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Problems and solutions in adopting information and communication technology in micro and small enterprises

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Abstract:
Micro and small enterprises (MSEs) are predominant worldwide and responsible for the greater employability of citizens, income generation, and production. However, they face resource constraints and rely on information and communication technology to remain competitive, which often causes many problems during or after the adoption process. Knowing the problems that affect micro and small enterprises and the solutions adopted may help other companies face the same issues. In this work, based on a systematic literature review (SLR), we identified and analyzed the problems that occurred during or after the implementation of information and communication technologies in micro and small enterprises and what actions were taken to solve them. We sought to understand the behavior of problems and solutions in the last 21 years and the factors that influenced them. We performed an SLR using the snowballing technique, retrieving 12,936 articles in eight iterations, and selecting and analyzing 105 papers. As a result, we identified 129 problems, divided into 12 categories, and 48 solutions. Such an analysis is advantageous for academia, governments, and business managers, as it allows one to understand problems in advance and formulate more efficient policies, plans, and projects for these enterprises.

Keywords:
Problems; solutions; information and communication technology; ICT; adoption; micro and small enterprises.

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1. Introduction

Small and medium-sized companies (SMEs) are identified as a vital economic sector, contributing to job creation [1][2], innovation, entrepreneurial spirit, and market competition [3-5]. Hillary [4] and Keeffe [6] note that 99.8% of businesses in the UK and globally are SMEs, playing a pivotal role in job creation, internal production, innovation, and productivity growth. Additionally, SMEs provide employment opportunities for women, immigrants, and minority groups [5] and are essential for socioeconomic development, especially in the face of globalization [7] and post-crisis economic recovery [8]. Their adaptability allows them to respond swiftly to market demands and withstand economic challenges [7].

Investing in Information and Communication Technologies (ICTs) substantially benefits small enterprises, improving productivity, operational efficiency, and long-term performance [9-11]. These technologies enhance decision-making, business operations, and small businesses' competitiveness, productivity, and profitability [12][13]. Despite the evident advantages, adopting ICTs in small and medium-sized enterprises (SMEs) faces challenges, including resource constraints, high costs, and a lack of knowledge, which hinder adoption [9]. Nonetheless, the positive outcomes of ICT adoption, such as efficiency gains and cost reduction, remain significant for small enterprises [14]. Therefore, understanding the key factors that influence ICT adoption in SMEs is essential for the growth and competitiveness of small businesses [14].

Several studies analyze factors that influence the success of IT projects. Varajão et al. [15] identify factors impacting IS management projects' success and classify definitions and measures of IT project complexity. Bezdrob et al. [16] investigate the reasons for the high success rate of IT projects in the Federation of Bosnia and Herzegovina. Other works are limited to identifying problems small and medium-sized companies face when adopting specific ICT tools. Haddara and Elragal [17] identify cost categories and factors for Egyptian SMEs adopting ERP systems. Hasheela-Mufeti and Smolander [18] explore SMEs' challenges when implementing ERPs in Southern Africa. Several literature reviews focus on the adoption of ICTs by small businesses, with some concentrating on specific regions [19][20].

Some studies carry out systematic literature reviews to identify factors that influence the adoption of ICT in SMEs, including work by Ghobakhloo et al. [21], Barba-Sanchez et al. [22], and Rokhim et al. [23]. However, these studies are outdated, and updating the problems faced in adopting ICTs is essential. Our research contributes to this update by highlighting the history of problems and solutions small businesses have faced in adopting ICTs over the last 20 years.

Thus, this study sought to elucidate the challenges faced by MSEs when incorporating ICT and to identify the practices they employ to prevent, mitigate, or transfer these challenges. The findings from this research may serve as valuable insights for academia, government entities, and funding agencies to enhance their ICT procurement, management, and development strategies, as well as their financing and support programs. Specifically, MSEs can better identify project risks and ensure the success of their ICT adoption and utilization endeavors. To this end, we conducted a systematic literature review (SLR) using the snowballing technique and employed descriptive statistics.

In our analysis of 105 articles, this work's main contributions cover identifying the main problems (129) faced by MSE in adopting Information and Communication Technologies (ICTs) in the last two decades and the solutions (48) implemented to resolve them. Furthermore, we delve deeper into the analysis of the problems, carrying out a sectoral breakdown (industry, commerce, and services) and a technological categorization (system, software, and hardware). Furthermore, our study includes a comprehensive mapping of selected works' profiles, examining research methods, data collection approaches, the number of publications in the field spanning 20 years, and the countries where these works were published.

The remainder of this work is organized as follows: Section 2 provides a background on MSEs and their utilization of ICT. Section 3 outlines the research method adopted in this study. Section 4 presents the research findings, while Section 5 discusses the results. Section 6 summarizes our conclusions and outlines avenues for future research.

2. Background

2.1 Micro, Small and Medium-sized Enterprises (MSMEs)

In the literature, the definitions of micro, small, and medium-sized enterprises vary according to annual revenue, number of employees, and other specific factors. Furthermore, these definitions may vary between countries, regions, and sectors [24].

According to the OECD [25], micro, small, and medium-sized enterprises (MSMEs) employ less than 250 people. MSMEs are subdivided into micro-enterprises (less than 10 employees), small (10 to 49 employees), medium-sized (50 to 249 employees), and large ones employing 250 or more people.

In Europe [26], a medium-sized enterprise is defined as a company that employs fewer than 250 people and has annual revenues of up to €50 million and an annual payroll of up to €43 million. A small business is a company that employs fewer than 50 people and has annual revenue or payroll of up to €10 million. A micro-enterprise is a company that employs less than 10 people and has revenues or payrolls of up to 2 million euros.

In the United States, the U. S. Small Business Administration (SBA) defines small businesses by firm revenue (ranging from $1 million to over $40 million) and by employment (from 100 to over 1,500 employees) [27]. These values vary by industry, revenue, and employment and are listed in the SBA Size Standards Table [27]. Micro-enterprise classification is not considered in the United States.

Small and medium-sized enterprises (SMEs) are considered the most crucial sector of the economy because they create jobs [1-3] and are a source of innovation, entrepreneurial spirit, and competition in the market [4][5]. Moreover, they take advantage of individual creative efforts, which makes them vital for a dynamic and healthy economy [4].

Hillary [4] highlights that 99.8% of businesses in the UK are small or medium-sized, which is also the case in other countries worldwide. Keeffe [6] states that these businesses are the majority globally and contribute to job creation and internal production in their respective countries [5]. Groepe [5] adds that they play a crucial role in innovation and productivity growth. Small businesses also create employment opportunities, particularly for women, immigrants, and minority groups [5], and are essential for socioeconomic development, especially in the face of globalization [7] and economic recovery following crisis [8]. Their agility and adaptability enable them to quickly adapt to market demands and withstand economic crises [7].

2.2 Benefits of Investing in ICTs for MSEs

Investing in information and communication technologies (ICTs) can benefit micro and small enterprises as it can help them improve their productivity, manage their operations effectively, and sustain their business performance in the long run [9]. ICTs can also improve decision-making and business operations [10]. Additionally, they play a critical role in improving small businesses' competitiveness, productivity, and profitability [13]. Furthermore, advances in technology that allow for more flexible production methods, downsizing, reorganization, and outsizing by large companies, and the rise of franchising and self-employment will result in more small businesses [4].

Innovation emerges as the key to enduring market challenges [28]. Innovation, defined as "the introduction of new or improved products, methods, processes, and organizational practices" [29], presents an avenue for MSEs to tackle and mitigate the issues they face. In this context, Information and Communication Technologies (ICTs) may be powerful tools to drive innovation and address MSEs' challenges. Carvalho et al. [24] highlight that MSMEs must invest in innovation to compete.

The widespread integration of technology into our daily lives is evident, and MSEs have embraced ICTs to alleviate or circumvent impediments to their growth. In a business context, ICTs encompass a suite of software, hardware, telecommunications, and management technologies, applications, and available devices used to create, analyze, process, store, and transform information [30].

The surge in ICT adoption by MSEs is undeniable. There has been a notable increase in the usage of devices such as smartphones and desktop computers, along with a growing adoption of cloud technologies among businesses [31]. Companies view IT as indispensable for ensuring smooth operations, enhancing customer service, expediting task completion, and attracting and retaining consumers [32]. According to Hassan and Ogundipe [32], for SEs interested in competing, adopting ICT is no longer merely an option.

The benefits obtained by IT adoption by companies of this scale are well-documented. However, as Rozmi et al. [9] highlighted, the adoption process is often hampered by high costs, lack of knowledge, and other internal and external factors.

2.3 Related Works

Several studies analyze the factors that influence the success of information technology projects. For example, in Varajão et al. [15], the authors focus on identifying which factors impact the success of information systems management projects. According to the authors, the results provide researchers and practitioners with a better understanding of IS project management success evaluation. Varajão et al. [15] systematically reviewed the literature to identify and classify definitions and proposed measures of the complexity of Information Technology projects. The article contributes to establishing a common language when discussing complexity and a better understanding of project complexity and its implications for practical IT engineering projects. Bezdrob et al. [16] investigate the circumstances and possible reasons for an unexpectedly high success rate of Information Technology (IT) projects implemented in the Federation of Bosnia and Herzegovina (F BiH).

Several works are limited to identifying problems small and medium-sized companies face when adopting specific ICT tools. Haddara and Elragal [17] identify the various cost categories and factors that could occur when Egyptian SMEs adopt ERP systems. This research provides a list of cost factors and their classifications that can help adopting organizations better estimate required ERP project budgets. Factors related to costs are essential to be considered in SMEs because these companies have restrictions regarding cost. Hasheela-Mufeti and Smolander [18] also explore issues in adopting ERPS. The study's objective is to identify challenges experienced by SMEs when implementing ERP systems and to suggest requirements for achieving successful implementations in SMEs in Southern Africa.

Many of the systematic literature reviews focus on a specific region. For example, Anjum [19] and Chandavarkar and Nethravathi [20] investigate the factors that influence the adoption of ICTs by small and medium-sized Indian companies.

Some works aim to carry out a systematic review of the literature to identify factors that influence the adoption of ICTs in SMEs, highlighting the work of Ghobakhloo et al. [21], Barba-Sanchez et al. [22] and Rokhim et al. [23]. However, these works were already published years ago. An update of this information is relevant to the area. Furthermore, in our work, we highlight the evolution of IT adoption and a history of the problems faced by small enterprises over 20 years. None of the related works have this purpose.

3. Research method

We performed an SLR to identify the problems and solutions encountered by MSEs during the adoption of ICTs. For the selection of articles, we used the snowballing technique. Subsequently, we performed an analysis of the results and applied descriptive statistics.

The choice of this methodology and method offers several advantages. As described by Kitchenham and Charters [33], an SLR adheres to explicit and systematic procedures, ensuring rigor and comprehensiveness in the review process. Snowballing involves leveraging the reference lists of relevant papers and citations within articles to identify additional pertinent literature. This approach allows one to concentrate on seminal works within the field, reducing the noise typically associated with a database search and ensuring comprehensive coverage of related research [34].

As described by Wohlin [34], the initial challenge in employing the snowballing technique is selecting an appropriate starting set of papers, which should encompass articles highly relevant to the research area. Once the start set is defined, each of the selected articles is analyzed. During each iteration, the references cited within an article are examined (backward search), as are the papers that subsequently cited the article (forward search). This iterative process continues until no further relevant work is added to a given iteration. We organized the SLR into three phases: planning, execution, and data extraction. These phases are elaborated upon in the subsequent subsections.

3.1 Planning

During this phase, one lays the foundation for their research by delineating their objectives and devising the methodology that will guide their inquiry. The planning process encompasses the formulation of research questions and the establishment of inclusion and exclusion criteria. The research questions are formulated to obtain the expected results related to the research topic [33].

This work sought to answer the following research questions to understand the problems caused by adopting ICTs and the solutions to solve, mitigate, or transfer them:

RQ1. What is the profile of the works that report problems and solutions?

RQ2. What problems occur during or after adopting ICTs in MSEs?

RQ3. What has been the behavior of these problems over the past 21 years?

RQ4. Do the problems change by industry or section of companies?

RQ5. Do the problems change according to the technology adopted?

RQ6. What are the solutions for these problems that occur during or after adopting ICTs in MSEs?

Wohlin [34] emphasized that before starting the snowballing process, it is necessary to have defined the inclusion (IC) and exclusion (EC) criteria for the snowballing since they will guide the reviewer in including work that meets the review objectives. For the inclusion criteria, we considered the type of work, year of publication, and size of the researched company, among others. We excluded companies with ICT as their core business due to technological bias and the trend towards better technology management, which could distort the results. We defined the following criteria for analyzing the studies that would be included or excluded in the context of the SLR:

Inclusion Criteria:

- The paper was published from 2000 to 2021;
- The title, keywords, or abstract made explicit that the paper was related to the research topic;
- The paper answered at least one of the research questions;
- Work related to IT adoption in MSEs.

Exclusion Criteria:

- The publication was a tutorial, workshop, technical report, or merely an abstract;
- The full text was not available;
- The publication appeared more than once in the reference lists and citations analyzed (duplication);
- Works that considered companies whose main activity was information and communication technology.

3.2 Execution

In the snowballing approach, the second phase begins with the start set. As highlighted by Wohlin [34], no universally correct or highly effective method exists to create this start set. Consequently, one viable approach is to select a well-cited work from a reputable database to form the basis of the start set. Our start set comprised nine works published from 2001 to 2016, all previously meeting the IC and EC. These articles are cataloged as [35] to [43].

Once the start set was established, we started the first iteration, employing backward and forward snowballing techniques. Backward snowballing involves examining the reference lists of the articles to uncover additional relevant works, as shown in Figure 1. In this process, we reviewed the list of references, excluding articles that failed to meet our predefined exclusion criteria.

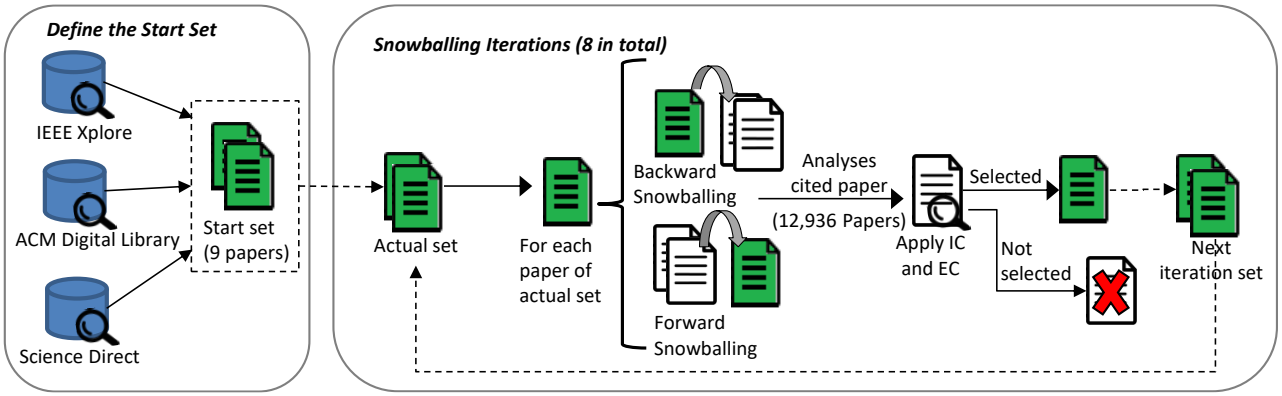


Fig. 1. Phases of the Snowballing Method

Conversely, forward snowballing involves identifying new articles by looking at papers that cite the article under examination [34]. For this, we leveraged Google Scholar's feature for tracking publications that cite a given work.

To assess the selected articles, we performed a comprehensive evaluation process that included the analysis of the titles, abstracts, and results and discussion sections. For the classification of companies in terms of size, we used as a criterion the number of employees established by OECD [25] when available, or we accepted the size (micro, small, or medium) reported in the work. We excluded articles focused exclusively on medium or large size companies. The article search procedures were conducted from January 23 to November 4, 2021. From the start set defined with nine articles, we analyzed 12,936 works in eight iterations and selected another 98 works. In total, our study encompasses the analysis of 105 articles [35-139], each contributing valuable insights to our research.

According to the recommendations of Wohlin [34], one essential efficiency measure in systematic literature studies is the ratio of included articles to the total number of candidate articles examined. We present the efficiency achieved in each iteration of our work in Table 1. To calculate the overall efficiency, we summed the articles included in each iteration, resulting in 105 (9+18+26+22+17+9+3+1+0). Simultaneously, we summed the total number of candidate articles examined in all iterations, resulting in 12,936 (870+1910+3202+3951+2118+661+196+28). The overall efficiency was calculated as the ratio of the articles included to the total candidate articles examined, yielding 0.812%. It is worth noting that efficiency is computed by considering all candidate articles evaluated throughout the study.

3.3 Data extraction

To perform the data extraction, we prepared reading sheets elaborated to capture a comprehensive information set. These sheets systematically collected details such as the title, authors, publication year, country and place of publication, primary research theme, objectives, type, and application context of an article, as well as any other pertinent information that addressed our research questions. Following the tabulation of this data, we applied measures and tools of descriptive statistics, which employs tables, graphs, and summary measures to elucidate and condense data characteristics, allowing a better understanding of their behavior [140].

Table 1. Efficiency

Iteration	Candidates	Included	References	Efficiency	Selected Articles
Start set	-	9	[35]-[43]	0%	8.57%
Iteration1	870	18	[44]-[61]	18/870 = 2.07%	17.14%
Iteration2	1910	26	[62]-[87]	26/1910 = 1.36%	24.76%
Iteration3	3202	22	[88]-[109]	22/3202 = 0.69%	20.95%
Iteration4	3951	17	[110]-[126]	17/3951 = 0.43%	16.19%
Iteration5	2118	9	[127]-[135]	9/2118 = 0.42%	8.57%
Iteration6	661	3	[136]-[138]	3/661 = 0.45%	2.86%
Iteration7	196	1	[139]	1/196 = 0.51%	0.95%
Iteration8	28	0		0/28 = 0%	0.00%
Total	**12,936**	**105**		**0.812%**	

4. Results and analysis

This section highlights the results obtained through the reading sheets according to each research question.

4.1 Profile of the works that report problems and solutions

This section analyzes the profiles of the selected works, considering factors such as methodologies, data collection methods, publication years, nationalities, and industry sectors to answer RQ1. It is important to note that a single study may fall into multiple categories.

RQ1. What is the profile of the works that report problems and solutions?

In terms of the nationality of the selected studies, they were distributed as follows: Brazil, 34 studies (32.38% of the total); South Africa, five studies (4.76%); Kenya, four studies (3.81%); Portugal, United States, and Malaysia, three studies each (2.86%); Finland, Netherlands, Indonesia, New Zealand, Pakistan, United Kingdom, and Australia, two studies each; and Canada, China, Ivory Coast, Egypt, Ethiopia, Fiji, Philippines, India, Iran, Northern Ireland, Japan, Jordan, Nigeria, Norway, Czech Republic, Singapore, Turkey, and Vietnam, one study each. Additionally, 21 studies (20%) did not specify a country (see Figure 2).

Figure 2 illustrates the number of papers published per year. Notably, the average number of articles published from 2012 to 2021 stood at 5.1 per year, while from 2000 to 2010, the average was 3.7 per year. The average number of papers published annually was 4.77, with a standard deviation of 2.95 and a variation of 8.72.

The most used methodologies were the case study and the survey, employed in 22 works (21% of the total), followed by multi-case study (13 articles, 12%), literature review (ten articles, 10%), descriptive studies and action research (six articles, 6%), and field studies (five articles, 5%). Another nine works (9%) used mixed methods, such as surveys, exploratory studies, or grounded theory, while ten others (11%) did not clarify the methodology employed (as shown in Figure 2).

The data collection methods used in conjunction with these methodologies were mostly data triangulation in 37 works (35%), followed by questionnaires in 30 (29%) and interviews in 22 (21%). Another five works (5%) used the literature search or systematic literature review. Eleven studies (10%) did not specify the data collection instrument used.

The selected studies covered a total of 4,469 companies, of which 3,333 (75%) were classified as MSEs by the authors without specifying the size, 371 were micro-enterprises (8%), 579 were small companies (13%), and 186 were medium-sized companies (4%). Medium-sized companies appear in the results because studies focused on small and medium-sized companies were included. However, 17 studies citing only medium-sized companies were excluded.

Of these companies, the service sector was cited in 52 works (49.52%), followed by the commerce sector in 46 papers (43.81%), and the industry in 44 works (41.9%). However, 23 studies (21.9%) did not specify the sector in which the surveyed companies operated, as shown in Figure 2. It is noteworthy that a paper may cite more than one sector.

4.2 Result considering faced issues

To facilitate the grouping of problems identified in the selected works, we developed a set of categories based on the work of Benamati et al. [141]. The selected works mention 129 distinct problems classified into 12 categories. Below is a brief description of each category and the related problems.

Company Management: this category encompasses issues related to company management and IT, such as gaps, needs, and deficiencies in business processes, organizational structure, and business rules.

IT Management: this category addresses problems concerning gaps, loss of control, and deficiencies in IT management and control, including strategic alignment and contracts.

Process and Change Management: this category highlights problems arising from the lack or deficiency of plans, processes, estimates, and controls related to IT and its adoption process.

Workforce: problems related to demands, difficulties, health, skills, and labor-related issues with IT.

Knowledge and Information: issues related to the lack or difficulty of information regarding IT, such as the absence of benchmarks and limited knowledge of IT capabilities.

Timelines and Deadlines: issues like delays and excessively long or short timeframes for adoption, customization, and training. This category suggests that the time spent on IT is a problem.

Costs and Expenses: problems related to IT costs since companies consider acquisition and maintenance costs as issues. Cost-related issues include labor costs, consultancy fees, training expenses, and project cost overruns.

Technical Issues: technical problems occurring within IT. These problems may be caused by or lead to improper use or adoption, and they pertain to more technical aspects of IT, such as security and maintenance, development, IT infrastructure, low performance, errors, and failures.

Adoption: encompasses problems related to the adoption process, including selection, deployment, migration of IT, and adaptations to physical spaces.

Usage: issues arising from the use of IT, such as underutilization, abandonment, system fragmentation, increased bureaucracy, business dependency on the system, and ‘support overload’.

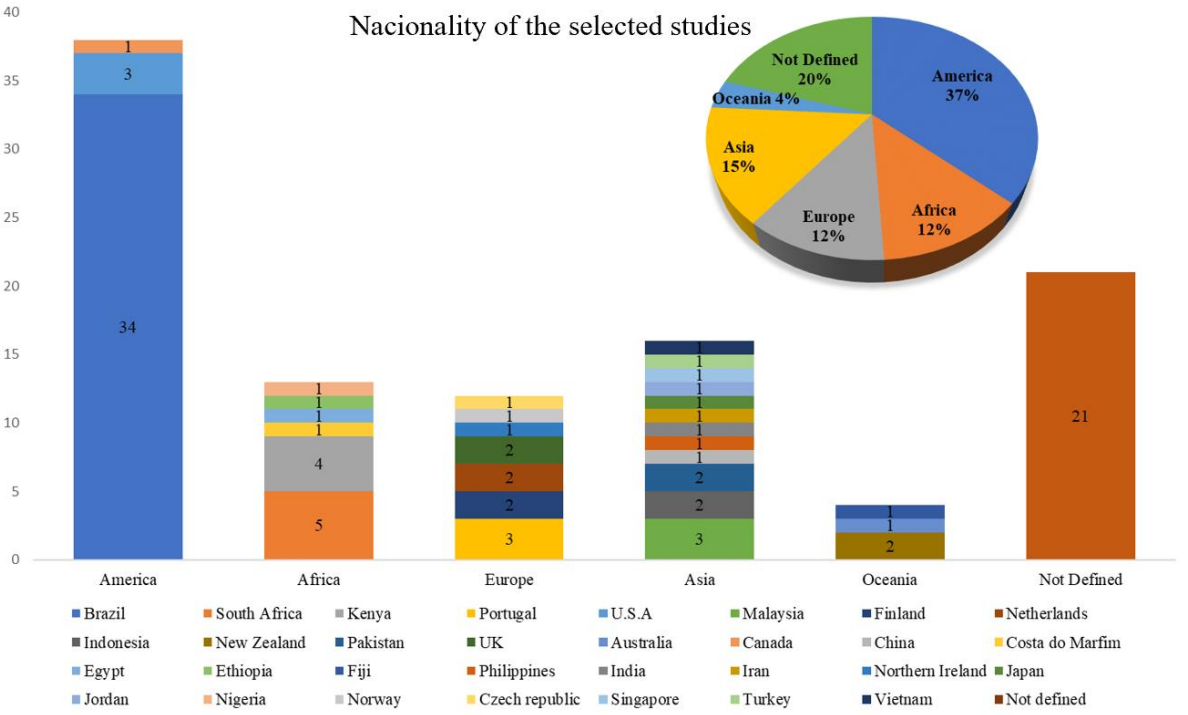
Cultural: cultural issues of the company and its employees related to IT.

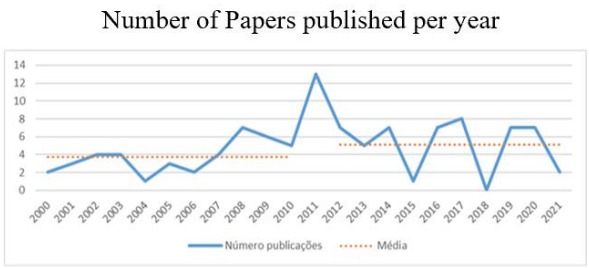
Niche: problems caused by IT in relationships between companies and their customers, partners, competitors, suppliers, and consultants. This category also includes a company’s interactions with the government and the judicial system.

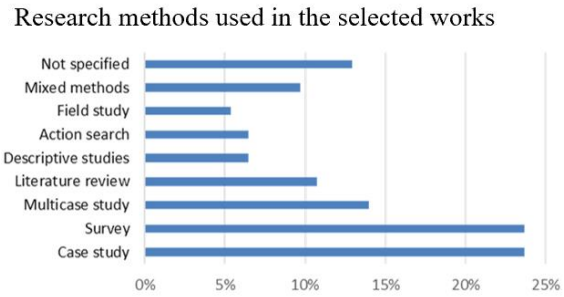
These categories are used to answer questions RQ2 to RQ5. Table 2 shows the problems identified in this research grouped by problem category and the works that cite each issue.

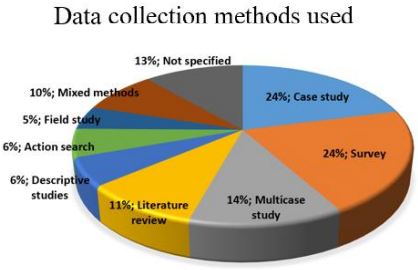
RQ2. What problems occur during or after adopting ICTs in MSEs?

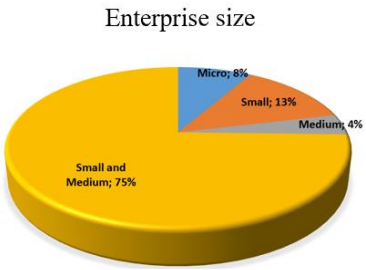
When examining the occurrence of these issues, the ‘Workforce’ category emerged as the most frequently mentioned, referenced in a total of 79 distinct papers (75%) (see Figure 3). Following closely, the ‘Technical Issues’ category was the second most cited, appearing in 67 works (64%), while the ‘Costs and Expenses’ category appeared in 60 papers (57%). Conversely, the least cited categories were ‘Company Management,’ with 27 works (26%), ‘Knowledge and Information,’ with 26 (25%), and ‘Process and Change Plan Management,’ with 23 (22%).











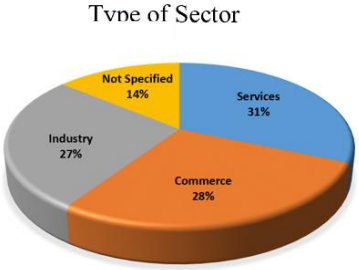


Fig. 2. Profile of the selected works

Table 2. Problems grouped by categories associated with works that cite them

	Problems	Works that cite the problem
Company Management	Unspecified business problems	[37][49][56][67][73][77][85]
	Need to reevaluate/redesign business processes/roles/activities	[35][46][89][91][94][110][122][137]
	Business processes were not well-defined/known	[82][101]
	Need to reevaluate/redesign the organizational structure	[36][37][49][67][77][113]
	Lack of analysis/knowledge about business rules by the company/employee/manager	[83]
	Lack/loss of synergy between departments	[37][67][77]
	Issues involving top management/leadership	[37][67][77]
	IT makes processes overly bureaucratic	[38][79]
	Lack of knowledge about available IT	[36][59][102]
	Lack of access to the latest technologies	[124]
	Lack of clarity in system specifications	[42][73][101][121]
IT Management	Loss of control over IT usage	[58][66]
	Lack or failure of IT usage planning policies	[68][73][75][98][121][126]
	Strategic alignment between IT and the company	[37][56][60][62][67][73][77][110][119][121][137]
	Issues with perceiving or measuring IT benefits	[36][39][47][49][65][86][88][97][100][110][113][129][132][138]
	Management difficulties	[86][121]
	Contractual/SLA problems	[51][82][108][133]
Process and Change Management	Unspecified problems in the development or implementation process	[36][45][49][51][63][79][107][110][139]
	Loss/lack of control over the implementation or development process	[36][45][75][91][92][123][135]
	Lack of IT adoption or change planning policies	[49][85]
	Deficiency in existing IT adoption or change planning policies	[47][48][78][121]
	Issues in selecting team members	[89][123]
	Lack of analysis and alignment of business processes	[47][137]
	Difficulty in estimating project resources	[73][76][91]
Workforce	Employees unqualified in ICT	[35][36][37][45][47][54][56][57][59][61][67][68][69][72][73][75][76][77][78][84][85][86][87][91][98][100][103][105][106][110][114][115][116][118][119][124][125][128][132][133][134][135][136][137][138][139]
	Difficulty in learning the technology	[88][130]
	Lack of training or ineffective training	[48][53][56][60][62][73][77][83][95][117][118][121][126][130][135]
	Employees not participating in training	[98]
	Need for training for the new IT	[35][36][46][49][80][83][88][100]
	Hired company or contractor doesn't know how to provide training	[36][49]
	Lack of employee commitment	[49][59][67][69][77][78][79][82][85][89][90][92][98][99][101][110][121][122][135][137][139]
	Employee resistance	[36][37][38][47][49][54][56][57][59][63][65][67][69][73][75][77][78][79][81][82][85][90][95][103][105][108][110][119][120][121][122][126][127][131][136][137][139]
	Unspecified workforce issues	[36][74][99]
	Employee health problems (RSI, Ergonomics)	[36][37][49][59][67][77]
	High employee turnover	[91][129]
	Employee overload	[36][49][138]

	Problems	Works that cite the problem
	Need for hiring employees	[49]
	Lack of employee or entrepreneur troubleshooting skills	[59][85][133]
	Loss of productivity	[41][53]
Knowledge and Information	Unspecified knowledge and information problems	[40][44][59][92][94][105][113][114][116][128]
	Lack of awareness about IT capabilities	[48][60][62][68][102][106][110]
	Lack of benchmark	[36][49]
	Difficulty in obtaining information about used IT systems	[136]
	Lack of knowledge about the adopted IT tool	[63][65][81][91][109][125]
Timelines and Deadlines	Unspecified time-related issues	[36][38][44][83][84][85][86][93][109][116][130][136]
	Time required to master the new IT	[35][50][105][136]
	Delays in implementation or delivery	[45][47][49][69][83][91][93][117][122][123][137]
	Time for selection and implementation processes was too short	[74]
	Time to implement is very long	[82][99][100][103][108]
	System migration time (long or short)	[108]
Technical Issues	Unspecified technical issues	[121][128][130][132][135][138]
	IT consumes a lot of resources	[104]
	Low performance	[51][53][58][59][93][111][114][129][133][137]
	Software does not meet the company's needs	[41][45][54][79][85][86][88][91][94][102][103][105][106][111][121][127][128][130][131][136][137]
	Lack of quality in internet/phone/power	[59][75][78][104][110][124][132][136][138]
	Unavailability of ICT resources	[78][123][128][132][133][138]
	Unspecified infrastructure issues	[59][61][75][82][85][98][103][106][119][121][132][136][138]
	Issues with data storage	[51][123][128][129]
	Failures, crashes, or errors	[109][111][112][128][129]
	Defect or inconsistency	[92][109][117]
	Documentation problems	[93][111][129]
	Unspecified security issues	[36][37][56][88][128][137]
	Security breaches or failures	[40][49][67]
	Viruses	[40][88]
	Backup issues	[59][66][76]
	IT maintenance is a problem	[102][106][132][138]
	Constant need for customizations due to changes in laws	[108][109]
	Difficulties in customizing IT to meet company needs	[36][41][45][49][55][57][63][71][75][83][100][108][121][123][137]
	Lack of knowledge about business rules by the developer	[75][83][117][125]
	Unspecified difficulties in development and implementation	[56][67][69][73][77][83][90][92][110]
	Issues with system requirement specification	[93][121]
	Lack of technical knowledge in the development team	[75][85]
	Communication problems during the development or implementation process	[53][92][118][135][137]

	Problems	Works that cite the problem
Costs and Expenses	Unspecified cost	[36][37][41][49][56][61][67][72][76][77][85][100][105][112][116][119] [128][131][134][136]
	Cost of ICT acquisition	[35][42][44][45][47][50][57][70][71][73][76][82][86][92][102][103][104] [106][113][114][128][132][133][135][138][139]
	Cost to maintain IT (technical support)	[38][41][45][75][82][86][87][98][100][104][105][106][110][113][114] [124][127][128][131][53][139]
	Cost higher than anticipated	[49][69][91][93][122][137]
	Labor cost	[73]
	Customization cost	[36][42][46][49][55][63][78][100]
	Consulting/support cost	[47]
	User training cost	[38][71][72][82][100]
Adoption	Unspecified integration difficulties	[36][49][69][71][76][88][89][94][103][112][123][128][129][135][137]
	Lack or inadequacy of integration between systems	[96][110][129]
	Incompatibility among technologies	[35][53][76][79][91][93][109][110][128][135]
	Need to integrate the new IT with existing IT systems	[88][121]
	Obsolete equipment	[37][67][77][85][105][115][128][129][134][139]
	Divergence between data structures	[66][117]
	High interdependence among system modules	[63]
	Need for technologies and/or complementary items	[38][46][74]
	Difficulties in purchasing additional items	[48][60][62]
	Wrong IT selection	[76][121]
	Product delivery was incomplete or not carried out	[51][75][93][110]
	System migration problems	[81][117][129][137]
	Installation problems	[76][93]
	Need to redesign the physical environment	[42][43][54]
	Lack of add-ons	[75]
Usage	Underuse of ICT	[35][36][38][48][49][50][51][52][60][62][65][66][68][73][75][78][81][86] [97][101][115][127]
	Difficulty in using available resources	[41][45][49][68][69][76][83][88][102][104][105][106][108][111][117] [121][126][132][133][138]
	Employee difficulty in adapting to the software	[42][53][82][117]
	Software was abandoned	[39][53][86]
	Lack of technical resources in usage	[73]
	High dependency on the system	[41][63]
	High obsolescence of IT	[36][49][99][100]
	Use of fragmented systems	[50][126]
	Bureaucratic issues	[45]
	Issues with Internet Service Provider	[88][136]
	System redundancy	[59][66][110][129]
	Technical support overload	[91]
	Inefficient or poor-quality technical support	[45][47][51][93]
	Unspecified technical support issues	[94]
	Many updates needed to keep IT operational	[128]

	Problems	Works that cite the problem
Cultural	Unspecified sociocultural issues	[37][55][56][63][67][73][77][81][85][89][105][106][118][132][138]
	Underestimation of IT or lack of trust in system information	[36][47][49][59][75][76][82][86][92][97][133][134][136][138][139]
	Change in working methods	[39][79][117][123]
	Unrealistic expectations	[51][59][97][120][121][125]
	Change in employee relationships with clients or among employees	[36][49][73][127][132][138]
	Increase in internal conflicts or lack of collaboration among employees	[36][49][69][98][101][135][137]
	Conflicts among stakeholders	[73][81][137]
Niche	Partners do not use technology	[136]
	Poor utilization of IT by the client	[86][104]
	Customer resistance	[128]
	Lack of consultants	[36][49]
	Need for external consulting for implementation or usage	[35][37][63][75][83][92]
	Dependency on IT suppliers or consultants	[45][68][71][78][108][128]
	Lack of technical support from the supplier	[36][37][49][56][59][64][67][77][85][92][104][117][121]114[129]
	TIC requires the issuance of tax documents	[36][49]
	Lack of government support and from other agencies	[73][132][134][135][138]
	Legal or judicial problems	[100][106]
	Unspecified issues	[49][73][119][121]

However, when disregarding specific categories, it became evident that the most frequently cited issue among MSEs was ‘employees unqualified in ICT,’ mentioned in 46 articles (44%). This was followed by ‘employee resistance,’ raised in 37 articles (35%), ‘cost of ICT acquisition’, referenced in 26 (25%), and ‘underuse of ICT,’ identified in 22 papers (21%). Figure 4 lists the top 20 problems that garnered the most attention when disregarding categories. Importantly, it is worth noting that articles may address one or more issues. In total, 129 distinct problem items were identified. On average, each of these items was mentioned in 0.9 papers, with a standard deviation of 1.3, indicating a wide dispersion of data from the mean. The variance of 1.75 further underscores this non-uniformity. Indeed, 47 items (36%) were cited at most twice, while only 20 items (16%) received mentions more than 11 times, constituting the top 20 problem items, as depicted in Figure 4.

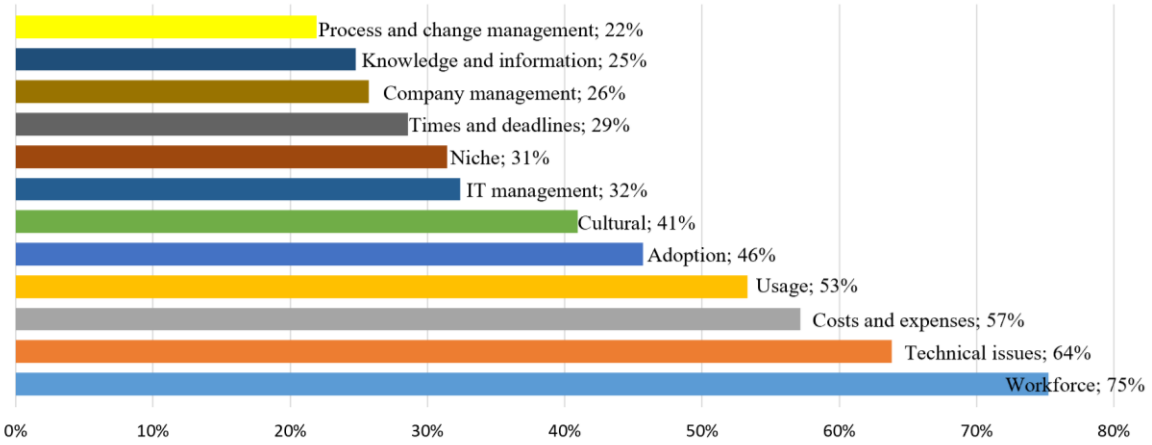


Fig. 3. Percentage of works that mention each problem category

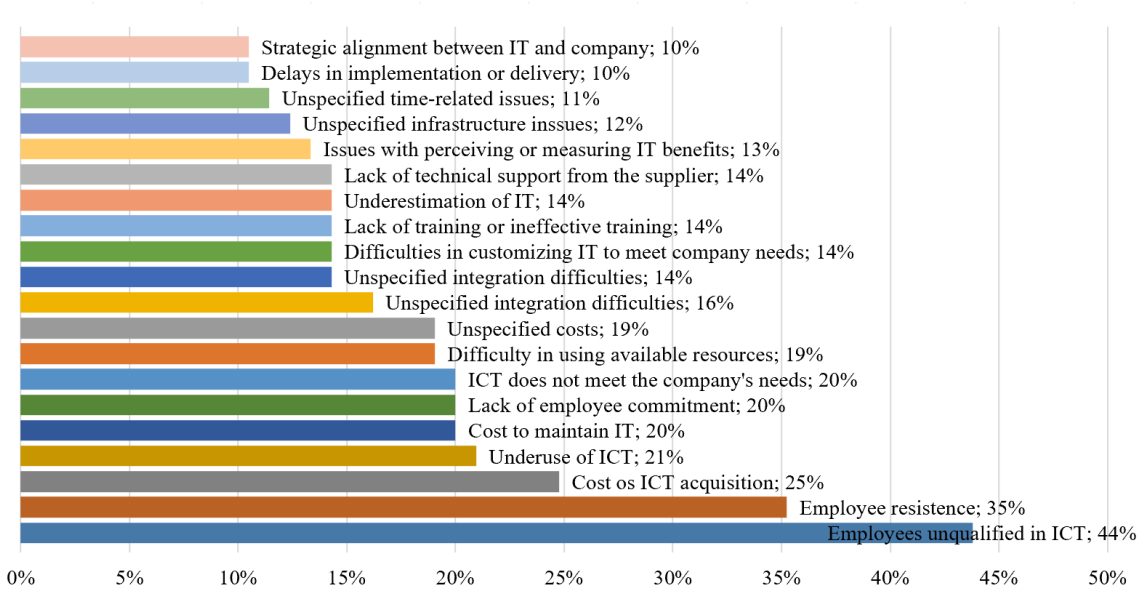


Fig. 4. Percentage of works that mention each issue

RQ3. What has been the behavior of these problems over the past 21 years?

Figure 5 illustrates the occurrence of issues grouped within the predefined categories across the publication years of the works. Notably, there was a substantial variation in category values over the years. On average, the variance among categories was 7.2, with the most significant variations observed in the 'Technical Issues' (17.1), 'Workforce' (16.5), and 'Usage' (11.4) categories. Conversely, the least significant variations were found in the 'Niche', 'Company Management' (both at 1.6), and 'IT Management' (0.4) categories. In terms of standard deviation, the average among problem categories was 2.4. The highest standard deviations were also observed in the 'Technical Issues' and 'Workforce' categories (both at 4.1), followed by the 'Usage' category (3.4). The lowest deviations occurred in the 'Niche' (1.3), 'Company Management' (1.2), and 'IT Management' (0.6) categories. The remaining categories exhibited variations ranging from 10.4 to 2.2, with standard deviations from 3.2 to 1.5.

Figure 6 showcases the categories with the highest occurrence of associated problems in each three-year interval. The most prevalent categories are represented by solid patterns, followed by second-place categories denoted by striped patterns, and third-place categories indicated by dotted patterns.

Consistently, the most cited categories across the years include 'Workforce' (13% to 19%), 'Technical Issues' (11% to 18%), 'Usage' (6% to 14%), 'Costs and Expenses' (6% to 11%), 'Adoption' (6% to 15%), 'Timelines' (11%), 'Company Management' (11%), and 'Cultural' (11%). These findings reveal that the primary categories of IT problems remained relatively stable over the years. However, there was an increase in the significance of 'Technical Issues' and 'Workforce-related' problems in recent years, possibly due to the growing complexity of IT systems and the heightened demand for skilled IT professionals. The outcomes also indicated that specific IT issues were more prevalent during distinct periods, such as problems related to 'Costs and Expenses' during the 2008 financial crisis.

Similarly, the 20 most cited problem items were analyzed across three-year intervals (see Figure 7). The average standard deviation among these problem items was 0.8, with 'employee resistance' (2.5), 'employees unqualified in ICT' (2.4), and 'cost to maintain IT' (2.0) having the highest values. Data variance also showed a significant spread when examining problem items across the studied years, with an average variance of 0.8. The issues with the highest

variations were ‘employee resistance’ (6.2), ‘employee underqualified in ICT’ (5.7), and ‘cost to maintain IT’ (4.0). The remaining items exhibited variations of less than 1.9 and standard deviations less than 1.88.

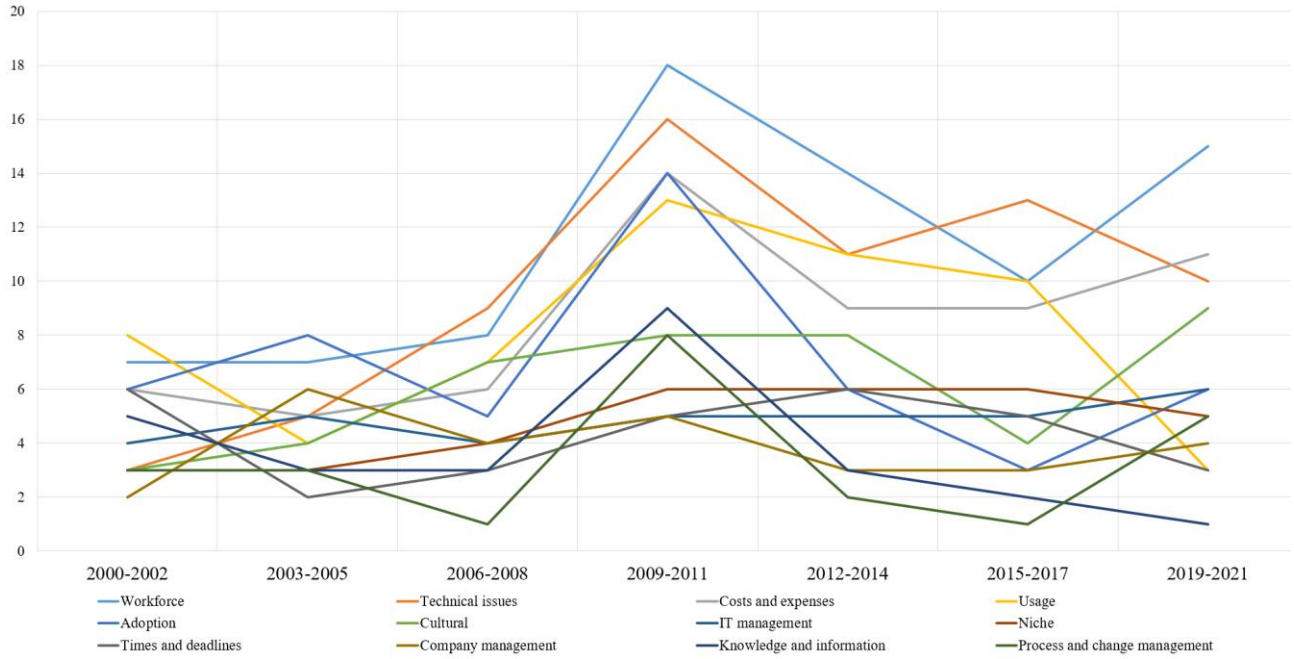


Fig. 5. Number of problems grouped within the predefined categories

RQ4. Do the problems change by industry or section of companies?

The industrial, commercial, and service sectors faced varying problems, each with different intensity levels. Figure 8 displays the top three issues within each problem category, with ‘Unspecified’ referring to studies that did not specify the sector under consideration.

In the industrial sector, challenges encompassed Workforce, Costs and expenses, and Technical issues. The most prevalent issues in this sector were ‘Employees unqualified in ICT’, ‘Employee resistance’, and ‘Acquisition costs’. All categories were mentioned at least nine times, with company management being the least cited, receiving nine mentions.

The commercial sector encountered problems related to workforce, technical issues, and costs and expenses. The most frequently cited issues in this sector were ‘Employees unqualified in ICT’, ‘Employee resistance’, ‘Unspecified costs’, and ‘Acquisition costs’. All categories were represented and mentioned at least nine times.

The service sector faced issues across all defined categories, with the most frequent problems falling into the Workforce, Technical issues, and Usage-related categories. The predominant problem items in the service sector included ‘Employees unqualified in ICT’, ‘Employee resistance’, and ‘Acquisition costs’. However, out of the 114 identified issues in this sector, 34 (30%) were mentioned only once, and 15 (12%) received no mentions.

In papers that did not specify the sector, problems encompassed the categories of Costs and expenses, Workforce, and Technical. The most frequently cited problems included ‘Employee resistance’, ‘Employees unqualified in ICT’, ‘Lack of employee commitment’, ‘Cost to maintain IT’, ‘Software does not meet the company's needs’, and ‘Difficulties in customizing IT to meet company needs’. This group reported problems from all categories with a minimum of four

mentions. There were 82 problems (64%) in total, of which 46 (56%) were mentioned once, and 47 (36%) were not mentioned.

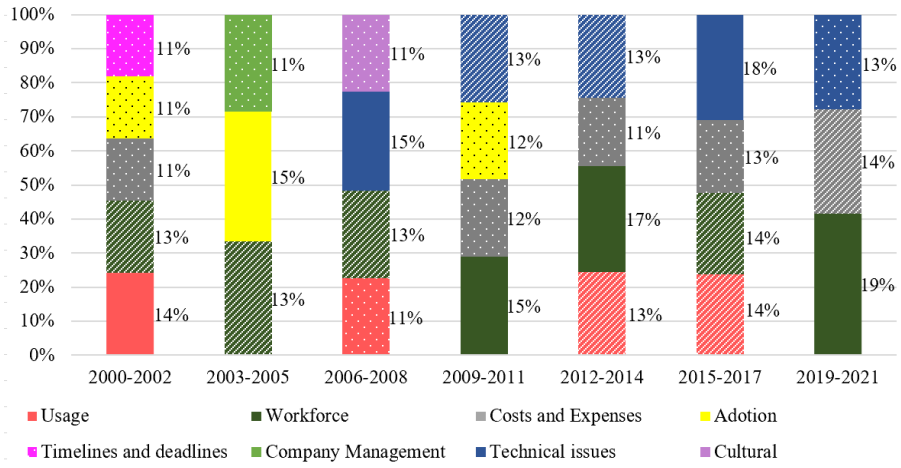


Fig. 6. Predominance of problems by three-year period

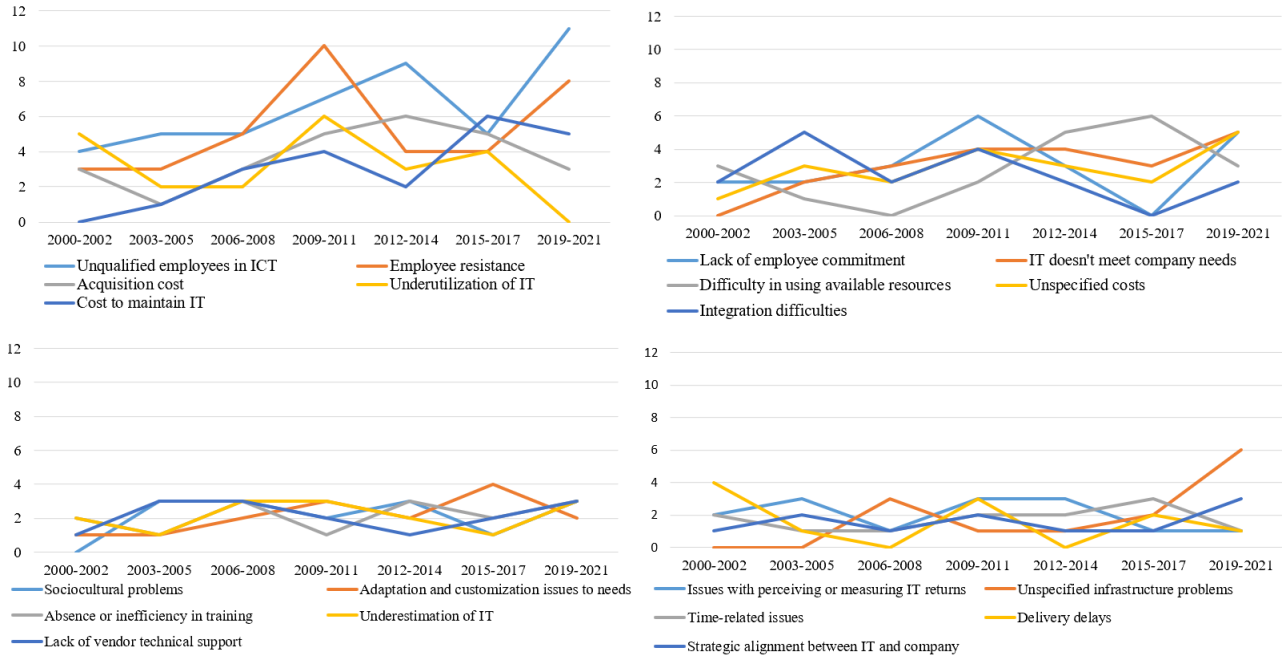


Fig. 7. Problems by Three-Year Period

In summary, the industrial sector faced more Workforce, Costs and expenses, and Technical issues, while the commercial sector primarily grappled with Workforce, Technical issues, and Costs and expenses problems. The service sector encountered challenges in all defined categories. Papers without specified sectors described challenges in the categories of Costs and expenses, Workforce, and Technical issues.

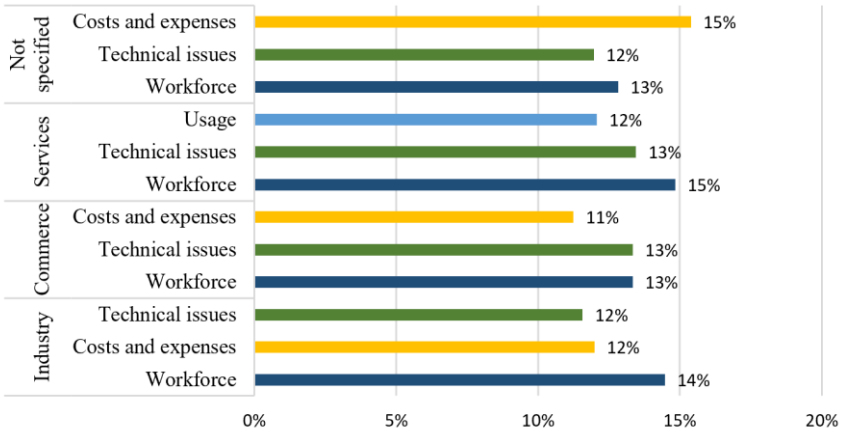


Fig. 8. The three most recurring problems categories in each sector

RQ5. Do the problems change according to the technology adopted?

When relating the researched technologies to the encountered problems, the Workforce category was predominant, cited in 16% of the papers across the three technologies (see Figure 9). When adopting or using software or systems, technical issues often arise due to a lack of alignment with the company's needs and the need for customizations. There may be two causes for this: a natural customization action to align the company and the system with reality or a managerial failure.

Regarding the former, it is a natural process when adopting Enterprise Resource Planning (ERP) systems, as they are often designed to cater to generic solutions rather than companies with unique processes, thus requiring adaptation of the software or system to the company's reality or vice versa. On the other hand, managerial negligence involves not studying the needs of the company and end users, such as not involving employees, suppliers, and managers in understanding precisely what the company requires [142].

Furthermore, usage problems are more prevalent when adopting software or hardware. These issues arise from not fully utilizing the new technology's potential, and the lack of ICT qualification among employees may exacerbate this, especially among older employees [143]. Across all strata, technology-related costs and expenses were a problem, particularly 'Acquisition costs' and 'Costs to maintain IT'. This proved problematic due to the limited financial resources of the MSEs, making them feel the impact of IT acquisition and maintenance costs on their budgets. Similarly, underutilization, redundancy, and difficulty in using IT are other factors contributing to the escalation of IT acquisition and maintenance costs, which significantly impacts MSEs since IT costs appear as one of the main expenses within a company, as observed by Quaresma and Pereira [144]. Thus, there is a significant influence of the type of technology on the problems faced by MSEs when adopting them.

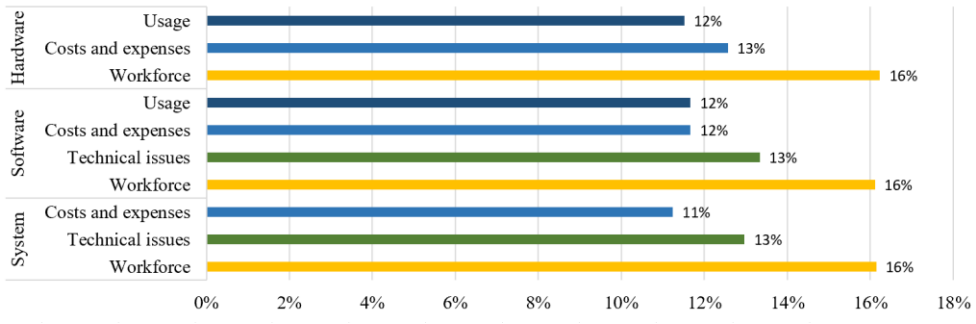


Fig. 9. Problem categories or problem item by type of technology

4.3 Result Concerning Solutions

Of the analyzed papers, 19 (18%) described solutions adopted by companies to mitigate, prevent, or transfer the problems they reported. This section discusses such solutions, with the selected works mentioning 48 distinct solutions.

RQ6. What are the solutions for these problems that occur during or after adopting ICTs in MSEs?

Changes in business procedures, especially involving employees, suppliers, and end-users, allow for identifying problems and understanding the needs that ICT must address in a company, avoiding underutilization and fragmentation (see Figure 10). Additionally, providing training and information to maintain engagement has proved to be a good solution to the lack of employee qualifications. This action also allows for a social role for the company, minimizing the responsibility of and waiting for governments to provide these learnings to the workforce. Jahren [145] confirmed that promoting user engagement through communication and information may benefit both employees and companies.

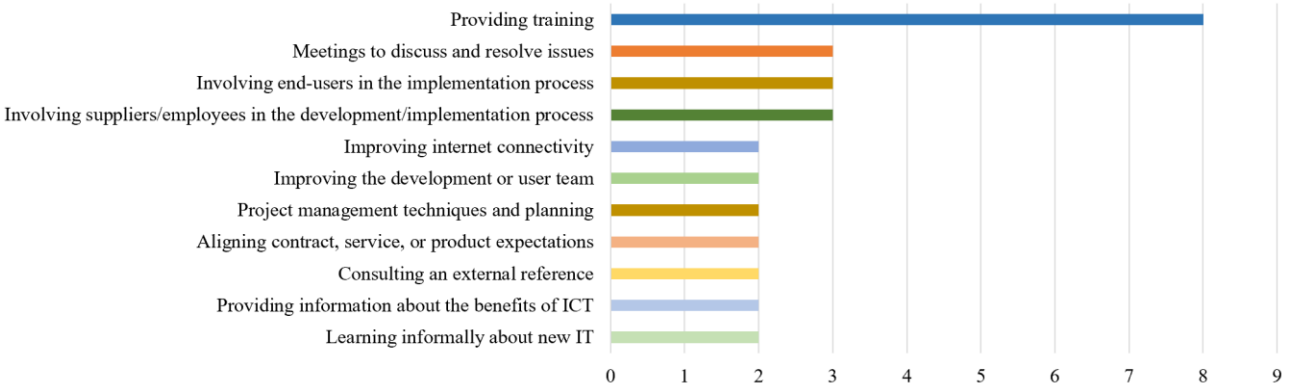


Fig. 10. Solutions when adopting ICTs in MSEs

5. Discussion

We analyzed 105 papers spanning over 21 years, extracting a total of 129 distinct problems and 48 proposed solutions. Notably, the problems displayed variable trends over the 21 years, with limited influence observed based on the type of technology employed or the sector of activity. However, workforce-related issues were consistently prevalent across all analyses.

While a relatively small number of works presented solutions, those that did primarily emphasized adopting new business procedures and providing education and training. Unfortunately, due to the scarcity of data on solutions, it was not feasible to generate significant insights into the evolution of solutions over the studied 21-year timeframe.

Considering these findings, various stakeholders, including managers, government bodies, development agencies, and academia, may take proactive measures to facilitate the more efficient, effective, and less turbulent adoption of ICT in MSEs. Once armed with knowledge of the most recurrent problems, managers may devise strategic plans to preemptively address, mitigate, or transfer these challenges, thus increasing the likelihood of project success. Government agencies may leverage this information to develop more targeted funding and development policies, while academia may explore the myriad opportunities presented by this topic. Through collaborative efforts, these entities may collectively enhance the adoption and implementation of ICT in MSEs.

The case study and survey methodologies proved to be the preferred among researchers. Case studies allow for semi-informal interaction with little control or interference from researchers [146], enabling on-site observation of the ICT adoption and usage process and the collection of valuable data from a researcher's perspective. On the other hand, surveys, which employ questionnaires as a data collection tool, allow for obtaining problems and solutions from the companies' perspective [147].

Most of the research primarily focused on small companies, which could be attributed to their significant representation, accounting for 90% of global businesses, and their acknowledged economic importance as the pillars of their respective economies [9]. There was substantial variation in the publication years of the works, with a noticeable upswing in interest and publications from 2011 onwards.

When examining the problem categories, workforce-related issues, technical issues, costs and expenses, adoption difficulties, and usage problems emerged as the most pressing concerns for MSEs. More specifically, these companies grapple with issues such as the inadequately qualified workforce in terms of both basic and specialized ICT skills, resistance, and lack of commitment from employees averse to change, the high financial outlays associated with procuring and maintaining ICT within their operations, and underutilization resulting from difficulties in comprehending and leveraging the available resources. Additionally, there was a recurring theme of ICT solutions falling short of meeting the specific needs of such companies. These represent the primary categories and problem items encountered by MSEs.

Resistance, costs and expenses, underutilization, and a failure to align ICT with company requirements may be considered moderately serious issues. Employee resistance may substantially impact the overall adoption process, potentially affecting system performance and utilization. Resistance may be rooted not only in concerns about job displacement due to technology but also in factors such as a lack of awareness regarding the benefits of ICT for employee roles and internal cultural dynamics within a company. Marques, Borges, and Almada [148] delved into the factors influencing the resistance or cooperation of entrepreneurs with organizational change, identifying elements like threats to social interactions, peer pressure, and prior experiences. Conversely, underutilization and misalignment with business needs often result from inadequate planning. These issues manifest when managers fail to conduct thorough requirement assessments, neglect to study the technology, or overlook the involvement of end users. These findings align with the research conducted by Wang et al. [6] and Biagi and Rodello [11].

Furthermore, the factors mentioned above may exacerbate the problem of ICT costs in MSEs. Given their resource constraints, these companies are particularly susceptible to the financial impacts of ICT expenditures. Any wastage resulting from underutilization or a failure to meet their specific needs only serves to magnify these cost-related concerns.

Regarding the analysis of problem behavior over the years, no discernible patterns emerged in either the categories or specific problem items. However, workforce-related problems, technical issues, and cost and expense consistently appeared with similar and increasing frequencies despite minor fluctuations over time. This close correspondence in their occurrence rates may suggest an underlying relationship or shared root causes among problems in these categories. Consequently, the shortage of specialized workforce could impede proper installation and utilization, subsequently

affecting ICT costs. In line with this, Zhang et al. [142] observed that training and education constitute critical variables that impact the success of ERP implementation in Chinese companies, particularly affecting usage, costs, and overall business performance.

Continuing our exploration of problem behaviors, it became evident that three primary issues persisted throughout the 21-year study period. Workforce-related problems consistently emerged as the most prominent concerns, taking the lead as the second most recurring issue from 2000 to 2008 and 2015 to 2017 and, more notably, dominating as the primary problem during the three-year periods of 2009–2011, 2012–2014, and 2019–2021.

Technical challenges also surfaced as a recurring theme. These problems claimed the top spot in the trienniums of 2006–2008 and 2015–2017, secured the second position from 2009 to 2014, and, most recently, placed third in 2019–2021. Technical difficulties have also been reported as impediments to ICT adoption among micro-sellers in Tanzania [149].

Cost-related issues occurred slightly less frequently, placing second from 2019 to 2021 and third from 2009 to 2017 and 2000 to 2002. Interestingly, this category did not feature as the primary problem in any specific year. Recent research by Mugo [150] in Nairobi highlighted that cost challenges related to hardware, software, internet, training, and support hindered ICT adoption. Similarly, the financial constraints often faced by MSEs render them acutely sensitive to the impact of ICT expenses. Nonetheless, despite these challenges, investments in ICT are often necessary due to the potential benefits they bring to a company. This notion was supported by Ezekiel [151], who observed a changing cost dynamic. In a study involving companies in a commercial center in Dar es Salaam, it was found that costs incurred before the adoption of new ICTs did not significantly affect company performance. However, after the adoption of these technologies, such costs began to have a positive impact on performance.

This analysis underscores the dynamic nature of problems over the years and the recurring relationship among cost and expense issues, technical challenges, and workforce-related concerns. Exploring the influence of technology types on encountered problems revealed minor distinctions among the three categories. Regardless of the technology type, workforce-related issues consistently emerged as the most prevalent, exhibiting equal intensity across these strata. When adopting or employing software or systems, technical problems often surface due to software or systems failing to align with a company's needs, requiring customizations. This predicament may stem from either a natural need for customization to harmonize the software or system with a company's specific requirements or from management oversights.

In the case of the former, it is common during ERP adoptions since these systems are frequently designed to cater to generic solutions rather than to companies with unique processes. Consequently, adapting the software or system to a company's reality and vice versa becomes essential. Conversely, managerial lapses involve neglecting to thoroughly study the company's needs and the requirements of end users. This omission extends to failing to engage employees, suppliers, and managers to gain a precise understanding of a company's needs [142].

Usage-related issues tend to surface more prominently during the adoption of software or hardware. These problems arise from underutilizing the full potential of new technology, with the lack of ICT qualifications among employees exacerbating the situation, particularly among older staff members [143]. Across all strata, technology-related costs and expenses emerged as a concern, particularly in acquisition and ongoing maintenance expenses. This challenge proves problematic due to the limited financial resources typical of small companies. As a result, they tend to feel the impact of ICT acquisition and maintenance costs acutely within their budgets. Moreover, underutilization, redundancy, and usability challenges of ICT further contribute to escalating acquisition and maintenance costs. These financial implications substantially impact MSEs, as ICT expenses often constitute a significant portion of a company's overall expenditures, as noted in studies by Quaresma and Pereira [144]. Therefore, it is evident that the type of technology employed significantly influences the challenges MSEs encounter during adoption.

The solutions most adopted by MSEs to address ICT-related problems include providing training, disseminating information, and fostering learning about ICT. Additionally, involving users, suppliers, or employees in the development and implementation processes, enhancing staff and resource capabilities, and applying management, project, and contract techniques are prevalent approaches.

Introducing changes in business procedures, particularly by engaging employees, suppliers, and end-users, facilitates a deeper understanding of ICT needs within a company. This proactive approach helps mitigate issues related to underutilization and fragmentation. Furthermore, providing training and information emerges as an effective strategy for addressing employee qualification gaps. This action not only contributes to resolving specific ICT challenges but serves a broader social role for the company. It reduces reliance on government initiatives for workforce education, placing the responsibility on the company to uplift its workforce. Jahren [145] provided evidence that fostering user engagement through communication and information dissemination may yield mutual benefits for employees and companies. In summary, the primary solutions implemented by companies encompass a range of strategies to address ICT-related challenges.

Threats to the validity

By adapting the categories proposed by Benamati et al. [141] to classify the problems in this research, we recognize the presence of potential threats to the validity of the work. If these categories are not defined unambiguously or comprehensively, there is a risk of selection bias, as some problems may be interpreted ambiguously and classified inconsistently. However, it is essential to highlight that adopting a categorization minimizes terminological variation, mitigating the use of different terms for similar concepts and reducing the potential compromise of results.

Extracting problems and solutions from work and classifying problems into pre-defined categories are inherently subjective processes. Reviewers' interpretation when applying these categories may introduce discrepancies and bias. Both authors performed the classification to mitigate this threat, and disagreements were discussed. Furthermore, we used descriptive statistics to minimize potential impacts from subjective interpretations when interpreting the results.

Another possible threat is related to the initial set of articles for snowballing. If these articles do not adequately cover all relevant databases, there may be a coverage bias, failing to include essential works. This threat was addressed through careful and extensive research to represent the literature in the start set.

6. Conclusion

Small enterprises play a pivotal role in both economic and social contexts, contributing significantly to their local environments. However, these businesses grapple with competitive pressures and the imperative to survive. To address these challenges, they often turn to ICTs. However, while ICT adoption may offer solutions, it may also introduce new complexities.

Given these considerations, our study aimed to identify the most prevalent problems that MSEs encounter during or after the ICT adoption process and explore the solutions employed to preempt, alleviate, or transfer these issues whenever possible. Our systematic literature review, facilitated by the snowballing technique and bolstered by descriptive statistics, yielded valuable insights.

In summary, our study made significant headway in traversing the existing literature systematically, employing a rigorous methodology to uncover a spectrum of problems and corresponding solutions. We have elucidated the profiles of works dedicated to this subject, delineated primary issues across 12 categories, and distilled the solutions utilized to combat them. Our findings unveiled the nuanced and non-standardized behavior of these problems over 21 years, shining a light on their intricate nature. Importantly, we noted that the sector of activity and the type of technology under study exert limited influence on the problems faced and the solutions implemented.

However, it is essential to acknowledge the limitations of this work. We were unable to segregate problems based on company specifics such as size or sector, as reported in the studies. The interrelationships between these problems also remain unexplored. Furthermore, limitations tied to the snowballing technique arose, particularly concerning the composition of the start set with a predefined set of known works.

Looking ahead, future research endeavors should aim to address these limitations, validate our findings, and delve deeper into the quest for even more effective solutions. By doing so, one may contribute to a more comprehensive understanding of the ICT challenges MSEs face and continue refining strategies for their success.

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