To answer the research questions and to present an extensive overview of the current state of knowledge in the area of sustainable ICT procurement, the literature must be covered impartially and thoroughly. A **Systematic Literature Review (SLR)** provides a reliable and fact-based assessment of the current state of knowledge and identifies gaps in the literature.

Defining Search Strategies and Selecting Research Sources

Intending to provide an adequate and robust search string to ensure the inclusion of all relevant sources, tests of various search queries across different databases were conducted, and the results were analyzed. As part of the SLR, key themes and associated keywords for database searches were identified. These themes and keywords are detailed in Table 8.

This section details the methods applied and the process followed in this systematic review. The whole process is summarized in Figure 22. In this study, Kitchenham and Charters general recommendations were followed for **Systematic Literature Reviews (SLRs) in Software Engineering** (Kitchenham, Charters, et al. 2007) along with Wohlin's snowballing technique (Wohlin 2014).

Table 8: Themes and Keywords Identified for Database Search

Theme	**Keywords**
IT Products	IT Devices, Office Equipment, Information Technology Systems, Infrastructure
Sustainability Evaluation	Environmental Impact Assessment, Carbon Footprint Calculation, Sustainability Criteria, Certification, Life Cycle Assessment, Environmental Standards, Framework
Sustainable IT Procurement	Green IT Purchasing, Eco-Friendly IT Procurement, Sustainable Technology Adoption
Business	Enterprise, Company, Organization, Industry

Search String Development

An optimal search string was developed by iteratively testing various combinations of keywords and refining them. This process involved a top-down approach, starting with broad general search queries and progressively narrowing them down, as well as a bottom-up approach, starting with specific queries and expanding them. The final search string as depicted in Table 9 was designed to ensure that all relevant studies were identified without including excessively irrelevant literature.

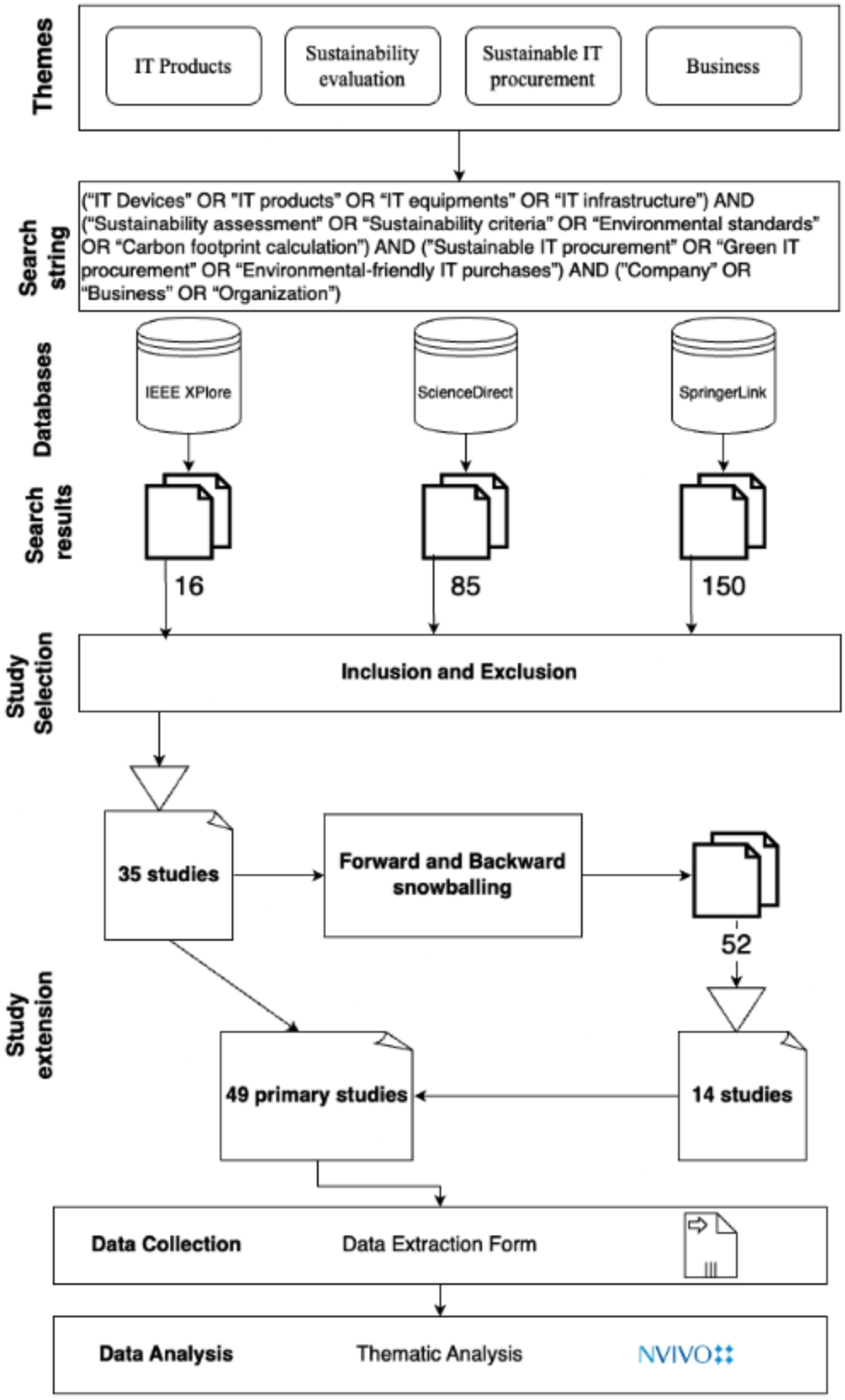

Figure 22: The Literature Review Process

Table 9: Databases and Search Strings

Database	**Search String**
IEEE Xplore, SpringerLink	(“IT Devices” OR ”IT products” OR “IT equipment” OR “IT infrastructure”) AND (“Sustainability assessment” OR “Sustainability criteria” OR “Environmental standards” OR “Carbon footprint calculation”) AND (”Sustainable IT procurement” OR “Green IT procurement” OR “Environmentally-friendly IT purchases”) AND (”Company” OR “Business” OR “Organization”)
ScienceDirect	(“IT Devices” OR “IT infrastructure”) AND (“Sustainability assessment” OR “Carbon footprint calculation”) AND (”Sustainable IT procurement” OR “Green IT procurement”) AND (”Company” OR “Business”)

Since the **ScienceDirect** search function has a limitation of a maximum of eight operators, two keywords were used from each of the themes to create the search string. **ScienceDirect** also did not support wildcards; therefore, those were not used, as the goal was to create a search string applicable to all selected databases without compromising data integrity.

In all cases, keyword searches were conducted within the title, abstract, and author keywords fields. To overcome the limitations of these searches, one round of backward and forward snowballing (Wohlin 2014) was implemented(see 10) to identify additional relevant papers.

Study Selection

In an SLR, the inclusion and exclusion criteria serve the purpose of selecting pertinent primary studies to address the research questions. The specific criteria for including or excluding papers are depicted in Table 10. These criteria were consistently applied to all retrieved studies from the selected databases.

Table 10: Inclusion and Exclusion Criteria for Literature Selection

Inclusion Criteria (IC)		**Exclusion Criteria (EC)**	
ID	**Criteria**	**ID**	**Criteria**
IC1	Paper written in English	EC1	Duplicate content
IC2	Paper accessible in full text	EC2	Irrelevant topics
IC3	Peer-reviewed literature	EC3	Non peer-reviewed sources
IC4	Relevance to sustainable ICT devices procurement	EC4	Non-specific ICT procurement
IC5	Relevance to the ICT sector	EC5	Paper not written in English

		EC6	Paper not accessible in full text

The search results were collected in a spreadsheet as well as an online tool **Parsifal** [1], recording metadata such as titles, authors, abstracts, and publication dates. The study selection process involved two steps: initially, the search results were screened based on the title and abstract for the keywords or synonyms that directly or indirectly connect the topic to the selection criteria. Studies that did not meet the inclusion criteria or met any of the exclusion criteria were removed. Then, a full-text review of the remaining studies was conducted to ensure they met all the inclusion criteria. Any studies that were found to be irrelevant upon full-text review were excluded. In some cases, even if the title or abstract didn't include the required keywords, but potential relevance was sensed based on the context of the article, then those were analyzed further. By applying these criteria rigorously, the study selection process yielded only 35 papers.

Snowballing

Since only 35 relevant papers were selected during the search, one round of backward and forward snowballing was conducted to accumulate the number of articles. This process involved collecting potentially relevant articles from the references in the primary studies (backward snowballing) and the articles citing the primary studies (forward snowballing).

After conducting snowballing based on those 35 papers, 52 more articles were identified as potentially relevant. Meta-information on those relevant articles was collected in a spreadsheet. Then, the same exclusion and inclusion criteria were applied, resulting in 14 more relevant articles to analyze in this work. As a result, 49 primary studies were ultimately selected for the analysis.

Data Extraction

The data extraction process was designed to systematically gather and categorize relevant information from the selected studies. This step was crucial for synthesizing the findings and addressing the research questions.

Table 11 shows the key themes that were identified as essential for data extraction, mapped to the corresponding research questions as mentioned in section 3.2. The aim was to use these themes for a more focused analysis of papers and extraction of data.

Table 11: Data Extraction Themes

[1] https://parsif.al/

Theme	Question/Insight	Mapped Research Question
Barriers Mentioned	What barriers to sustainable ICT procurement are identified in the study?	Sub-RQ1
Enablers Mentioned	What factors are mentioned as enablers for sustainable ICT procurement?	Sub-RQ2
Framework and tools	Does the study propose any specific methodology, tool or framework? If so, what are its key components and features?	Sub-RQ3
Sustainability Assessment	Does the study discuss any criteria or methods for assessing sustainability? What are the key assessment metrics used?	Sub-RQ3
Additional Themes	Are there any additional relevant insights, such as case studies or specific sector applications?	Relevant to all RQs

The online tool **Parsifal** was utilized to develop a standardized data extraction form based on the identified key themes and required insights. Each of the selected studies was thoroughly reviewed and using the developed data extraction form, the necessary information was extracted and inputted. Information related to barriers and enablers was recorded qualitatively, noting specific examples and descriptions provided in the studies.

Details about methodologies, frameworks, and sustainability assessment criteria were documented to perform comparative analysis. Other tools such as **NVivo**[2], and **Tableau**[3] were used for analysis to gain deeper insights into the data.

[2]https://lumivero.com/products/nvivo/

[3]https://www.tableau.com/