APPENDIX A

The papers [1-5] present a research methodology for conducting an SMS (Systematic Mapping Study). In this particular study, the methodology used is based on the updated SMS guidelines described in [2]. The concept of edge computing was first introduced in 2001, and thus, this SMS covers research studies published between 2001 and the end of 2019. The study involves a review of research works on edge computing during this period. The SMS process in this paper consists of three main phases: the planning phase, the evaluating phase, and the conducting phase, as illustrated in Fig. *1*. In this section, we will provide detailed explanations of these three phases.

1 PLANNING THE MAPPING STUDY

The SMS process starts with the planning phase, which consists of several sequential steps. In this subsection, we will discuss the steps of the planning phase in the order in which they should be performed.

1.1 Specifying the Scope and Research Questions (RQs)

The main objective of scientific researchers who conduct systematic mapping studies is to provide a comprehensive overview of a particular topic, which can be used as a reference for future research in that field [3]. To ensure a more objective approach to the SMS process, it is crucial to define some research questions (RQs) at the initial stage of the review process. These RQs serve as the basis for the SMS process and guide the effort to answer them. In this paper, we have identified and defined eight RQs, each with its own rationale, which are summarized in Table 1.

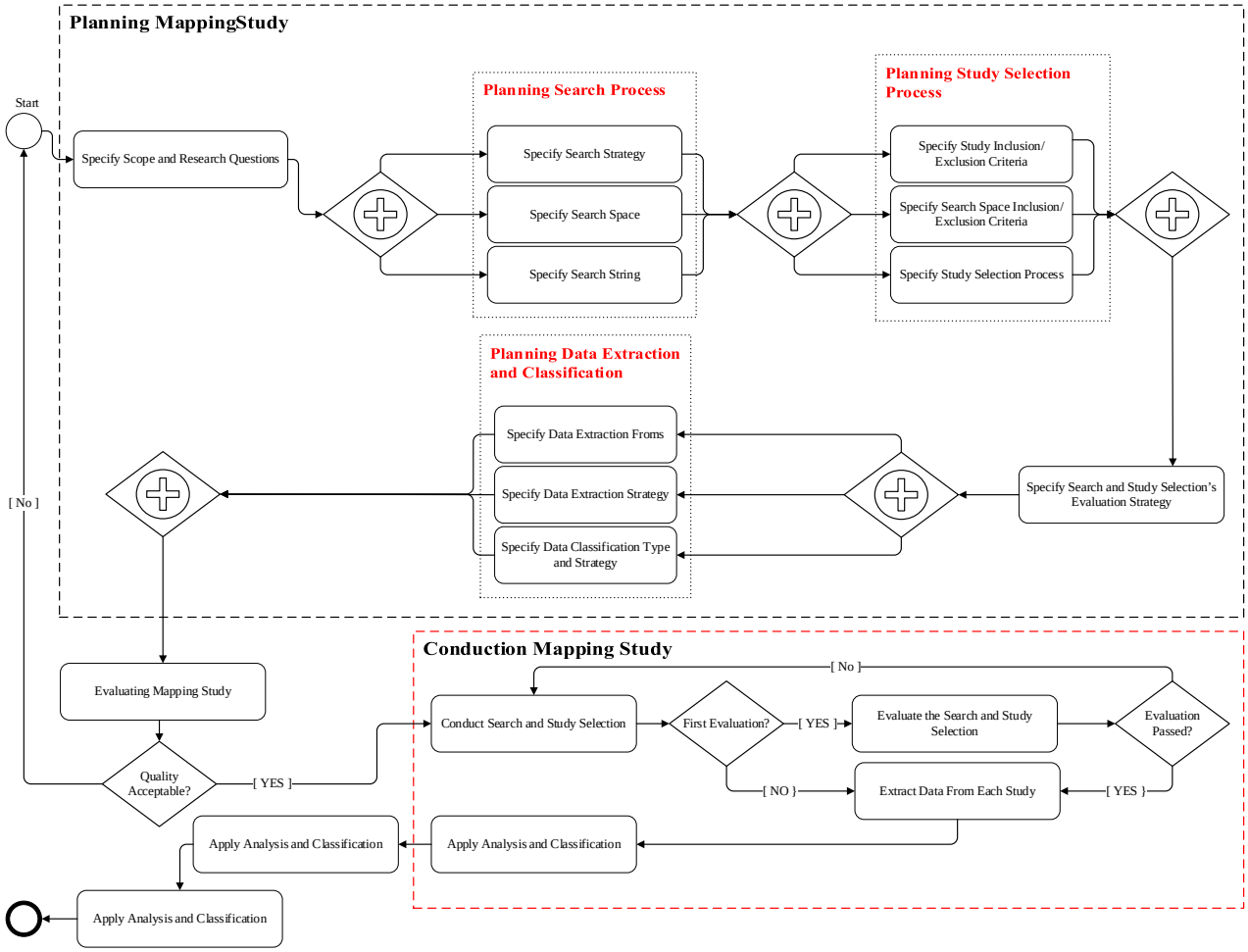

Fig. *1*. SMS process [6]

In order to find suitable answers for each of these RQs, we search for published works that have made contributions to the field of edge computing. Since the concept of edge computing was first introduced in 2001, we consider studies from that year onwards. Furthermore, since we began this study in 2017, we have included searches up until the end of 2019. As we completed the review in mid-2020, we have excluded the year 2020 from our analysis in order to maintain reasonable accuracy.

1.2 Planning of the search strategy

The search process for the review may need to be repeated multiple times during the review period. As this process can be time-consuming, it is likely to be performed by different members of a group. To ensure consistency in the search process and adherence to the same rules and decisions made during the review, a precise search process must be planned beforehand. To accomplish this, the planning of the search process is divided into three sub-steps, which include specifying the search strategy, search space, and search strings, as illustrated in Fig. *1*. We have provided detailed explanations of these sub-steps in the following subsections.

1.2.1 Specifying the Search Strategy

To begin our search strategy, we randomly selected a set of initial secondary studies, which included surveys or reviews that had explored the field of edge computing. These studies are listed in Table 2. As we conducted our SMS process, we came across additional reviews. A comparison between our work and the other secondary studies (surveys and reviews) that we found is presented in section 5 of the main article.

As depicted in Fig. 2, we employed three types of search strategies - manual search, backward snowballing, and database search - to retrieve studies. For manual search, we used queries to manually search each venue in the search space list that was obtained using the search space strategy (refer to section 1.2.2). In the snowballing method, we examined the reference lists of each newly added paper to find new related venues. In the database search phase, we conducted a manual search using defined keywords in well-known databases such as Google Scholar, Springer Link, IEEEXplore, ACM Library, and ScienceDirect.

Table 1. Defined research questons (RQs)

	RQ	Research Questions	Rationale
General Questions	1	What is the level of activity in the field of edge computing, and how are studies distributed across different types and publication years?	By examining the current volume of research and general trends, we can gain a better understanding of the appeal of this field. Comparing the amount of research conducted in different publication years can also provide insight into the maturity of edge computing.
	2	Who are the most active researchers and research venues in the field of edge computing, and how are they distributed geographically?	Understanding the demographics of edge computing research is a useful starting point for researchers who want to explore this field, as it can identify the most active scholars, venues, and countries involved in this research area.
Structural Questions	3	What are the primary research topics being studied in the field of edge computing?	In order to gain insight into the current state of research, it is necessary to identify and categorize these topics, evaluate and analyze their distribution, and identify potential trends in the field.
	4	How are applications distributed among the various research topics?	To gain a better understanding of the importance and practicality of each research topic, it is necessary to identify the percentage of studies published for each application within a given research topic relative to the total number of studies.
	5	How are various architectures distributed across different research topics?	Architecture can be Fog Computing, Cloudlet, MEC and so on.
	6	Which techniques are commonly utilized in the field?	To gain a better understanding of the various research topics, it is necessary to identify the primary techniques used within each topic and analyze their relationship with other aspects. These techniques may include game theory, heuristics, and others.
	7	What forms of empirical evaluation have been employed in the field?	By empirical evaluation, we refer to whether the environment being studied is real, simulated, or a testbed.
	8	Which qualitative requirements (QoS) have primarily been considered in the move towards edge computing?	Answering this research question can provide insight into when researchers should use edge computing. QoS considerations may include factors such as time, cost, energy consumption, and more.

By combining all search phases, we have compiled a vast dataset of relevant studies in the field of edge computing from 2001 until the end of 2019. To distinguish between the three methods employed in our search, we have introduced a flag known as the S-Flag. The S-Flag is assigned a value of 0 and 1 for the backward snowballing and manual search steps, respectively.

To improve the accuracy and comprehensiveness of our search, we have built upon our previous work in the search process. During the snowballing stage, we not only extracted new venues but also compiled a list of previously unseen studies. These are studies whose venues (search spaces) had been searched before, but which were not found in the results of previous search queries. We then applied our study selection process to these unseen studies and added the selected studies to our dataset of included studies. With this approach, we have taken a significant step towards achieving comprehensive coverage of the domain.

Our overall search strategy comprises seven primary steps that involve the use of three search methods. These steps are outlined below:

Stage 1: In this step, we specify the initial set of secondary studies, and extract the initial set of keywords. We then use some combination of these keywords to create final queries for manual searching, as described in section 1.2.3. We also define a variable called "phase," which indicates the number of steps completed in each cycle of search strategy execution.

Stage 2: The initial set of search spaces is created by backward snowballing the cited papers in each secondary study of the initial set. However, we only add search spaces that meet some defined quality criteria to the initial set of search spaces. We will discuss these quality criteria in section 1.3. If a new search space is found during the examination of the secondary studies, we execute stage 3; otherwise, the process jumps to stage 5 (backward snowballing). In this step, the S-Flag is set to zero.

Stage 3: Firstly, we add the newly discovered search spaces from stage 2 to the search space set. Secondly, we apply manual search to them by considering the initial keyword set and extracted queries. This step generates a new search study set.

Stage 4: In this step, we apply the study selection process to the new search studies set. We should include or exclude studies based on the defined inclusion or exclusion criteria, which are discussed in section 1.3.1. If we have included at least one search study, the search process jumps to stage 5; otherwise, it jumps to stage 2. Moreover, if we find any new related keyword in an included study, we add it to the keyword set to gradually complete it.

Stage 5: For any included study found by manual search, we apply backward snowballing (S-Flag set to one). Backward snowballing involves examining the reference section of an included study and extracting the related cited papers. If we find any new related study, the process jumps to stage 4.

Stage 6: In this step, we conduct a database search using a set of pre-defined keywords, and extract new unseen papers.

Stage 7: In the final step, we apply the study selection process to the recently found papers, and then the search process ends.

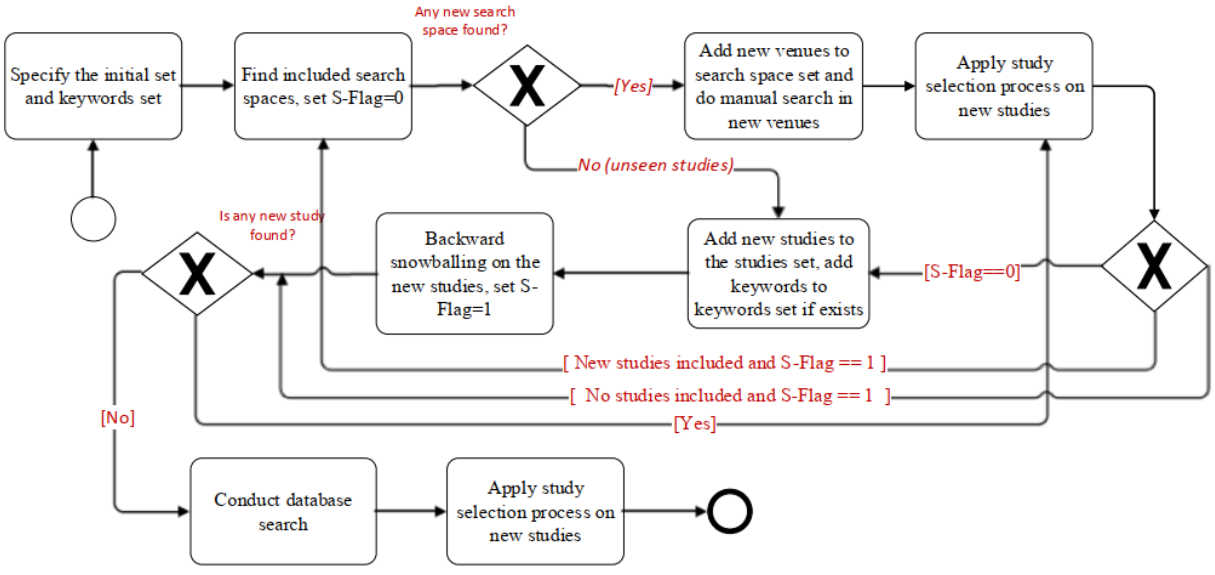

Fig. 2. The search strategy

Table 2. Initial set (secondary studies) of this SMS

#	Secondary Study Title	Type	Year	Ref.
1	A Comprehensive Survey on Fog Computing: State-of-the-Art and Research Challenges	Survey	2018	[7]
2	A Taxonomy for Management and Optimization of Multiple Resources in Edge Computing	Survey	2018	[8]
3	Mobile Edge Computing, Fog et al.: A Survey and Analysis of Security Threats and Challenges	Survey	2018	[9]
4	Survey on Fog Computing: Architecture, Key Technologies, Applications and Open Issues	Survey	2017	[10]
5	Moving from Vehicular Cloud Computing to Vehicular Fog Computing: Issues and Challenges	Survey	2017	[11]
6	On Multi-Access Edge Computing: A Survey of the Emerging 5G Network Edge Cloud Architecture and Orchestration	Survey	2017	[12]
7	Edge Cloud Computing Technologies for Internet of Things: A primer	Survey	2017	[13]
8	Fog Computing for Vehicular Ad Hoc Networks: Paradigms, Scenarios, and Issues	Survey	2016	[14]
9	A Systematic Literature Review of Fog Computing	Survey	2016	[15]
10	Edge Computing: Vision and Challenges	Survey	2016	[16]
11	Edge-centric Computing: Vision and Challenges	Survey	2015	[17]
12	An overview of Fog Computing and Its Security Issues	Survey	2015	[18]

1.2.2 Specifying the Search Space

In general, the term "search space" refers to different sources where information can be found, such as journals, conferences, and workshops. As depicted in Fig. *1*, the first step in conducting a search is to identify a set of initial search spaces, which are then added to the secondary study database. Our SMS has covered relevant papers published between 2001 and 2019. At the beginning of the search process, the search space set is empty. However, as previously mentioned, the first step in the search strategy is to examine the cited papers in the secondary studies that have been identified (listed in Table 2)). This step helps to identify additional journals that should be included in the search space set. As the search process progresses, the search space set is gradually completed. A complete list of all included search spaces can be found in $SupFile_{W3,T4}$, while the process of extracting the search spaces is illustrated in Fig. 3.

1.2.3 Specifying the Search Study String

Although our goal is to identify studies that contribute to the field of edge computing, simply using the keyword "Edge Computing" is not enough to find all relevant papers. To address this, we first developed a set of keywords, or search strings, which were refined through a three-phase process outlined in section 1.2. As previously stated, we created several queries by combining the defined keywords, which are listed in Table 3. These queries were used to search through databases from various publishers. The defined keywords can be found in the supplementary file $SupFile_{w3,T3}$.

Table 3. Constructed queries for finding related paper

ID	Search query
1	"edge computing" OR ("edge processing" AND cloud) OR ("mobile edge" AND (cloud OR computing))
2	fog AND (computing OR node OR cloud)
3	(offloading AND (edge OR "mobile cloud"))
4	((micro-data center OR micro-datacenter) AND (cloud OR edge)) OR microcloud OR micro-cloud OR cloudlet
5	"nomadic computing" OR "mist computing" OR "osmotic computing"

1.3 Planning of the Study Selection Process

As previously outlined in our search strategy, we used manual search and backward snowballing methods to identify relevant papers. While the manual search method involved using constructed queries to locate papers within predetermined search spaces, some papers only mentioned our keywords as a general concept without specifically addressing our main focus. Additionally, in the backward snowballing stage, it is likely that some irrelevant studies were included in the reference section of related papers. Therefore, we need to develop an inclusion/exclusion strategy that defines specific criteria for selecting papers and search spaces. This subsection will address these issues and discuss the criteria that should be used for selecting papers and search spaces.

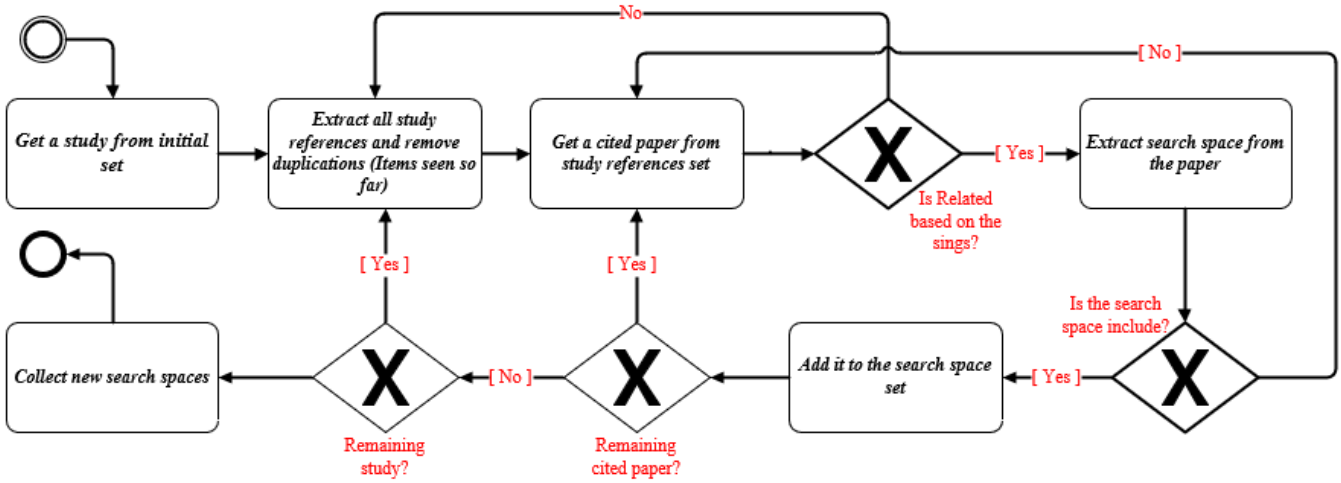

Fig. 3. The Process of Included Search Space Extraction [5]

1.3.1 Specifying the search space inclusion/exclusion criteria

In order to obtain more reliable answers to our RQs, we must analyze studies of appropriate quality. As the quality of the studies can be influenced by the search spaces in which they are found, it is important to select search spaces based on specific inclusion/exclusion criteria. Our initial investigations revealed that there are a vast number of published studies related to edge computing, making it difficult, if not impossible, to review all of them in a single survey. Therefore, we have chosen to limit our focus to journals in our SMS process and exclude other types of search spaces such as conferences and workshops. In section 2, we will discuss this limitation and its conditions in more detail. Furthermore, we have filtered the available journals based on specific criteria, which are outlined in Table 4. As shown, each journal will be selected if its JCR is available, and its aims and scopes are relevant to our focus in this SMS process. The exclusion criteria thresholds were determined empirically. When setting the JCR threshold, we considered two key points: firstly, a slight change in the threshold value should not significantly affect the number of included/excluded papers; secondly, our defined threshold should not exclude qualified papers.

1.3.2 Specifying the study inclusion/exclusion criteria

In order to identify studies that are suitable for answering our research questions, we have established a set of inclusion/exclusion criteria as outlined in Table 5. Any study that meets at least one of the conditions PEC1 to PEC5 will be excluded from our SMS process. Of these criteria, only PEC1 is directly related to the content of the studies. To enhance the accuracy of our selection based on PEC1, we have established certain indicators based on the identified keywords. These indicators allow our team members to include/exclude studies with greater precision. We have reviewed the title, abstract, and keywords of the extracted papers in order to determine their inclusion/exclusion status. However, in some cases, we have also reviewed the full text of the paper. A comprehensive list of included papers, excluded papers, secondary papers, and specified indicators can be found in the $SupFile_{E2,T1}$, $SupFile_{E2,T3}$, $SupFile_{E2,T2}$, $SupFile_{w3,T1}$ respectively.

Table 4 Search space exclusion criteria

Criterion	Description
JEC1	JCR is not available
JEC2	Aim and scope are not related
JEC3	Magazine

Table 5 Study exclusion criteria

Criterion	Description
PEC1	The study does not relate to edge computing
PEC2	The contribution of paper does not relate to the field of study (the study does not have any of the signs in table $SupFile_{W3,T1}$)
PEC3	The study is not a journal paper, e.g., it is a magazine paper, conference paper, gray literature, conference cover, poster, etc.
PEC4	The study is not a primary study (e.g., survey)
PEC5	The paper cannot be accessed (e.g., not indexed) or belongs to an excluded journal

1.3.3 Specifying the Study Selection Process

In order to apply the aforementioned criteria for selecting studies, a predefined strategy must be followed. As papers can be written in various ways, understanding their primary contribution may require different levels of reading, such as title, keywords, abstract, and full text. In this SMS, we adopted a two-step strategy: 1) initially, we attempted to include/exclude each paper by reading its title, abstract, and keywords, and 2) for papers whose contribution was not clear from step one, we read the entire text. After applying this strategy to each paper, one of three outcomes may result: the relevant paper is included, the irrelevant paper is excluded, or when the relevance of the paper cannot be determined, it is assessed by another expert. Fig. 4 illustrates the strategy utilized to select studies.

1.4 Specifying the Search and Study Selection Evaluation Strategy

In order to ensure the reliability of the SMS results, it is important to have an evaluation strategy. However, it can be challenging to identify the exact set of relevant studies. To address this, a test-set is typically created, which consists of a set of papers that are expected to be found during the SMS process [19]. To create this test-set, we used the quasi-gold standard (QGS) metric developed by [20]. This metric involves identifying studies published in well-known research communities. Two team members were assigned to perform the evaluation phase. Initially, the test-set was empty. The team members identified several pioneering researchers in the field of edge computing by searching Google Scholar. They then examined the homepages of these researchers to find related papers and added them to the test-set. The inclusion/exclusion criteria were then applied to these papers. To evaluate the completeness of the identified studies, we used the quasi-sensitivity formula, as shown in Eq. 1 [20, 21]. The result was compared with a predefined threshold. If the number obtained from the formula is less than the threshold, it is necessary to redo the SMS process to obtain more complete results. Since an acceptable threshold is typically in the range of 70% to 80% [20], our result of 90.34% indicates that our SMS process has achieved a high level of accuracy.

$$Sensivity = \frac{\#\ of\ found\ included\ studies}{\#\ of\ total\ included\ studies} \times 100 \quad (1)$$

1.5 Planning of the Data Extraction and Classification Process

In order to answer the RQs outlined in section 1.1, we need to extract specific information from the included papers. Table 6 shows which information is relevant for answering each of the research questions. It is worth noting that the "Topic" column in Table 6 is derived from the "Keywords" field using a combination of keyword clustering and expert knowledge, as described in section 3.1.4.

2 EVALUATING THE MAPPING STUDY

This step is responsible for reviewing the output of the previous phase and transitioning the SMS process to the next phase if the output meets the required quality standards. However, if the output quality is not acceptable, revising the planning phase is necessary before proceeding to the next phase. To evaluate the mapping study, we have used the evaluation metrics described in [22]. Based on the information provided in the work of [2], we have determined that our mapping study phase meets the acceptable quality criteria, and it is reasonable to proceed to the next phase (conducting the mapping study). Additional information and details can be found in $SupFile_{E7,T1-T3}$.

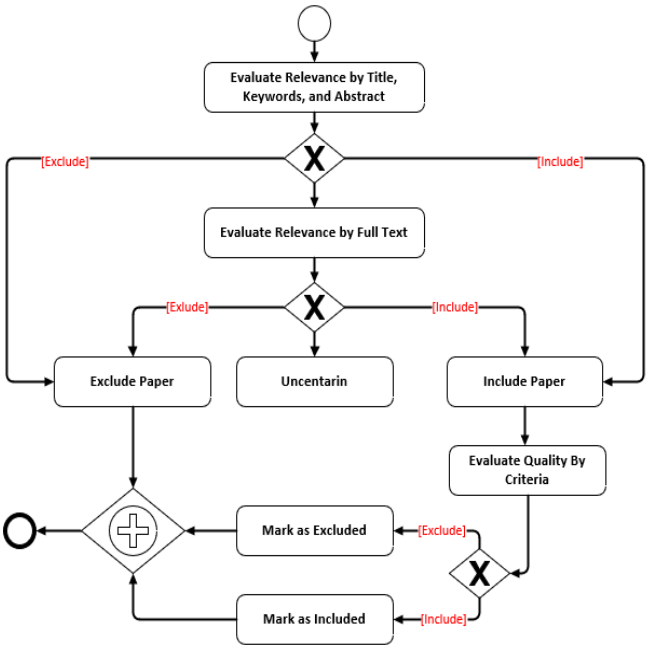

Fig. 4. The Study Selection Strategy [6]

Table 6. Extracted items needed for answering RQs

RQ#	Items
1	Author name, author affiliation, country
2	Search space, Paper Title/abstract Paper context, Keyword, Topics, Publication year
3	Topics, Author Keywords
4	Topics, Paper context
5	Topics, Paper context
6	Topics, Paper context
7	Paper context
8	Topics, Paper context
9	Topics, Paper context

3 CONDUCTING THE MAPPING STUDY

Up until this point, sections 1 and 2 have outlined the strategies utilized in this SMS. Moving forward, the subsequent sections will detail the outcomes of implementing these strategies.

3.1.1 Conducting the process of search space and study selection

This section provides a comprehensive overview of the search and study selection process. The details include the use of keywords during the search process, identification of search spaces, and the selection of relevant papers through a series of studies.

As outlined in Section 1.2.2, the initial keyword set is used in Phase 1 of the search process (see $SupFile_{w3,T3}$). Subsequently, the extracted keywords from each phase are used in the following phase. For example, the keywords obtained from the initial set and the included studies of phase 1 are used in phase 2.

Complete information on the search spaces obtained during the search process, including the reasons for their exclusion, is provided in $SupFile_{w3,T4}$. Furthermore, the aim and scope of each identified search space are listed in $SupFile_{W3,T5}$. We have also included some indicators in the field of edge computing in $SupFile_{W3,T1}$ to help with the inclusion/exclusion of studies and search spaces For instance, studies numbered 1, 4, and 5 in Table 2 resulted in several search spaces, some of which are presented in Table 7. The quality of each search space is evaluated based on the exclusion criteria outlined in Table 4, and its inclusion/exclusion status is indicated in the last column of the same table. For example, , in Table 7, the journal with the JID = 92 is excluded because there is no information about Q and IF found for it. Also, the journal with the JID = 20 is unrelated to the field of edge computing, and thus it is excluded. This information is described in $SupFile_{w3,T4}$.

Table 8 displays the final statistics of the search spaces set. We found 805 distinct search spaces during the search process, out of which 112 were included and added to the search spaces set. Further information on the included/excluded search spaces in each phase is provided in Table 8. For instance, NI1 and NE1 indicate the number of included and excluded search spaces in phase 1, respectively.

The included and excluded studies set are reported in $SupFile_{E2,T1}$ and $SupFile_{E2,T3}$, respectively. Additionally, statistical information about studies in each search space is provided in $SupFile_{W3,T11}$. Table 9 presents a sample of these studies from the search spaces presented in Table 7. For example, the contribution of the second study is not related to the field of edge computing and is thus excluded. After adding the included studies, if new keywords emerge, the existing keywords set is updated by adding these new keywords.

Table 10 presents the final statistics of the studies. Out of 8725 papers identified during the search process, 1440 studies were included and added to the final studies set. NI1 and NE1 indicate the number of search spaces for included and excluded studies in phase 1, respectively.

3.1.2 Evaluating the Search and Study Selection Process

We have conducted a validation to verify the accuracy of our SMS, as outlined in section 1.4. As part of this validation process, we explored the home pages of pioneering researchers in the field of edge computing in order to identify any previously undiscovered studies. The list of these unseen studies can be found in $SupFile_{E7,T1}$. According to the information presented in this table, we were unable to find 12 of the studies during our initial search process.

3.1.3 Data Extraction

Once we had completed the identification of the studies to be included, we began the process of reading and extracting relevant information from them. Details about this process can be found in $SupFile_{E5,T5}$. The extraction of information was carried out by a team of five members, and subsequently reviewed by three other members.

3.1.4 Analysis and Classification of data

As previously stated, the primary objective of this SMS is to answer the RQs outlined in Table 1, as well as to identify the main topics and sub-topics in the field of edge computing. In order to achieve this, the data that has been extracted and organized in the previous stages must now be analyzed.

There have been various techniques proposed for identifying the scope of a research field based on keywords. Two well-known methods are the statistical similarity factor [23, 24] and the use of co-occurrence matrices [25, 26]. However, the statistical similarity factor method only considers a small section of the text (such as a paragraph) for identifying topics and sub-topics, which can lead to inaccuracies. Additionally, similarity-based keyword clustering techniques often struggle with effective classification [27]. The co-occurrence matrix method involves grouping keywords into several clusters based on their co-occurrence, and then determining topics and sub-topics that share a similar cognitive orientation. However, this method is only suitable for small study domains and a limited number of keywords. Given the broad scope of the field of edge computing and the large number of scattered keywords, this method was not useful. Instead, in this research, the topics and sub-topics were determined based on expert knowledge.

To construct a research tree for the field of edge computing based on the reviewed studies, we aimed to identify topics and sub-topics at various levels. The first level of the research tree is the most crucial for answering the RQs. Given the high

dispersion of keywords, it was essential to utilize an accurate method for finding and analyzing them. The following steps describe the process of constructing the first level of the research tree:

Step1 – In this step, the keywords for all the studies included in the research are extracted. If the author(s) did not specify the keywords, an expert member of the team defines them. Additional information is provided in $SupFile_{E3,T1}$.

Step 2 – once all the keywords have been extracted or defined, the team tries to categorize them. Keywords with similar meanings, such as "resource allocation", "allocation of computing resources", and "resource management", are allocated to the same category. The team uses an incremental approach to categorize the keywords. Initially, there are no categories. An expert examines the keywords one by one and decides to which category they should be added. Each new keyword can be added to an existing category, or a newly created category based on its concept. As a result of this step, 1560 categories are created.

Step 3 – In this step, an initial view of the existing topics in the field of edge computing is determined by an expert using the topics from other review papers. Then, the categories from the previous step are mapped to corresponding topics (refer to $SupFile_{E3,T3}$). The final topics are reviewed by other experts in the team, which may result in the addition of new topics. This step creates the first level of the research tree.

Step 4- After specifying the main topics in the field of edge computing located at the first level of the research tree, the expert extends each topic by defining its sub-topic. This is done by examining the existing keywords in each topic and categorizing them based on their experience. Additionally, thematic similarities are used to determine the tree topics. Table 11 shows a list of these thematic similarities.

Table 7. Sample Extracted Journal Search Space and Results of Search Selection Process

JID	Journal Name	Topic	IF (JCR-2017)	Q (JCR-2017)	Publisher	ROE	Type
3	Future Generation Computer Systems	• Computer Science Theory and Methods	4.639	Q1	Elsevier	-	JCR
11	IEEE Access	• Engineering Electrical and Electronic	3.557	Q1	IEEE	11	JCR
13	Journal of Internet Services & Applications	• Computer Science • Computer Networks and Communications • Computer Science Applications	0.401	Q2	Springer	JEC1	SJR
20	IEEE Systems Journal	• Engineering Electrical and Electronic • Computer Science Information Systems • Telecommunications • Operations Research and Management Science	4.337	Q1	IEEE	JEC2	JCR
69	Journal of Parallel & Distributed Computing	• Computer Science Theory and Methods	1.815	Q2	Elsevier Inc.	-	JCR
92	ACM Sigmobile Mobile Computing & Communications Review	-	N/A	N/A	ACM	JEC1	JCR

Table 8. Search Space Set Statistics

No.	Search Spaces	NI_1	NE_1	NI_2	NE_2	NI_3	NE_3	NI_4	NE_4	NI_5	NE_5	Total
1	Journals	59	110	48	486	4	54	1	43	0	0	805
2	Conferences	-	-	-	-	-	-					-
3	Workshops	-	-	-	-	-	-					-
4	Total	59	110	48	486	4	54	1	43	0	0	805

Table 9. Sample Studies from Included Search Space of Table 8 and Results of Study Selection Process

Paper Title	Journal Name	Year	Exclusion Criteria
A fog computing-based concept drift adaptive process mining framework for mobile APPs	Future Generation Computer Systems	2018	-
A multimedia healthcare data sharing approach through cloud-based body area network	Future Generation Computer Systems	2017	PEC1
Augmenting computing capabilities at the edge by jointly exploiting mobile devices: A survey	Future Generation Computer Systems	2018	PEC3

Table 10. Study Set Statistics

No.	Search Spaces	NI_1	NE_1	NI_2	NE_2	NI_3	NE_3	NI4	NE4	NI5	NE5	Total
1	Journals	599	1770	158	3669	13	1084	0	43	671	718	8725
2	Conferences	-	-	-	-	-					-	-
3	Workshops	-	-	-	-	-					-	-
4	Total	599	1770	158	3669	13	1084	0	43	671	718	8725

Table 11. Sample of Thematic Similarities between keywords

Topic	Thematic similarities	Sub Topic
Computation Offloading	Offloading/Outsourcing/ Cooperative task computing/ Task outsourcing/Verifiable outsource	Computation Migration
	Mobility/ Follow me edge/ Distributed mobility management/ E-mobility/ Seamless application execution/handover/Service handoff	Mobility-Management
	Decision making/ Collaborative decision-making/ Computing mode selection	Decision-Making
	Partitioning/ Computation partitioning/Data segmentation strategy/ Dynamic partitioning of computation	Partitioning

During the process of conducting an SMS, which includes the planning and conducting phases, there are various factors that can impact its validity. Therefore, one important aspect discussed in Section 2 is the identification of threats to validity. The primary goal of the validation process is to provide evidence to address any threats that may arise during the systematic review. Some of the key pieces of evidence are discussed below:

Obtaining a set of qualified studies: To achieve this, we utilized two popular search methods, namely SLR and SMS, in order to design a comprehensive search process that would yield a relevant set of studies. We also evaluated our search process to ensure its reliability.

Ensuring the inclusion of the most relevant studies: To achieve this, we utilized an evolutionary process to refine the set of keywords used in the search process. In edge computing, certain keywords may not have a specific meaning on their own, so we combined them using logical operators (AND, OR). Additionally, we utilized manual snowballing to extract and review any relevant studies that may have been missed in our initial search, which was an improvement over our previous works.

Addressing reviewer biases or misunderstandings during the study selection process: To mitigate this challenge, two researchers conducted the study selection process independently, and any discrepancies were resolved by a third researcher or by utilizing decision rules (as described in Section 1.3.3).

Ensuring a complete set of search spaces: To avoid missing any high-quality studies during the search process, we evaluated the process and its results, and some members of the team created a test-set to eliminate any individual biases.

Extracting raw data from papers without author keywords: We extracted several keywords for each of these papers using the full-text of the papers and stored them in relevant forms to facilitate analysis and classification.

Naming level-one topics: After clustering keywords with expert knowledge, we selected appropriate names for each cluster. Since the field of edge computing has a wide range of topics and scattered keywords, we chose names that showed conceptual similarities at a higher level. For example, for the "Resource Management" topic, we selected this name because it encompasses keywords such as "Resource Management," "VM migration," "Service provisioning," and "Task allocation." To ensure objectivity, team members discussed and agreed upon the proposed topic names in joint meetings.

Lack of coverage of conferences and workshops: Although there are quality studies related to edge computing published in conferences and workshops, we had to limit our review to studies published in journals due to the large volume of studies in this field. To our knowledge, this does not have a significant impact on the entire process. Mapping studies often limit their searches in various ways, such as selecting only journal papers, searching specific sources, or searching papers published in specific years, as stated in [2]. Consequently, while a mapping study may be auditable, it may not necessarily be completed. This allows other researchers to expand and complete this SMS. However, the primary responsibility of an SMS is to identify the main research topics and sub-topics [3]. To this end, we used other secondary studies such as surveys to obtain topics and sub-topics in the research tree. These secondary studies cover related papers from other search spaces such as conferences and workshops. We hope that the coverage of topics and sub-topics has reached the desired level. To further improve this review, one could have an independent review of studies published in conferences and workshops in the future.

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