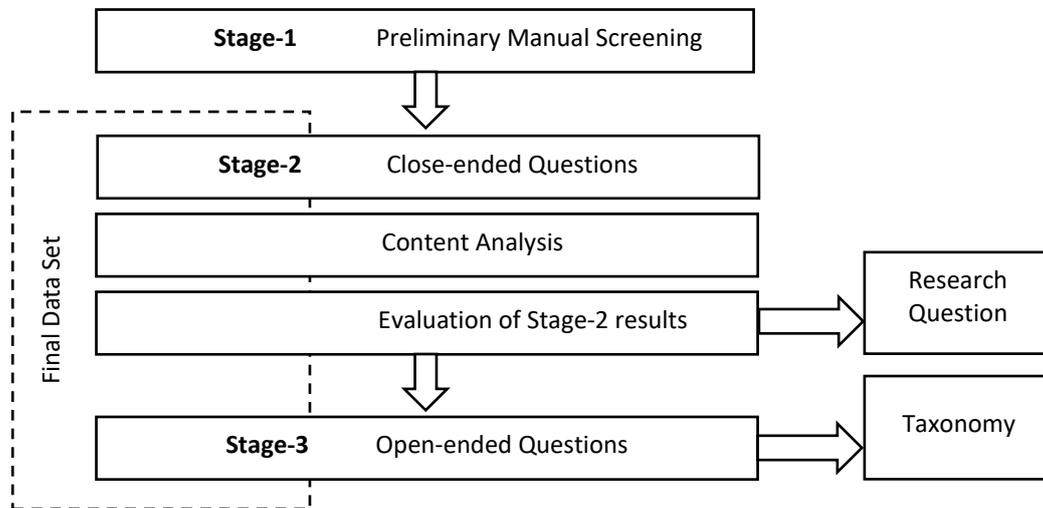


Figure 2: The Three Stages of Phase 2 - Showing the flow of Investigative Analysis, Addressing the Research Question, and Building the Taxonomy

3. Findings

The Phase-1 preliminary paper selection process is conducted against the ACM and IEEE Xplore databases. Table 1 details the resulting values from the application of each of the exclusion filters illustrated in Figure 1. The search criteria used, and respective variants of the principal keywords and phrases applied are also detailed for the purpose of replicability. A total of 168 papers were shortlisted for the Phase-2 analysis.

Table 1: Phase 1– Preliminary Paper Selection as of 12th Nov 2022

Search Criteria	IEEE Xplore	ACM	Total Papers
EF1- Abstract:("knowledge management" OR "Management of knowledge" OR "Knowledge transfer" OR "Knowledge acquisition" OR "Knowledge capture" OR "Knowledge distribution" OR "Knowledge dissemination" OR "Knowledge share" OR "Knowledge sharing" OR "Knowledge application" OR "Knowledge retrieval" OR "Knowledge use" OR "Knowledge creation" OR "Knowledge Usage")	9284	1227	10511
AND			
EF2- Abstract:(business OR firm OR organization OR organisation OR company OR enterprise)	3564	278	3931
AND			
EF3- Abstract:(size OR smb OR sme OR medium OR small OR "Very small" OR micro)	278	52	330
AND			
since 2003	247	52	299
AND			
since 2012	131	37	168

3.1 Stage 1 – Manual Eligibility Screening

This next phase begins with a manual screening process that assesses whether the key phrases, words, and their respective variants were filtered correctly by the databases' advanced search facilities. Furthermore, the

evaluation seeks to confirm that the context within which the key phrases and words are used is relevant to the study and to address the research question. The series of close-ended Assessment Criteria Questions (ACQs) used to manually screen the papers are detailed in Table 2.

Table 2: Phase 2 - Stage 1 ACQs for the Manual Paper Screening Process

ACQ#	Manual Paper Screening Criteria	Yes	No	Set
1.0	Is the paper unique within this dataset? (NO for Duplicate)	166	2	168
1.1	From 1.0 is EF1 met? (the phrase 'Knowledge Management' or variants)	166	0	166
1.2	From 1.1 is the paper's primary discussion on KM?	132	34	166
1.3	From 1.2 is EF2 met? (the word 'Business' or variants)	132	0	132
1.4	From 1.3 is the paper's primary discussion on Business Activity?	112	20	132
1.5	From 1.4 is EF3 met? (word 'Size' or variants)	112	0	112
1.6	From 1.5 is 'size' used within the context of business size?	81	31	112
1.7	From 1.6 does the paper present primary research? 'NO' represents literature review, systematic review, or taxonomy	72	9	81
1.8	Exclude paper from further review if the value of 1.0 to 1.7 = 'NO'	N/A	96	N/A

Of the initial 168 papers that were eligible for Phase 1, the manual screening process found 96 papers to have failed the screening criteria and were therefore excluded from further processing. 2 papers were found to be duplicated and 34 papers did not tackle KM as the primary focus of the research (ACQ# 1.2). A further 20 papers failed to meet ACQ# 1.4 which requires the paper to discuss the application of KM within the context of business organizations. Of these, 31 papers were found to have used the term 'size' as a measure for aspects other than to describe the size of a business entity (ACQ# 1.6). A final 9 papers were excluded since they analyze secondary research (ACQ# 1.7) and would include data that is duplicated from other papers that already form part of this study. In summary, a total of 72 papers passed the manual screening process and formed the final data set.

3.2 Stage 2 – Does the Micro-Enterprise Need a Different Approach to KM?

This stage seeks to answer the research question by performing an in-depth analysis of the 72 shortlisted papers. The first series of questions (Series 2.1) seeks evidence supporting the existence of research on KM that specifically caters for a particular size of an organisation. Each paper is assessed against the close-ended ACQs detailed in Table 3. The results are not mutually exclusive and therefore if a single paper meets the criteria for mentioning large and small enterprises it is added to each row accordingly.

Table 3: Series 2.1 - Close-Ended ACQs to Determine the Sizes of Organisations Being Discussed

ACQ#	Series 2.1 - What research on KM exists that considers organisational size?	Yes	No	Set
2.1.1	Does the paper mention Large Enterprises?	32	40	72
2.1.2	Does the paper mention Small or Medium Sized Businesses?	66	6	72
2.1.3	Does the paper mention Very Small or Micro-enterprise?	9	63	72
2.1.3.1	From 2.1.3 does the paper mention Very Small or Micro-enterprise exclusively?	0	9	9
2.1.3.2	From 2.1.3 is Micro-enterprise a key focus of the paper?	7	2	9
2.1.3.3	From 2.1.3.2 does the paper suggest a different KM approach for Micro Ent.?	4	3	7
2.1.4	Does the paper mention more than one size of enterprise?	30	42	72
2.1.4.1	From 2.1.4 does the paper consider firm size to be a key factor influencing KM use?	9	21	30
2.1.5	Does the paper discuss issues that challenge SMEs or Micro Ent. when using KMS?	20	52	72

As a result of this series of criteria assessments, 32 papers mention Large Enterprises, 66 mention Small or Medium sized and 9 mention Micro-enterprise (ACQ# 2.1.1 to 2.1.3). 30 papers mention more than one size of

organization and will be assessed further since they have the potential to discuss firm size as a key factor in KMS utility. Of these 30, only 9 discuss firm size within their study. Of the 9 papers that mention micro-enterprises, none mention it exclusively, implying that all the papers in this set have some correlation to at least two firm sizes. 2 of these papers Rumanti *et al.*, (2016) and, Rahim, Mahmood and Masrom, (2016) make an insignificant mention to micro-enterprise choosing to focus on the larger firm sizes, however, 7 papers make a notable contribution toward organisational size being a key factor of KM utility. Torres-Blasido *et al.*, (2019), validate a production model within a manufacturing micro-enterprise that seeks to increase productivity by encouraging its staff to share knowledge through the process of socialization. Pham and Nguyen, (2017), explore the impact of KM on business performance and provides evidence that “there is a difference in understanding and applying KM across three categories of firm size: medium, small and very small enterprises.” Hall and De Raffaele, (2013), discuss the increased threat of corporate amnesia to the micro-enterprise due to its size and the dissemination of the entire organization’s tacit knowledge among the few staff members. Hartono *et al.*, (2017), conduct a qualitative study that compares KM strategy to various organization sizes. The paper finds that a codification-based KM strategy benefits the larger firms whereas a personalization strategy benefits the smaller firms. The findings on micro-enterprise are largely inconclusive and “more follow-up studies” are required (Hartono *et al.*, 2016)(Mahmod, Rosnan and Hazman-Fitri, 2013). Whilst mostly informal, Knowledge Sharing is at its highest level in the smallest of firms and proportionately less in firms of increasing size (Riaz, Buriro and Mahboob, 2019). Holistically, Hartono *et al.*, (2016), determine that, unlike large and medium-sized firms, smaller firms suffice with a simple KM system without the need to pursue a level of KM maturity. Their study recognizes that research “often treat firms as a single monolithic group” and disregards firm size to be a moderating factor in KMS’. Mahmod, Rosnan and Hazman-Fitri, (2013), claim that “most of the studies conducted have not considered the differences of company size as well as specific features of SME that could affect KM” and “is largely disregarded by SMEs”. Of these 7 papers, Pham and Nguyen, (2017), Hall and De Raffaele, (2013), Hartono *et al.*, (2017), and Hartono *et al.*, (2016) suggest that a different approach to KM for the micro-enterprise is necessary.

The second series of questions (Series 2.2) evaluates each paper on the KM models and cycles studied. Table 4 summarizes the findings and shows that 67 of the 72 papers discuss at least one stage of the KM cycle, and 57 of these include Knowledge Sharing amongst other stages. Despite only 20 of the 72 papers referencing an established KM model, there exists a fair distribution of papers that discuss each of the main KM cycle stages. However, the discussion on knowledge sharing has a significantly higher presence across the papers than in other stages of the KM cycle.

Table 4: Series 2.2 - KM Models and Cycles Used

ACQ#	Series 2.2 – What KM Models and Cycles are being used or proposed	Yes	No	Set
2.2.1	Does the paper reference an established KM model? (Wiig, Zack, Bukowitz, McElroy, Dalkir, Nonaka, SECI, ICAS, Boisot, Choo, I-Sense, von Krogh and Roos etc.)	20	52	72
2.2.2	Does the paper discuss specific KM-Cycle stages?	67	5	72
2.2.2.1	From 2.2.2 does the paper discuss K-Capture / Collection?	34	33	67
2.2.2.2	From 2.2.2 does the paper discuss K-Creation / Innovation?	45	22	67
2.2.2.3	From 2.2.2 does the paper discuss K-Dissemination / Distribution / Sharing?	57	10	67
2.2.2.4	From 2.2.2 does the paper discuss K-Application / Retrieval / Usage?	24	43	67

The third series of questions (Series 2.3) seeks to establish the implementation/adoption challenges of KM for Micro, Small and Medium-sized enterprises (MSME). Table 5 summarizes the findings.

Table 5: Series 2.3 - The State of Research on KM Implementation for MSME

ACQ#	Series 2.3 - What are the implementation challenges of KM for MSME?	Yes	No	Set
2.3.1	Does the paper argue firm size to be a key factor affecting KMS implementation?	25	47	72
2.3.2	Does the paper argue firm size to be a key factor affecting KMS’s usable features and functions?	10	62	72
2.3.3	Does the paper identify implementation challenges?	21	51	72

This series of ACQs found 25 papers that support business size to be a determining factor affecting the use of KM. Mansfield et al.'s (2021) paper identifies the “lack of resources”, the “paucity of data governance policies” and opposition toward “accepting new practices and knowledge” as the main factors in smaller enterprises that determine the use of KM. Sadler & Evans (2016) supports this by stating that although “KM is now easier to implement and manage” it should “not be underestimated as ‘easy to implement’” and proceeds to explain that “it requires change from all levels of management and a shift in culture” to be of potential value. This implies that the smallest of firms would find it easier to change organizational culture and have fewer strata of management to contend with. Despite Alvarez et al. (2019) focus on KM in a factory production line, their paper recognizes that a key challenge of SMEs is “low human productivity” which they attribute to the prioritization of production numbers over a “practice of knowledge management within their production chain”. This is evidence that SMEs involved in a production line setting either negate the benefits of KM or may not justify its implementation. Hartono et al. (2017) found recent studies suggesting that the “size of the organization may be considered as a key moderating variable” in the implementation of KM. The paper explains that there exists “a statistically significant relationship between the level of implementation of KMS and a construction firm’s performance”, and that a “codification-dominant KMS” is more attuned to the requirements of the larger firm. The paper also found that the statistics relating to the smaller firms were inconclusive and required further study. Only 10 papers presented evidence that firm size determines the usable features and functions of KMS. Key amongst these was Wiratmadja et al. (2014) who identify “six areas of SME technical competence that became a crucial source of knowledge in its business processes”. Although they are specific to the firm being studied, the identification of key technical competencies and key business activities would determine the applicable KMS features and functions that would feasibly yield the desired benefits. Implementation challenges were identified by 21 of the 72 papers reviewed. Mahmud, Rosnan and Hazman-Fitri, (2013) argue “organizational policy, a knowledge-friendly culture, an information system culture and training” are essential prerequisites for KM implementation. Risman, (2012) consider the lack of motivation to be among the key challenges, and Torres-Blasido *et al.*, (2019) perceive cultural change as being the largest challenge. From the Stage 2 analysis, too few papers make any substantial contribution toward KM for the micro-enterprise, clearly indicating that the amount of research in this area from a computer science perspective is in very short supply. Although this analysis cannot be considered conclusive for addressing the research question due to the limited number of qualifying papers, there is, however, clear evidence that indicates the need for further research to determine this with certainty.

3.3 Stage 3 – The Taxonomy

Through a series of open-ended questions, this third stage builds on the data gathered from the previous two stages, results in a reflective analysis of the findings, and forms the structure of the taxonomy. Four specific focus areas were extracted from the set of 72 papers, these are Adoption Challenges, Perceived Benefits, and Suggested Technologies.

The taxonomic elements in bold print detailed in Figure 3 represent those extracted from the subset of 7 papers (ACQ# 2.1.3.2) and therefore exclusively represent the Micro-enterprise.

ADOPTION CHALLENGES		PERCIEVED BENEFITS	
STAFF Staff incentive Staff Indispensability Tech skills Staff Motivation Communication difficulties	BUSINESS Lack of Policies Lack of Management Sturcture Culture Change Organizational Learning Poor Informatization Complex KM Theory Unaware of KM Benefits	KNOWLEDGE Knowledge Reusability Timely access to Knowledge Accurate Knowledge Retrieval	BUSINESS Business Performance Vectors Competitive Advantage Enhanced Business Strategy Increased Productivity Wealth Generation
COSTS Cost Overhead Time Shortage	TECHNOLOGY KMS Availability	CUSTOMER Target Customer Needs Costing Accuracy Superior Information Quality	INNOVATION Improved Innovation Capability Readiness to Innovate
SUGGESTED TECHNOLOGIES			
PROPRIETARY Confluence R2RML Onthology SPARQL Text2Onto Framework Social Engagement Tools	Graspeo SharePoint Intranet Yammer	PLATFORMS Mobile Web Platform Cloud Platform Web 2.0 site Social Media Platform	GENERIC CRM System Database System Generic ICT Tools

Figure 3: The Taxonomy

The phenomenon of Staff Indispensability is found to be accentuated in micro-enterprise. Staff members feel that they personally own certain knowledge and refuse to share it with others out of fear of losing the value they contribute toward the firm. A constant need to keep staff motivated to capture and share knowledge is also noted together with a lack of organizational policies in the micro-enterprise. This allows for processes to be applied out of convenience rather than need. Furthermore, the need for cultural change toward organizational learning is paramount to successfully realizing the benefits of a KMS. The lack of KMS availability for micro-enterprise, together with the overhead costs resulting from licensing, skills training and administrative time required is also recorded in the taxonomy.

4. Conclusion

This paper summarizes the distribution of recent studies on KM and KMS across the European Union's MSME business size classifications. This endeavour is supported by a rigorously structured and formal approach within the research area and outlines the analysis of the literature represented. It exposes the existence of a gross imbalance in KM research through a resulting emphasis on knowledge sharing and dissemination over other KM stages. The resulting taxonomy contributes new insight into the applicability of current KM research to MSMEs. Furthermore, it establishes that there is insufficient consideration for micro-enterprise in existing KM models, designs, systems, and practices, and provokes a re-think on how KMS can specifically cater for this business size.

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