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Skills Mismatch in the Portuguese Logistics Sector: Higher Education and Employability Challenges

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Thesis Application for the Doctor of Philosophy degree in Business Sciences, submitted to the Universidade Portucalense.

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DEDICATION

Wife, daughters and parents, I dedicate this thesis to you.

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SCIENTIFIC PUBLICATIONS AND CONFERENCE PRESENTATIONS

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RESUMO

Esta tese investiga as competências profissionais requeridas no contexto da transformação digital, com foco na educação superior e na formação de profissionais na área da logística e gestão da cadeia de abastecimento (Supply Chain Management – SCM). A investigação é composta por três capítulos complementares, que abordam de forma progressiva e integrada as mudanças nas exigências do mercado de trabalho, os desafios enfrentados pelas instituições de ensino superior (IES) e as estratégias para o desenvolvimento de competências técnicas e comportamentais (hard e soft skills).

O primeiro capítulo apresenta uma revisão sistemática da literatura sobre transformação digital, competências e educação. A análise de 87 artigos internacionais permitiu identificar sete eixos temáticos: literacia digital, identificação de competências, uso de tecnologias digitais no ensino, modelos de aprendizagem, requalificação da força de trabalho, impacto das tecnologias no mercado de trabalho e adequação dos cursos de graduação. A investigação revela a crescente lacuna entre as competências demandadas pelo mercado e a formação oferecida pelas IES, sugerindo a necessidade de reformas estruturais nos currículos para preparar os estudantes para um ambiente digital dinâmico e em constante mudança.

O segundo capítulo aprofunda a análise no contexto português, identificando e comparando as competências requeridas para profissionais de logística e SCM no cenário da transformação digital. A metodologia combina uma revisão sistemática da literatura com uma análise de conteúdo de 300 anúncios de emprego em Portugal. Os resultados evidenciam a valorização crescente de competências técnicas associadas às tecnologias da informação, bem como competências interpessoais como comunicação, trabalho em equipa e flexibilidade. A análise revela também discrepâncias entre o que é valorizado no mercado e o que é desenvolvido academicamente, propondo um modelo de competências adaptado ao contexto nacional.

O terceiro capítulo examina a integração de soft skills na formação superior em logística em Portugal. Através de uma análise de planos curriculares, entrevistas com coordenadores de cursos e grupos focais com profissionais do setor, identificam-se lacunas significativas na oferta educacional. Apenas 40% dos cursos analisados incluem disciplinas específicas de soft skills, representando uma fração mínima dos créditos totais. O estudo propõe um modelo incremental de desenvolvimento dessas competências ao longo da formação universitária, defendendo uma abordagem

pedagógica baseada na aprendizagem experiencial e na colaboração ativa entre academia e indústria.

Em conjunto, os três capítulos desta tese demonstram a necessidade urgente de alinhar os sistemas educativos às exigências do mercado de trabalho digital. A investigação oferece contribuições teóricas relevantes para os estudos sobre educação e competências digitais, ao mesmo tempo que propõe recomendações práticas para instituições de ensino, formuladores de políticas públicas e organizações empresariais.

Palavras-chave: Transformação digital, competências, soft skills, ensino superior, logística, cadeia de abastecimento.

ABSTRACT

This thesis investigates the professional skills required in the context of digital transformation, focusing on higher education and the training of professionals in the field of logistics and supply chain management (SCM). The research consists of three complementary chapters, which progressively and comprehensively address changes in labor market requirements, challenges faced by higher education institutions (HEIs), and strategies for developing technical and behavioral skills (hard and soft skills).

The first chapter presents a systematic review of the literature on digital transformation, skills, and education. The analysis of 87 international articles identified seven thematic areas: digital literacy, skills identification, use of digital technologies in teaching, learning models, workforce retraining, impact of technologies on the labor market, and adequacy of undergraduate courses. The research reveals a growing gap between the skills demanded by the market and the training offered by HEIs, suggesting the need for structural reforms in curricula to prepare students for a dynamic and constantly changing digital environment.

The second chapter deepens the analysis in the Portuguese context, identifying and comparing the skills required for logistics and SCM professionals in the digital transformation scenario. The methodology combines a systematic review of the literature with a content analysis of 300 job advertisements in Portugal. The results highlight the growing value placed on technical skills related to information technology, as well as interpersonal skills such as communication, teamwork, and flexibility. The analysis also reveals discrepancies between what is valued in the market and what is developed academically, proposing a skills model adapted to the national context.

The third chapter examines the integration of soft skills in higher education in logistics in Portugal. Through an analysis of curricula, interviews with course coordinators, and focus groups with industry professionals, significant gaps in the educational offering are identified. Only 40% of the courses analyzed include specific soft skills subjects, representing a minimal fraction of total credits. The study proposes an incremental model for developing these skills throughout university education, advocating a pedagogical approach based on experiential learning and active collaboration between academia and industry.

Together, the three chapters of this thesis demonstrate the urgent need to align education systems with the demands of the digital labor market. The research offers relevant theoretical contributions to studies on education and digital skills, while

proposing practical recommendations for educational institutions, public policymakers, and business organizations.

Keywords: Digital transformation, skills, soft skills, higher education, logistics, supply chain.

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1 INTRODUCTION

1.1 Background

The current era is characterized by profound changes in the business and education landscapes, primarily driven by the rapid advances of the digital transformation. This transformation, which involves the strategic assimilation of digital technologies into business models, processes, and products, has substantially reshaped the demands of the job market. Consequently, the skill sets required of contemporary professionals have also evolved (Benavides et al., 2020).

The European Union has recognized the importance of aligning education policies with the growing demands of the labour market, emphasizing the need for continuous skills development and the prevention of skills gaps. Despite a growing consensus on the importance of soft and digital skills, a notable discrepancy persists between the skills required by specific sectors and those taught within higher education institutions (Rathelot & van Rens, 2017).

In the logistics sector, an area significantly impacted by this digital revolution, increasingly complex challenges arise, particularly those related to automation, data analysis, artificial intelligence, and managing globally interconnected supply chains. In this context, technical knowledge alone is no longer enough. Soft skills are now strategically vital for professional fulfillment, particularly in dynamic and collaborative contexts (Nahavandi, 2019).

This divergence is particularly evident in the logistics sector in Portugal, where the gap between industry requirements and academic curricula hinders graduates' ability to face contemporary challenges effectively and impedes the potential of higher education institutions to promote sustainable socio-economic development (Brunello & Wruuck, 2019). The logistics sector, a cornerstone of international trade and supply chain management, plays a central role in Portugal's economic growth and competitiveness. However, its continued success depends on the availability of a skilled workforce capable of adapting to technological advances, managing complex global supply chains, and navigating the complexities of a rapidly changing business environment (Mangan & Christopher, 2005).

Higher education institutions, therefore, face the challenge of adequately preparing students for this emerging paradigm. However, criticism persists regarding the inflexibility

of university curricula and the compartmentalization of socio-emotional skills training, which is often relegated to optional courses or extracurricular activities. Consequently, there is a growing need to develop a curricular approach that integrates soft skills in a progressive and structured manner throughout the academic journey (Lozovoy et al., 2019). A significant impediment to bridging the skills gap in the Portuguese logistics sector is the scarcity of well-structured teaching methodologies aligned with the market in higher education institutions. Universities around the world are increasingly offering courses to develop interpersonal skills and to improve students' employability (Cornali, 2018). This deficiency is compounded by the lack of collaboration between academia and industry, which limits the ability of higher education institutions to effectively identify and meet the evolving skills requirements of the logistics sector (Martes, 2020).

This PhD thesis aims to provide a comprehensive analysis of the skills gap in the Portuguese logistics sector, offering insights into the underlying causes and proposing practical solutions to bridge the gap between academia and industry. This research not only contributes to the academic discourse on skills development and employability but also provides valuable guidance for higher education institutions, policymakers, and industry stakeholders seeking to increase the competitiveness and sustainability of the Portuguese logistics sector. By examining the strategies employed by higher education institutions to integrate soft skills into their curricula, this study aims to identify best practices and address the challenges encountered in aligning academic programs with industry needs (Almeida & Morais, 2021).

The urgency of this issue is amplified by the increasing automation, data analytics, and interconnected digital platforms that characterize the rapidly evolving logistics landscape. As logistics becomes more technology-driven, a simple focus on emerging technologies can cause logistics research and real-world applications to overlook the importance of developing human skills (Woschank & Pacher, 2020). The competencies and skills required of logistics and supply chain professionals should serve as a benchmark for skills development in students and workers (Sun & Song, 2018).

Thus, the research presented in this thesis aims not only to identify existing challenges but also to provide actionable recommendations that equip graduates with the skills necessary to thrive in the modern logistics sector and contribute to Portugal's sustainable socio-economic development. This undertaking acknowledges the need for a workforce equipped with technical knowledge and a strong set of soft skills, such as problem-solving and communication, to navigate the complexities of the modern, interconnected world (Theotokas et al., 2024). Furthermore, this research highlights the importance of personalized communication strategies in raising awareness about the significance of soft skills in the digital era. Additionally, the study examines the value of

industry-academia collaborations, in which companies partner with educational institutions to develop curricula tailored to meet specific industry demands.

1.2 Research Problem

Although there is a growing consensus on the importance of both soft and digital skills for employability, a considerable discrepancy remains between the skills required by the logistics sector in Portugal and those taught in higher education. This discrepancy hampers graduates' ability to meet modern challenges and restricts the potential of higher education institutions to contribute to sustainable socio-economic development. The lack of well-organized teaching approaches, particularly those aligned with current market needs, exacerbates this problem (Mainga et al., 2022; Risopoulos-Pichler et al., 2020). Most schools are not meeting the demand for logistics personnel, highlighting the need for curricula that are more aligned with the sector's demands (Jian et al., 2010). This is all the more vital given the ever-changing business environment, which requires constant innovation and adaptation. To prepare graduates for the challenges of the modern logistics industry, higher education institutions should prioritize integrating practical skills and industry-relevant knowledge into their curricula (Lukman et al., 2021).

1.3 Objectives

This study aims to contribute to the understanding and development of skills relevant to the logistics sector, taking into account the context of digital transformation. The specific objectives of this research include:

- Carrying out a systematic literature review to identify the skills most in demand by the digital transformation, as well as the existing gaps in educational training.
- Identifying and empirically comparing the skills required by the Portuguese labor market in the areas of logistics and SCM with the skills addressed in the academic literature.
- To develop an incremental and coordinated framework for improving transversal skills in higher education logistics courses in Portugal.

This research aims to provide actionable recommendations for higher education institutions, policymakers, and industry stakeholders to improve the employability of logistics graduates and promote the sustainable development of the logistics sector in Portugal. These findings can be used to better prepare logistics graduates for success

in the workforce by proposing a framework for developing soft skills among logistics students in Portugal, through the creation of more effective curricula that align with the demands of the logistics sector.

The study aims to develop a framework for integrating soft skills and digital skills into higher education curricula effectively and sustainably. This framework will cover pedagogical approaches, assessment methods, and learning activities specifically designed to promote the development of these skills in students. These recommendations aim to address issues such as curriculum development, teacher training, industry collaboration, and lifelong learning to promote the development of market-driven skills (van Hoek, 2001). The ultimate goal of this research is to enhance the employability of logistics graduates and contribute to the sustainable socio-economic development of Portugal by aligning higher education with the logistics industry's needs (Rao, 2014).

1.4 Justification

This study distinguishes itself by systematically addressing three crucial and interconnected dimensions: a theoretical framework of competencies, an empirical examination of the Portuguese context, and the development of a practical pedagogical intervention model. Consequently, this thesis aims to enhance the alignment between higher education and the labor market, thereby improving students' employability, supporting educational institutions in developing competency-based curricula, and providing resources for companies to create professional profiles tailored to the digital age.

The study has the potential to generate actionable insights and recommendations that inform curriculum development, teaching practices, and policy interventions in higher education. By bridging the skills gap and enhancing the employability of logistics graduates, the research can contribute to Portugal's sustainable socio-economic development and strengthen the competitiveness of its logistics sector (Yue & Zhao, 2020).

1.5 Thesis structure

This work consists of five chapters. Chapter 1 presents the motivations for this work and introduces the three essays developed in the subsequent chapters.

Chapter 2 - Digital Transformation, Skills and Education: A Systematic Literature Review. This chapter presents a systematic review of 87 scientific articles indexed in databases such as Web of Science and Scopus. The analysis revealed an apparent dissociation between the evolution of professional demands and the training responses of HEIs, providing a practical conceptual framework for interpreting the empirical results presented in the following chapters.

Chapter 3 - Identification and Analytical Comparison of Skills in Logistics and Supply Chain Management in Portugal. This chapter provides an empirical analysis of the supply of and demand for skills in the Portuguese logistics sector. Using content analysis techniques and statistical analysis, the research revealed emerging competencies and gaps between what companies demand and what educational programs currently offer.

Chapter 4 - Proposal for an Incremental Framework for the Development of Soft Skills in Logistics Higher Education. This chapter develops and presents a proposal for an educational framework that gradually and structurally integrates soft skills into Logistics higher education courses, based on curriculum analysis, interviews with course coordinators, and a focus group with professionals from the sector.

Chapter 5 - Conclusions and Recommendations. Presents the general conclusions of the thesis, theoretical and practical implications, limitations, and suggestions for future research.

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2 DIGITAL TRANSFORMATION, SKILLS AND EDUCATION: A SYSTEMATIC LITERATURE REVIEW

Abstract

Digital transformation (DT) is raising new challenges. This article seeks to understand how DT has changed business strategies, requiring a new profile of professionals, analyzing the most sought-after skills and identifying opportunities for future professionals. Also, it studies whether universities have incorporated in their training the new skills required by the labor market impacted by DT. To these ends, a systematic literature review dealing with digital transformation, competence, and education was conducted. The existing literature was categorized into seven main areas of investigation: digital literacy; skills identification; use of digital technologies in teaching; learning models; workforce qualification or re-skilling; digital technologies in the labor market; and undergraduate course analysis. This structuring then lays the groundwork for capturing gaps in the literature and proposing future research.

Keywords: Sustainable Development, Environmental Management, Social Responsibility, Financial Performance

2.1 Introduction

Digital Transformation may be understood as referring to the integration of digital technologies into business models and business processes (Hess et al, 2016; Liu et al, 2011). Digital technologies include social media, artificial intelligence, analytics, or embedded devices. One of the goals of that integration is to create value and generate revenue from digital assets (Bharadwaj et al., 2013; McDonald and Roswell-Jones, 2012), encompassing intellectual property, digital media, data and information, online platforms, and websites. Having occurred throughout the 21st century, Digital Transformation is characterized by the merging of cyber-physical systems, the Internet, the Internet of Things (IoT), industrial integration (Xu et al., 2016), industrial information integration (Xu, 2020), as well as the growth in the use of artificial intelligence, cloud

computing, robotics, 3D printing, data science, and advanced wireless technologies (Xu et al., 2018).

As Amit and Zott (2012) note, the digital future, which is increasingly shaped by digital technologies and the digitalization of various aspects of life and business, presents new opportunities and challenges for organizations and requires a new type of employee that can work in unstructured and unpredictable circumstances. Given the expected changes in occupations, the demand for new and different skills is bound to increase. Higher education is vital in generating skills (Kurbanov et al., 2020). Even if preparing students for the labor market is not the sole role of higher education (Barnett, 1994; Bergan and Damian, 2010; Chur, 2011; Klemenčič, 2010), it seems critical that higher education institutions (HEIs) adjust and anticipate the new skill-sets demanded in the labor market (Pineda-Herrero et al, 2018). However, up to now, there seems to be a gap between what the market sees as relevant and what HEIs have offered (Goulart et al., 2021).

The purpose of this research is twofold. First, in the wake of the digital transformation, to systematize extant research on the most sought-after skills and opportunities for future professionals. Second, to systematize extant research on whether universities have incorporated the new competencies required by the labor market into their training.

To meet these goals, a systematic literature review was conducted of 87 articles in the Web of Science and Scopus databases dealing with digital transformation, skills, and education in internationally known academic journals in English.

We develop a conceptual framework that summarizes the relevant personal skills and competencies in the context of digital transformation and that clarifies how new digital technologies have impacted undergraduate courses. The proposed framework has practical applications for professionals, business organizations, and universities. First, it provides professionals with a roadmap to align their skills and competencies with the needs of the labor market. Second, it helps companies realize how digital transformation demands skilled professionals to successfully implement digital strategies, i.e., the organizational initiatives and actions undertaken to leverage digital technologies and capabilities to achieve business objectives. Third, it can assist universities wishing to adapt their product-mix to provide the skills and qualities demanded.

The article begins by presenting the concepts of digital transformation, competencies for digital transformation, and education for digital transformation. Next, the methodology and the literature selection process adopted are presented. This study

seeks a content analysis of the articles. Then, the research results are presented, and finally, the conclusions.

2.2 Literature Review

2.2.1 Digital Transformation

Vial (2019, p. 118) argues that digital transformation is a multidimensional, technology-driven phenomenon impacting society, politics, and the economy. He defines it as "a process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies".

One of the dimensions of digital transformation is the offering of new products and services, enabling the creation of new business models. Nambisan et al. (2017, p.224) thus characterize digital transformation as "the creation of, and consequently change in, market offerings, business processes, or models that result from the use of digital technology". Another noteworthy dimension refers to changes in business strategies. Digital transformation within the firm is a specific type of strategic change (Klarner and Raisch, 2013; Rajagopalan and Spreitzer, 1997), because it alters a company's value creation and may alter its purpose (Hess et al., 2016). Finally, the changes in processes brought by digital transformation are highlighted by many authors. As per Downes and Nunes (2013) and Matt et al. (2015) Digital Transformation goes beyond the simple digitization of resources and involves the transformation of core operations, products, and business processes, culminating in revised or entirely new business models.

2.2.2 Skills for Digital Transformation

According to Kohnke (2017), three primary requirements must be met by companies for a successful digital transformation: new skills and competencies (e.g., digital skills), different organizational capabilities, and different forms of leadership (e.g., digital vision).

Skills and competencies may be classified in many ways. Skills can be defined in terms of cognitive factors (e.g., different types of knowledge), perceptual and intellectual motor skills (e.g., dexterity), affective factors (e.g., attitudes, values, motivation, etc.), personality traits (e.g., self-confidence), and social skills (e.g., communication and cooperative skills) (Ellstrom and Kock, 2009). In their turn, Hecklau et al. (2017) classify competencies into four categories: technical knowledge, methodological, social and

personal skills. Others focus on the type and composition of skills, dividing them into hard skills, which include technical skills, aptitudes, knowledge, and abilities that the individual needs to perform his or her job, and soft skills, which refer to personal and behavioral skills (traits, character, attitudes, motives) (Robles, 2012; Woodruff, 1991).

What it means to be digitally competent is far from clear. Usually, competencies can be described in terms of knowledge, skills, and attitudes, which can be hierarchically organized (Cheetham & Chivers, 2005). However, when it comes to digital competence, current definitions vary depending on the context and specific language used, digital literacy, e-skills, information literacy, and media literacy (Ala-Mutka, 2011) resulting in a "jungle of jargon" (Anusca Ferrari et al., 2012).

Several authors (Ala-Mutka, 2011; Eshet-Alkalai, 2004; Eshet-Alkalai and Chajut, 2010; Ferrari, 2012; Martin, 2006) have attempted to develop the concept of digital skills, defining the components and elements it includes. They seek to enable an assessment or measurement of skills and abilities and improve the understanding and development of digital competence in society.

2.2.3 Education for Digital Transformation

As digital technologies enable new forms of automation (Neumeier et al., 2017) and decision-making processes (Dremel et al., 2017; Hess et al., 2016), questions about the need to develop the skills of existing workers (Hess et al., 2016) as well as the skills needed in future workers (Colbert et al., 2016) are also becoming increasingly relevant (Watson, 2017).

In the literature, the concept of employability is presented with various definitions associated with the skills and qualifications of the individual. However, it invariably involves an individual's ability to obtain employment (Brown et al., 2003; Harvey, 2001; Yorke, 2006). This ability reflects, inter alia, the possession of competencies (hard or soft skills) that can be demonstrated in the performance and results in a work context.

To meet the challenges of competitive markets, higher education is expected to produce graduates that meet the needs of firms (Bridgstock, 2009; Barth et al, 2007). There seems to be a consensus on the need to bring higher education and employers closer together to align curricula with labor market needs (Boden and Nedeva, 2010; Crebert et al., 2004; Kumar and Jain, 2010) and to promote partnerships and protocols to promote and plan professional internships (Lowden et al., 2011) (Harvey, 1999). True to this, Nagarajan and Edwards (2015, p. 26) add that the development of professional skills is "a distributed responsibility".

Many authors offer practical recommendations for HEIs. Sieber (2017) suggests that rigid structures, based on content matrices, with mandatory and equal requirements for all students, should give way to models allowing learners to create their portfolios and learning trajectory. Pacheco et al. (2020) propose a series of recommendations aimed at transforming educational institutions in three key aspects. Firstly, they advocate for a shift from traditional teaching methods to embrace digital education, disrupting the conventional analog approach. Secondly, they encourage internal reviews of how courses are structured and delivered within the educational sector. Lastly, they address the potential challenges posed by external factors such as legal frameworks, rules, and regulations governing the sector.

2.3 Methodology

This paper conducts a systematic review of the literature that relates to digital transformation, skills, and education. According to Greenhalgh (1997), a systematic review can be understood as an overview of primary studies that contains an explicit statement of objectives and methods and that is conducted according to an explicit and reproducible methodology.

The literature selection process consisted of the phases indicated in Figure 2.1. Each phase aimed to refine the number of articles according to predefined criteria.

Search Terms:

1) Topic: Digital; Skill*; Education
2) Topic: Digital; Skill*; Tertiary
3) Topic: Digital: Skill*; “Higher Education”

Selection Criteria:

- Year: 2018 - 2022
- Type of Documents: Articles
- Language: English
- *Wos* Categories: *Business/Management*
- *Scopus* Categories*: Business, Management and Accounting*

Web of Science database		**Scopus database**	
1) Digital; Skill*; Education	62	1) Digital; Skill*; Education	179
2) Digital; Skill*; Tertiary	3	2) Digital; Skill*; Tertiary	9
3) Digital: Skill*; “Higher Education”	15	3) Digital: Skill*; “Higher Education”	44
Total: 80 articles		**Total: 232 articles**	

Duplicate Articles
108 articles

Selected for Analysis:
204 articles

Excluded Articles:

- Did not discuss Digital Transformation: 63
- Did not discuss Skills: 29
- Did not discuss Education: 25

Total articles excluded: 117 articles

Final Sample
87 articles

Figure 2.1 - The Stages of the Systematic Search Process

2.4 Results

The temporal distribution of publications shows us that the total publications in the period from 2018 to 2022 show the largest variation between the year 2018 with 11 publications and the year 2019 with 32 publications. Not considering the year 2022 as it was still in progress.

Regarding the temporal distribution of citations, we can observe a large number of citations in 2021. However, this effect occurs because a single article had many citations this year, 116 citations. These movements can be observed by analyzing Figure 2.2.

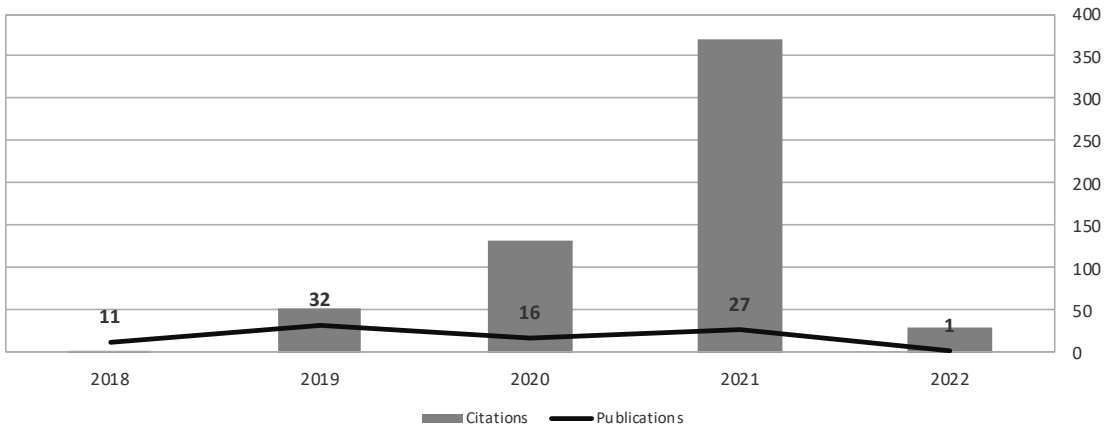

Figure 2.2 - Time distribution of publications and citations

Regarding citations, the articles in the sample received 586 citations with an average citation rate of 6.73 and a standard deviation of 16.72. The coefficient of variation (quotient between the standard deviation and the mean) of the data shows a value of 248%, indicating a large dispersion among the citation numbers, which can be explained by the large citation volume of a single article. In addition, 25.29% of the articles were not cited at all; 49.42% were cited 1 to 5 times; 8.05% received between 6 and 10 citations, and 17.24% obtained more than 10 citations.

2.5 Content Analysis

After carefully analyzing the articles that make up this database of studies, we extracted relevant data, analyzing the keywords, type of research, objectives and conclusions of each article, we were able to identify themes and categories. We then conducted an analysis of the clusters formed to see if the grouping would allow for an organized analysis and conclusions on specific topics. As a result, we identified 7 distinct groups according to their main contributions: i) digital literacy; ii) identification of competencies; iii) use of digital technologies in teaching; iv) learning models; v) qualification or requalification of the labor force; vi) digital technologies in the labor market; vii) analysis of undergraduate courses.

2.5.1 Group 1: Digital Literacy (N=11)

In this group, the studies look at digital literacy and its importance in light of the digital transformation in society. According to the Council of the European Union (2018,

p. 9), “digital competence involves the confident, critical and responsible use of, and engagement with, digital technologies for education, work, and participation in society”. A very relevant theme is how digital literacy impacts society. Digital literacy can impact social inequality, and it is advisable to promote the use of ICT in disadvantaged groups to reduce social inequality (Zilian and Zilian, 2020). This aspect can be evidenced when Hidalgo et al. (2020) demonstrate that the level of digital literacy is related to the level of socioeconomic status of the individual. While Sait and Anshari (2021) state that digital literacy is crucial for the country's economic development in the digital economy.

Measuring the level of social literacy is discussed in several articles. In the area of education, Tetep and Suparman (2019) measure the level of media literacy of undergraduate students. While Kaarakainen (2019) and Rahim (2019) study high school students. Teachers are also assessed, indicating that the teacher literacy process is still at an early stage (Hidayati et al., 2020) demonstrating that digital skills and competencies will be important in building new learning scenarios (Tejedor et al., 2020; Tewari and Birla, 2018).

Regarding organizations, managers' digital literacy level is an important factor for success in digital transformation, since only with proper knowledge can managers make strategic decisions for the organization (Bolek et al., 2018). However, organizations need to develop models for measuring the level of employees' digital literacy (Cetindamar et al., 2021).

Despite the importance of digital literacy in the digital economy, no contribution offers a framework for a collective effort to improve digital literacy, but only actions taken individually. An important aspect that the literature cannot determine is whether there are intangible sociocultural factors that shape ICT usage behavior across different countries.

2.5.2 Group 2: Identification of Competencies (N=16)

In this group, the studies work on identifying the individual competencies required by the digital transformation.

New competencies are required from professionals so that they can act in this digital transformation scenario. The identification of these new competencies is a theme present in several articles. We have identified the following sectors:

- the retail sector, where social skills are important if the potential of new technologies is to be fully understood and utilized (Woods et al., 2021);

- accounting, where future accountants need to be able to understand the uses and limitations of digital technologies in business in a broad context and not just limited to the accounting function (Tsiligiris and Bowyer, 2021);
- data analysis, when it concludes that in Russia the demand is more for hard skills, while in the US the demand is more for soft skills (Skhvediani et al., 2021);
- law, which concludes that the legal workforce must develop knowledge in other areas (e.g. digital technology and design thinking) in addition to legal knowledge (Janeček et al., 2021);
- library science, when it was concluded that library science courses need to update their menus so that graduates have the necessary skills to work with new technologies (Ascoli and Galindo, 2021);
- industry, which identifies cognitive skills as the most important for human capital, followed by emotional and behavioral skills (Singh et al., 2021; Spöttl and Windelband, 2021).

Marketing was the area with the most articles that seek to identify competencies. One of the important aspects is whether graduates are leaving their training with the competencies that the market demands, specifically with the competencies needed to work with digital marketing (Elhajjar, 2022; García Martín and Echegaray, 2019) and how universities are adapting themselves to teach these new competencies (Kurtzke and Setkute, 2021).

This said, those who are already in the market also need to have these new skills. Echegaray and Martin (2019) show that six of the top 10 skills required by the market are related to the digitalization process. While Di Gregorio et al. (2019) identify five categories of employability skills: basic social skills, analytical skills, digital and technical skills, procurement skills and customer perception skills.

In addition to impacted sectors, functions also need to adapt to the new reality. Kurmanov et al. (2021) and Philip and Gavrilova Aguilar (2021) identify the skills that managers need to lead the organization in digital transformation. Entrepreneurs are also impacted: Harding et al. (2020) analyze the skills for entrepreneurship in the digital age and conclude that it is necessary to provide more training in the technology area. For organizations to be able to innovate, Wodarski et al. (2019) consider that it is essential to develop knowledge, skills and attitudes related mainly to cognitive, social, interpersonal and innovative skills for graduates to succeed in the innovation process.

Although the articles assess the skills that the market is demanding, one issue that could be studied is the assessment of the return on investment by governments and the students themselves in cases where educational programs do not match the structure of the skills demanded in the market.

2.5.3 Group 3: Use of Digital Technologies in Teaching (N=12)

In this group, the studies work on the use of digital technologies in the education system. This refers to several phenomena, such as the development of e-learning, equipping institutions with software, or introducing artificial intelligence into the educational process and applying digital tools and resources in various educational contexts, including classrooms, remote learning, and virtual environments.

The education sector is changing as a result of digital transformation through the adoption of new technologies, but for this to occur, educators must be at the forefront of this process (Crittenden et al., 2019; Iivari et al., 2020). One of the first technologies that the industry adopted was the e-learning system. With the challenges raised by the Covid-19 pandemic, the use of this kind of technology was deepened by the need for online classes. Still, its application requires the qualification and adaptation of teachers (Stewart and Khan, 2021; Webb, 2021).

The adoption of new technological tools allows the emergence and use of new modes of education, MOOCs (Massive Open Online Courses) is a form of education that can be used in various contexts and for various purposes, whether for the teaching of students in various areas (Goglio and Bertolini, 2021) or even for the training of teachers (Sharov et al., 2019). Faridi and Ebad (2018) consider that the increased use of MOOCs will require universities to adapt and accept them as certification tools.

Social media can also be used for teaching. López-Carril et al. (2020) demonstrate how Linkedin can be used in teaching sports management, while Low and Wong (2021) investigate the use of Facebook by engineering students. In addition to social networking, other technology tools are being used, Abdurahimovna (2021) analyzes the use of communication technology tools in learning to model clothing, which allows the adoption of a project-based teaching methodology.

The changes generated in the education system by the adoption of new technologies will require their use to be evaluated by stakeholders, to understand how students are reacting to this change (Vizo et al., 2020) or to measure the impact of the changes on education indicators, thus being able to identify best practices and support states in adopting new education policies (Cosmulese et al., 2019).

The section presented examples of adopting digital technologies in education but emphasized that educators must be prepared and stimulated to work with the new learning elements for the best implementation of digital tools. In addition, everyone involved in the educational process must be aware of the differences between the traditional way of delivery, the new ways of teaching, and the changes needed to support structures and processes when adopting digital technologies in education. Future studies

may evaluate the use of digital platforms that exlplore the development of digital educational provision, which allows to improve the qualification of teachers, scientists and students.

2.5.4 Group 4: Learning Model (N=18)

In this group, the studies work on new learning models in light of digital transformation. A learning model involves a combination of mechanisms and activities for acquiring new skills and knowledge to encourage and facilitate learning.

Habanik et al. (2019) state that knowledge can quickly become obsolete with technology changing so fast that traditional learning will no longer be effective, and the education system needs changes. As such, León et al. (2018) present the T-based model, which consists of training with 75% based on acquiring technical knowledge and 25% based on acquiring knowledge in innovation and entrepreneurship. In the same vein, Melnyk et al. (2021) reveal that a person needs to acquire new knowledge and skills in the shortest possible time and, to achieve this goal, the use of digital modeling and other disruptive technologies is required. Finally, the demand from new generations requires that new methods be applied, using the innovations generated by digitalization in teaching (Marie and Kaur, 2020).

The new skills demanded by the market and the use of digital tools make it necessary to revise curricula to better train students for the digital economy, such as the knowledge to work with Big Data (Grenčíková et al., 2021). While, Ilori and Ajagunna (2020) argue that implementing STEAM Education, i.e. focusing on science, technology, engineering, arts and mathematics subjects, regardless of the context, will be critical for everyone. Li (2020) already proposes a curriculum structure based on systems thinking, that is, having the ability to understand facts not only in themselves but also in other people and instances involved in the situation.

Various learning models are being put in place as a result of digital transformation. Rohm et al. (2021) Discuss project-based learning in another article, Rohm et al. (2019) analyze this methodology in marketing courses. Learning through business games also benefits from technological innovations and enhances the attainment of the new skills required (Bashynska et al., 2019). Kemp et al. (2019) evaluate the use of the Matchmaking technique as a facilitator of student learning. However, other methodologies are evaluated, Rohman et al. (2020) verify the impact of implementing project-based, technology-based, active learning in physics (PROTECTIVE), while Moldoveanu and Narayandas (2019) describe how the PLC (personal learning cloud) is making it possible to measure skill acquisition. For these new methodologies to be

successfully implemented, Vinogradova et al. (2019) advocate the introduction of SMART education, which is a methodology that establishes criteria, which are specific, measurable, achievable, realistic and time-bound, thus enabling the monitoring of implemented actions.

For the efficacious introduction of these new learning models, the teaching environment needs to be rethought, with changes to the design of the teaching environment (Van Den Berg, 2019), the existence of classrooms with available technologies will be necessary (Tarabasz et al., 2018). The educational processes will also need to change, with the opportunity to outsource some educational processes emerging (Kurilova et al., 2019). However, Kisa (2019) argues that all these changes alter the processes of the various players in the educational process, such as educational policymakers, teachers, and students.

2.5.5 Group 5: Labor Qualification or Requalification (N=13)

In this group, the studies work on the qualification or retraining of the workforce in light of the digital transformation. They explore how companies perceive the impact of digital technologies on the education and training needs of current and future employees.

For organizations to successfully implement digital strategies, the workforce needs to be qualified with the essential skills for the new business model (Cardenas-Navia and Fitzgerald, 2019). Several business sectors are demanding new skills from future employees, ranging from sectors such as IT, where a positive relationship between IT skills and employment has been demonstrated (Atasoy et al., 2021), hospitality and tourism, where digital skills will enable the implementation of innovations in the area. (Adeyinka-Ojo et al., 2020), mining engineering, which is important for increasing the productivity and efficiency of mining companies' activities. (Alvarez et al., 2019), civil engineering, which would propitiate the implementation of new working methods, and civil construction, which would propitiate the implementation of new working methods. (Ibrahim et al., 2019), in France, industrial electronics, which established a partnership with the academic area to capacitate the sector's employees with the new skills required (Bonnaud, 2021) and entrepreneurship, where it was demonstrated that spaces focused on the development of entrepreneurship can promote 21st-century skills. (Rayna and Striukova, 2021).

The workforce that is already within organizations also needs to adapt to this new scenario, thus organizations need to invest in retraining these employees. Achtenhagen and Achtenhagen (2019) conclude that retraining the organization's employees is important for the decision to implement digital technologies. For this requalification to

occur, Cascio (2019) states that the human resources training and development sector needs to adapt to provide the qualifications required by the market. Regarding the vision of the employees, Kar et al. (2021) analyze the employee's behavior for the requalification process. The education sector also has to requalify itself to be qualified for the new market needs (Suhasini and Santhosh Kumar, 2019).

A theme discussed by Perkins and Pryor (2021) and Cowley et al. (2021) is the use of digital credentials to certify that the professional has acquired professional competence.

2.5.6 Group 6: Digital Technologies in the Labor Market (N=6)

In this group, the studies work on the impact of the adoption of technologies in the labor market, both for organizations and employees.

With digital transformation, various digital technologies have been adopted by the market, causing impacts and changes in society, due to the need for new skills for the labor market (Vassiliadis and Hilpert, 2020) and in jobs, especially with the introduction of robots in various sectors of the economy (Marin, 2018). Barna and Epure (2020) discuss youth unemployment because they are not qualified to work with the new technologies. For this problem not to occur, Dyatlov et al. (2018) argue that public or private investment in human capital should be a strategy adopted by countries. While Foerster-Pastor and Golowko (2018) they analyze what skills the IT sector requires from employees to be employable. The regional innovation systems have to face several challenges because of the transformation, needing to adapt to the new technologies of the market (Brunetti et al., 2020).

2.5.7 Group 7: Undergraduate Course Analysis (N=11)

The studies conducted in this group examine undergraduate courses to assess the impact of changes in higher education institutions (HEIs), including curriculum modifications and teaching methodologies. The research aims to understand how these changes influence undergraduate students' learning experience and outcomes. By analyzing the effects of curriculum and teaching method adjustments, these studies contribute to the ongoing efforts to enhance the quality and effectiveness of undergraduate education.

The changes generated by transformation have made it necessary to discuss the challenges in the relationship between the university and digital technologies (Nguyen,

2018). As such, Kazaishvili (2019) aims to determine whether teaching methods based on digital tools result in 21st-century skills.

Analyses of undergraduate courses to see if they prepare students for the digital market are frequent. For instance, in the case of advertising, Jones (2018) identifies the skills that students need to compete and have jobs, which include analysis and Big Data, while Xie et al. (2018) make a comparison of the public relations degree between the US and China (see also Fang et al., 2019 and Nunan and Di Domenico, 2019). In accounting, Al-Htaybat et al. (2018) identify crucial skills, like data analysis and problem-solving, and suggest curricular changes in undergraduate courses, while, Banasik and Jubb (2021) assess whether master's courses in Australia incorporate the specific skills for employability in this sector as the digital transformation deepens. As for industrial electronics, Bonnaud and Bsiesy (2020) conclude that an adaptation of the training of engineers and technicians in the field of microelectronics is important, this adaptation of training, which must meet quality and efficiency criteria, to the acquisition of skills and know-how is essential to meet economic, industrial and social needs. Finally, in the IT area, Fitzgerald et al. (2018) look at how one HEI made the adaptations that the market indicated were needed in the data science course. Goulart et al. (2021) also assess whether there is a difference between the skills required by the job market and those developed by HEIs in IT.

2.6 Discussion

2.6.1 Skills Changes

The topic of digital transformation has been widely discussed in different economic sectors, and interest in it is growing, in academia and the market, as the growing number of studies that relate digital transformation to skills and education show. Organizations are encouraged to select and implement digital strategies. However, to be successful, they need employees with the required new competencies, who must arrive at the job market trained by the HEIs. For the trained employees comes the opportunity to compete, value and manage the knowledge they possess, which is seen as a source of competitive advantage.

The main contribution of this article was to systematize the knowledge about digital transformation, skills, and education. The main areas of research on digital transformation, incorporated into the groups defined in the section above, allow the

development of a framework for analyzing digital transformation. Figure 2.3 summarizes the different research areas.

Digital Transformation has had a strong impact on the way people do business, work and live, due to the emergence of new digital technologies in the labor market (Group 6), changing the skills required by the labor market. Thus, the process of identifying the skills required in the various sectors of the economy is important to understand the new needs of the market (Group 2). Digital literacy is ever more crucial for citizens and workers (Group 1).

Another change caused by digital transformation is about the qualification or requalification of the workforce, because only with a staff qualified for the new technologies will organizations be able to implement digital strategies (Group 5).

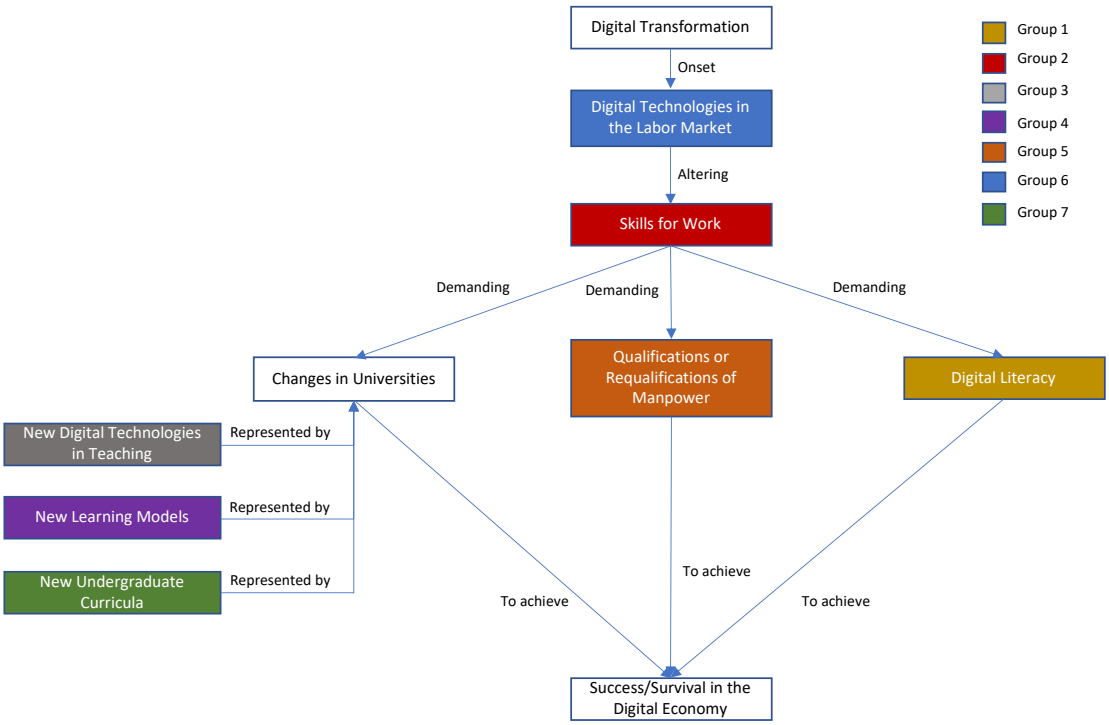

Figure 2.3 - Main Issues in Literature

2.6.2 Changes in HEIs

The new skills demanded by digital transformation require HEIs to change so that graduates enter the labor market with skills that meet the needs of employers. Changes in HEIs can be divided into three categories:

- the use of digital technologies in learning, which is an opportunity for the education sector to consider new strategies for student development (Group 3);

- the adoption of new learning models, to transform and improve teaching and learning processes to be more suitable for digital transformation (Group 4);
- the analysis of the curricula, so that they are more adequate to the demands demanded by the job market (Group 7).

2.6.3 Future Research

During the paper, we identified some gaps in the literature. However, future research relating to the themes is needed. The main difficulty in preparing this study was the large number of areas affected by the change generated by digital transformation, which makes it difficult to flesh out the relationship among competencies, education and digital transformation. It also reveals, on the other hand, that studies in this area still need to be conducted, which proves to be a fertile field for future publications, as well as the possibility of expanding studies in this area. In Table 2.1, we present some recommendations for future research.

Table 2.1- Recommendations for Future Research

Group	Recommendations for Future Research
Group 1: Digital Literacy	- To evaluate possible divergences and similarities in digital skills between different countries and to assess whether the socioeconomic level factors detected in the Spanish population remain the same in other countries; - Identify which forms of ICT use enhance digital problem solving for different groups, but also use cross-country analysis to determine if different intangible socio-cultural factors that shape ICT use behavior.
Group2: Identifying Competencies	- Conduct a review of marketing curricula to investigate the extent to which social skills are currently part of a formal curriculum, for example, in explicit learning outcomes or as a stand-alone course; - Evaluate the return on investment by governments and by the students themselves, in cases where educational programs do not match the structure of skills required in the market.
Group 3: Use of Digital Technologies in Teaching	- Consider online courses on the Ukrainian-language EdEra platform that will allow you to creatively process educational information and improve your qualifications as a teacher, scientist, and student; - Consider coverage of a broader population and region in the civil engineering discipline or different engineering disciplines.
Group 4: Learning Model	- Develop experiential activities for use in marketing courses and then investigate the effectiveness of these activities; - An exploration, through a case study, of how technology will impact the teaching and learning process of the next Alpha Generation.
Group 5: Labor Qualification or Requalification	- Investigating whether digital certificates are influencing recruitment practices and analyzing whether digital certificates can help students and graduates secure employment; - To investigate more closely the activities carried out in the fab lab and makerspaces to assess, in terms of educational design, the specific skills that are promoted, and what kind of learning environment would be most suitable for this.
Group 6: Digital Technologies in the Labor Market	- Study how the business sector, along with governmental and educational institutions can collaborate to meet the skill set in demand;
Group 7: Undergraduate Review	- Investigating the types of computer skills most valued in the workplace would also be beneficial; - Explore whether digital programs can replace traditional programs offered in colleges and schools, such as advertising, public relations, and journalism. - Regulatory framework that enables or hinders the creation and/or modification of courses.

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3 IDENTIFICATION AND ANALYTICAL COMPARISON OF SUPPLY CHAIN MANAGEMENT SKILLS IN PORTUGAL

Abstract

The use of digital technologies to optimize performance in logistics and supply chains is a phenomenon that aims to put the customer at the center of business thinking. The new scenarios arising from digital transformation force logistics to adapt to a more complex, ever-changing, and highly uncertain environment. So, the demand for well-qualified logistics professionals to perform in this context becomes important for organizations. The objective of the article is to identify the key logistics and supply chain management competencies to perform in an environment impacted by digital transformation. We analyzed the content of textual data from: (1) job advertisements in the logistics area in Portugal, and (2) academic research articles on competencies in the logistics area. The results show an evolution in the skills required, with greater emphasis on technical skills related to information technology. Furthermore, interpersonal skills such as communication, teamwork, and flexibility are highly valued.

Keywords: Supply chain digitalization, Logistics competencies, Supply chain competencies, Soft skills, Hard Skills, SCM competencies framework.

3.1 Introduction

Supply Chain Management (SCM) is key to creating value for companies, reducing costs, and increasing customer satisfaction through better quality, on-time delivery, responsiveness, innovation, and service (Reis et al., 2021). Supply chain processes are vital in business, especially global operations (Garay-Rondero et al., 2020). Rapid economic, technological, financial, and social changes have continuously evolved supply chains. Notably, the emerging digital technologies associated with Industry 4.0 have led to advanced technologies such as blockchain, artificial intelligence (AI), cloud computing, and big data being used to simplify multifaceted tasks and accelerate supply chain integrations (Garay-Rondero et al., 2020; S. Y. Lee, 2021).

Despite years of process innovations and sophisticated technological solutions, an agile and adaptable supply chain remains a difficult goal to achieve. Possibly, it is people who are causing constraints in supply chains. The issue seems to be about talent, not technology, especially as the market becomes more complex (Kirby, 2003). In a study on digital talent by Hoberg et al. (2015), it was observed that there is a significant shortage of digital skills in the workforce. The lack of digital talent slows down or delays digital transformation. Digitalization requires a workforce with a digital skill set, capable of using digital technologies and solutions, and having durable business intelligence (Liboni et al., 2019).

When examining the literature on the skills and competencies of logistics professionals to operate in the context of digital transformation, we find that previous research lacks discussion and empirical investigation of the skills required in logistics and supply chain management in the digital economy. In short, previous research does not provide logistics organizations with an industry-specific understanding and operationalization of the requirements for logistics personnel in a rapidly changing environment. From a practical point of view, this gap is relevant for both employers and employees. The research provides a comprehensive overview of the changing nature of logistics positions and the skills required in the new digital domain.

In this article, we focus explicitly on the logistics and supply chain management field in Portugal and its evolving scenario due to the digital transformation, particularly with regard to characterizing the workforce's skills. The aim is to identify the skill set SCM employers in Portugal are looking for in professionals in the field. The skills requirements of the labor market can indicate the design of study programs and the adaptation of teaching methods. This approach opens up new avenues for improving higher education curricula.

Our approach uses content analysis, which focuses on the text of 300 job advertisements in the supply chain and logistics sector in Portugal, to identify the skills required by the job market in logistics professionals. At the same time, it examines the research output in articles written by academics in reference journals focused on logistics and supply chain so that we can see whether there is a change in skills in the logistics area over time as a result of the digital transformation.

By addressing this research question, we contribute to theory and practice. This study presents a conceptual model that combines the existing competencies in Supply Chain Management (SCM). In addition, we have identified the skills employers expect from professionals in the field. New competencies, such as the adaptation competency, are becoming more relevant as technology advances, customer requirements change, and supply chain integration becomes an industry practice. This study has the potential

to guide companies in restructuring their organization, creating new positions, and developing competencies while at the same time helping academic institutions to improve the training of logistics students more effectively.

The rest of the article is structured as follows. After this introductory section, we present a literature review, followed by a discussion of the theoretical context of qualifications and competencies in the logistics market with digital transformation. We then present a conceptual framework and describe the methodology used in the empirical research. The results and the main implications for theory and practice are then discussed. To conclude the article, we provide avenues for future research.

3.2 Literature Review

3.2.1 The challenge of Digital Transformation

Digital transformation has proven to be an effective way of exploiting technology and digital resources for business model innovation and is a driving force behind the development of the smart supply chain. Compared to the disadvantages of traditional supply chain information silos and asynchronous information exchange, successful digital transformation enables a supply chain to improve operational efficiency, reduce costs and expand service capabilities, thereby achieving real-time, intelligent, and interconnected supply chain management (Choi et al., 2019; Hartley & Sawaya, 2019).

A recent study (CSCMP & ToolsGroup, 2021) highlights several challenges when implementing digital transformation (DT). Among them, the skills deficit in the team is the main obstacle, as pointed out by 41% of the participants. Other challenges mentioned include the inadequate quality or absence of data (34%), uncertainties related to COVID-19 (28%), the rigidity of existing technological structures (28%), and fear of change (28%).

According to the World Economic Forum (WEF, 2016), digitalization in logistics could grow to 1.5 trillion dollars in value by 2025. However, analysis shows that logistics companies are now behind the DT curve compared to media, telecommunications, banking, and retail (Riedl, 2018). The logistics services industry has struggled to adopt technologies (Gunasekaran et al., 2017; Mathauer & Hofmann, 2019) and increase its capacity for innovation (Bellingkrodt & Wallenburg, 2013; Busse, 2010; Wagner, 2008). The literature points to a lack of technological know-how (Cichosz et al., 2020), low education level of the workforce (Karia, 2018), and difficulties in transferring innovation

between the various branches of dispersed LSPs (Busse & Wallenburg, 2014; Cichosz et al., 2017).

3.2.2 Skills and the Impact of Digital Transformation

Competencies or skills enable a person to achieve a certain performance or result. However, Lapiņa & Ščeulovs (2014) argued that these concepts should not be confused with the employee's performance in a given task, as this can vary depending on certain factors, such as motivation and organizational structure. Competencies, in addition to cognitive competencies, also include elements such as self-awareness, self-regulation, and social competencies. According to Albino (2018), competencies are primarily behavioral and, unlike personality and innate intelligence, can be learned through training and development. Competencies exist when they are demonstrated. Consequently, they apply when the individual can use their skills and abilities in a professional activity. Thus, Lindberg & Rantatalo (2015) define professional competence as "the inferred potential for desirable activity within a professional practice." This definition focuses on the concrete manifestation in practice from which evaluations infer qualities. This article will classify competencies into two main groups: hard skills and soft skills (Swiatkiewicz et al., 2015).

Technical skills directly related to the type of work performed and the individual's ability to learn new skills, such as knowledge of a foreign language or adapting to new communication and information technologies, are called hard skills. Rainsbury et al. (2002) define hard skills as competencies related to the technical aspects of doing certain tasks at work and often take into account the acquisition of knowledge. Laker & Powell (2011) refer to hard skills as the skills that enable employees to compete in tasks, including skills related to scientific knowledge, professional skills, and technical knowledge.

In general terms, soft skills are the interpersonal, human or behavioral skills needed to apply technical skills and knowledge in the workplace (Weber et al., 2011). Soft skills emphasize competencies and behavioral elements to collaborate with others (Patacsil & Tablatin, 2017). Tsey et al. (2018) refer to soft skills as an individual's mindset, i.e., a combination of qualities, personality traits, and attitudes that can help with conflict management.

The differences between hard skills and soft skills lie not only in the limited connection to qualification and lack of accreditation in the case of soft skills (as there is no diploma confirming the level of individual soft skills) but also in their development. Hard skills are primarily related to knowledge (e.g., the cold welding process, English

grammar, accounting, etc.), so they can be easily trained and measured. According to Patacsil & Tablatin (2017), hard skills are easier to quantify, measure and observe, unlike soft skills. Soft skills are more subjective and difficult to measure, as they are not traditionally learned along an individual's educational path.

Recent studies show that digital transformation requires a set of digital skills and capabilities from the workforce. Organizations must equip their workforce with digital skills to meet organizational objectives if they want to benefit from their investments in digital technologies (Kane et al., 2019). Developing, finding, or competing for digitally skilled labor is often mentioned as a major challenge in digital transformation (Horváth & Szabó, 2019; Karacay, 2018; Obermayer et al., 2022).

The digital transformation requires that workforces not only possess digital skills but also rely more heavily on other individual characteristics (Dremel et al., 2017). Renowned organizations (McKinsey, 2021; World Economic Forum, 2020) indicate that most companies face increased skills gaps, highlighting the pressing need for a workforce with crucial skills. These essential skills include critical thinking, complex problem solving, adaptability, and resilience, as Trenerry et al. (2021) pointed out as the fundamental pillars required for today's dynamic workforce.

There is also a growing emphasis on social skills such as problem-solving and creativity in technology-oriented environments (Börner et al., 2018; Grundke & Marcolin, 2018). In the study by Chuang & Graham (2018), along with the increased demand for highly specialized skills, employers also emphasized essential human skills, such as creativity, problem-solving, and critical thinking.

3.2.3 Competencies and Skills in SCM

The debate on the skills required of SCM professionals began in the early 2000s and has considered practical perspectives and educational (Jordan & Bak, 2016). However, despite the large body of research, knowledge about SCM competencies is still fragmented and inconclusive, as research and definitions on the topic vary in scope and meaning (Campos et al., 2019; Derwik & Hellström, 2017). The literature on Supply Chain Management (SCM) competencies tends to use logistics and SCM interchangeably, as is also done in this article.

Supply Chain Management (SCM) is key to creating value for companies, reducing costs, and increasing customer satisfaction through better quality, on-time delivery, responsiveness, innovation, and service. SCM competencies are considered an important antecedent to supply chain integration (Suttiwatnaruput et al., 2014), and the

use of advanced SCM practices can make the difference in an organization's success or failure in meeting customer needs and staying in business (Fawcett & Waller, 2013).

Murphy & Poist (1991) categorize the skills needed by logistics managers as business skills, logistics skills, and management skills. This structure is known as BLM (Business Logistics Management). Mangan & Christopher (2005), using a triangulated research approach to capture the views of education and training providers, participants in training programs, and corporations, identify the main areas of knowledge and competencies/skills that comprise three categories of general knowledge, specific logistics/supply chain management and competencies/skills. Gammelgaard & Larson (2001) postulated a three-factor model of SCM competency areas for executive development. The model comprises interpersonal/managerial competencies, quantitative/technological competencies, and supply chain management competencies. Myers et al. (2004) examined the impact of logistics competencies on the value generated by logistics managers for their organizations and suggested four groups of general management competencies: social, time management, decision-making, and problem-solving.

Lutz & Birou (2013) examined the logistics programs of 37 universities, formulating five classes of competencies (in partial accordance with Myers et al. (2004)): social skills, decision-making skills, problem-solving skills, time management skills, and general knowledge. Bourlakis et al. (2013) analyze the supply and demand of logistics graduates by analyzing the content of job advertisements and teaching programs. They identify a gap between industry requirements in terms of logistics-related positions and the focus of degree programs and illustrate the importance employers attach to non-SCM-related soft skills such as leadership, communication, project management, and team-related skills.

Finally, despite some consensus in the literature, competencies and categories are sometimes presented with overlapping terminologies for similar concepts and sometimes in a complementary way with new and different measures. More recent studies corroborate that there is no consistency in the classification identified, with some identical individual competencies being classified differently by different authors (Kotzab et al., 2018; Wong et al., 2014).

3.2.4 Competencies and Skills in SCM in the Context of Digital Transformation

Supply chain management has evolved since the integration of purchasing and logistics was introduced in the 1980s. Its focus has shifted from increasing efficiency to

improving value creation for the end customer through relationship management and coordination (Min et al., 2019). Supply chains must now be efficient, reactive, agile, resilient, responsible, innovative, and adaptable (Christopher & Ryals, 2014; Min et al., 2019). In addition, the ongoing digital transformation will require integrated supply chains through new technologies and digital platforms. SCM professionals must deal with these constant changes and demands by adopting more proactive behaviors (Prajogo & Sohal, 2013) and being more strategic than technical (Derwik et al., 2016; Min et al., 2019).

Several studies highlight difficulties in filling vacancies due to issues such as the lack of talent with the necessary skills (Makarius & Srinivasan, 2017; Whysall et al., 2019) or insufficient talent capabilities to keep up with technological change (Tatoglu et al., 2016).

Van Hoek et al. (2002) emphasize the wealth of skills needed to do the job properly, specifically in SCM. According to Van Hoek et al. (2002), only technical aspects are often considered when training SCM talent. Stank et al. (2011) focus on the skills needed to manage modern supply chain companies. Their research focuses on four critical skill dimensions: leadership quality, cross-functional understanding, technical knowledge and global orientation.

Prajogo & Sohal (2013) point out that supply chain professionals perceive several competencies and skills as important for the supply chain integration stage, the most important of which are communication and teamwork skills. According to Closs & Mollenkopf (2004), supply chain professionals will need to possess a diverse set of skills to meet the various challenges expected in the future, including intercultural communications. Therefore, in general terms, SCM skills requirements should also be dynamic and evolve with the operational context (Mageto & Luke, 2020).

The logistics sector in Portugal, according to data from KPMG & Portuguese Logistics Association (2021), handled around $14.7 billion in 2020, which represents 5.7% of the country's Gross Value Added (GVA), with more than 11,500 companies in the logistics sector, employing 2.8% of the workforce in Portugal.

In the report by KPMG & Associação Portuguesa de Logística (2021), the attraction and retention of talent are identified as one of the challenges facing the logistics sector in Portugal, as the introduction of technological skills means that there is a shortage of specialized resources because they are being sought after by all sectors of activity. Therefore, the challenge is to attract this type of talent to a sector that is not very attractive in terms of compensation and career and to have the ability to develop and retain them in the organization.

3.3 Methodology

This article aims to identify the key logistics and supply chain management competencies required for action in an environment impacted by digital transformation. The research question is: What skill set do SCM employers in Portugal expect from professionals in the field?

To achieve our research objectives, we carried out two approaches: (1) a systematic literature review (SLR) was used to investigate academic articles on SCM competency frameworks, (2) a content analysis of the text of job advertisements in the logistics area in Portugal (Figure 3.1).

The articles selected for this study were searched in the Web of Science and Scopus databases. The keywords used in the search were Skills, SCM, and Logistics, in the categories Management, Business, Transportation, Supply Chain Management and Logistics. Peer-reviewed articles in English from 2000 to 2022 were selected for review. This is the period selected because Schallmo et al. (2017) characterize it as the beginning of the digital transformation, since the rise of smart devices and social media platforms led to a drastic change in the world, altering the methods that customers used to communicate with companies, and also changed the expectations that customers had regarding response times and multichannel availability.

The selection of the final articles to be included in this study involved identifying the articles in the databases (217), screening by title (183), reviewing abstracts to select eligible articles (19), and reviewing the full text to finally select the articles to be included (6), as they were articles that presented a framework on competencies in Supply Chain Management.

Concerning the advertisements, we used the content analysis method for the text of the job advertisements. Content analysis is the “research technique for making replicable and valid inferences from text (or other meaningful matter) to the contexts of their use” (Krippendorff, 2004, p. 18) - in the text of the job advertisements.

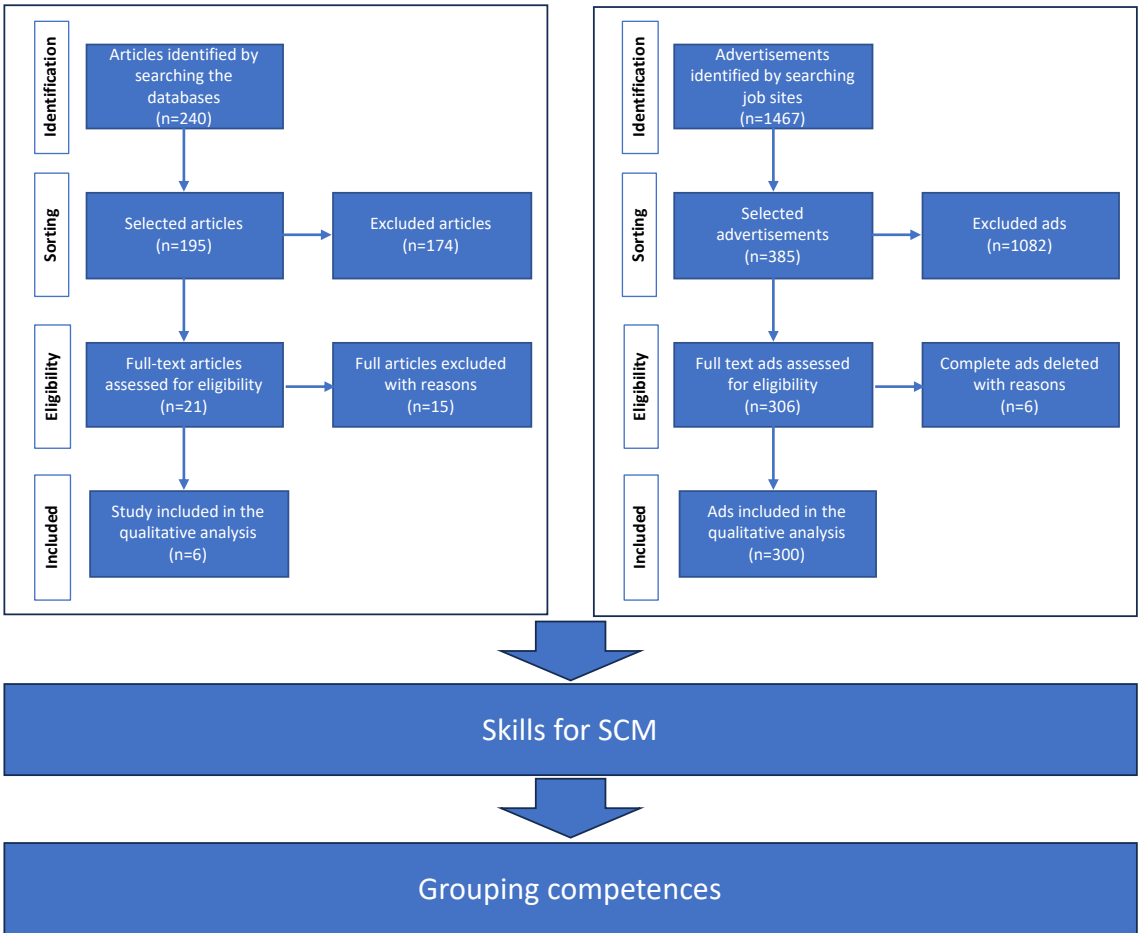

Figure 3.1 - Methodological approach

3.3.1 Collecting Data from Job Advertisements

Job advertisements were collected online for analysis on the following websites: emprego.sapo.pt, net-empregos.com, michaelpage.pt and randstad.pt, during June and July 2022, with vacancies between December 2021 and July 2022.

Initially, we examined the job advertisements available during data collection, using the keyword search logistics (*logística*) and the search region, Portugal, as these were the criteria we wanted to answer in our research. In the initial sample, we obtained 1,467 advertisements. After excluding advertisements that did not require a degree as the minimum level of training for the vacancy, we were left with 385 advertisements. We then excluded duplicate ads, leaving us with 306 ads. Next, we excluded ads for workplaces outside Portugal, leaving us with 300 ads. We consider this number of ads to be significant, as in 2021, the logistics sector in Portugal offered 2644 vacancies, including all levels of training (IEFP, 2022).

The next step was identifying each job advertisement's occupational category (GFLMA, 2021). Categorical variables were introduced: (1) industry sector, (2) level of minimum experience, (3) job title and function, and (4) level of training required.

The data was then coded according to skills using NVivo 11.0, a software program for analyzing the content of qualitative data. This tool enabled the creation of 46 nodes, each corresponding to a skill. The coding of the advertisements was carried out by two independent researchers, achieving high inter-coder reliability, with a Cohen's Kappa value of 0.86. The job advertisements were coded individually to see if they corresponded to a specific node. However, we decided to follow the advice of Krippendorff (2004, p. 287) and develop a dictionary from the sample. To do this, we adopted the empirical approach of developing the dictionary from the text of all the ads (Appendix 2). The data for each category was included in the frequency counts. Frequency analysis of keywords in texts has been widely used in many studies to identify the skills required by the sector from the text of job advertisements (Den Hartog et al., 2007; SM Lee & Lee, 2006; Mar Molinero & Xie, 2007; Redman & Mathews, 1997; Todd et al., 1995).

A cluster analysis was used to group the skills into homogeneous groups, allowing similarities between the skills to be detected. In this study, we opted for the complete linkage method, which maximizes the distances between the clusters, providing a discriminating view of the grouping structure. Considering the binary nature of our data, we chose Jaccard's coefficient as a measure of similarity. This coefficient is particularly suitable for binary data, as it quantifies the overlap between clusters, indicating the proportion of common elements in relation to the total number of distinct elements. Jaccard's coefficient is an appropriate measure for assessing the similarity of clusters in contexts where the presence or absence of certain characteristics represents observations (Everitt et al., 2011). This analysis was carried out using SPSS software.

In the second phase, the chi-squared test of independence was used to assess whether there was an association between the various skills and the various categorical variables mentioned above. This test was carried out using the R software.

3.4 Results

3.4.1 Analysis of the Content of Competencies Based on the Literature and Mapping of the Competencies of the Advertisements

Using our literature review, we created a catalog of 230 competencies identified in 6 relevant articles on logistics sector competencies (details in Appendix 1).

Overall, there is no consistency in the classification of the competencies identified, with some identical competencies classified differently by different authors. In order to make a better comparison of the competencies, we used the comparative model presented by Mageto & Luke (2020), which divides competencies into soft skills and hard skills. In this comparative table, we included the skills identified in the job advertisements (Table 3.1).

Table 3.1 - List of competencies in Supply Chain Management

Skills Category	Skills	Gammelgaard and Larson (2001)	Myers et al. (2004)	Mangan and Christopher (2005)	Murphy and Poist (2007)	Lutz and Birou (2013)	Bourlakis et al. (2013)	Job Ads (2022)
Hard	Financial management	-	-	✓	✓	-	-	-
SCM	Logistics planning	✓	-	-	-	✓	✓	✓
Skills	Human resources management	✓	-	-	✓	-	-	✓
	Statistical data analysis	✓	-	-	✓	-	✓	-
	Information systems management	✓	-	✓	✓	✓	✓	-
	Modeling operating systems	-	-	-	-	-	✓	✓
	Market regulation	-	-	-	✓	-	-	-
	Marketing	-	-	-	✓	-	✓	-
	International market regulation	-	-	-	✓	-	-	-
	Contract management	-	-	-	✓	-	-	✓
	Transport management	-	-	✓	✓	✓	✓	✓
	Inventory control	-	-	-	✓	✓	✓	✓
	Planning the location of logistics facilities	-	-	-	✓	-	-	-
	Product demand planning	-	-	-	✓	-	-	-
	Supply chain management	✓	✓	✓	✓	✓	✓	✓
	Storage	-	-	-	✓	✓	-	✓
	International logistics	-	-	✓	✓	✓	✓	✓
	Reverse logistics	-	-	-	✓	✓	✓	-
	Packaging	-	-	-	✓	-	-	-
	Controlling	-	-	-	✓	-	-	-
	Quantitative methods	✓	-	-	✓	-	-	-
	Business management	-	-	-	✓	-	-	-
	Strategic management	-	-	✓	✓	-	-	-
	Commercial management	✓	-	-	✓	-	-	-
	Industrial management	-	-	-	✓	✓	-	-
	E-commerce	-	-	-	✓	-	-	✓
	Foreign language	✓	-	-	✓	-	-	✓
	ERP knowledge	✓	-	-	-	✓	-	✓
	Project management	✓	-	✓	-	-	✓	✓
	Microcomputing	✓	-	-	-	-	✓	✓
	Third-party management	-	-	-	-	✓	✓	-
	Quality management	-	-	-	-	✓	-	✓
	Just in time	-	-	✓	-	✓	-	-
	Auto-Cad	-	-	-	-	-	-	✓
	Business Intelligence	-	-	-	-	-	-	✓
	Lean	-	-	-	-	-	-	✓
Soft	Customer relationship management	-	-	-	✓	✓	✓	-
SCM	Business ethics	✓	-	-	✓	-	-	-
Skills	Customer focus	-	-	-	-	-	-	✓
	Communication	-	✓	-	✓	✓	✓	✓
	Negotiation	✓	-	-	✓	-	-	✓
	Time management	✓	✓	-	✓	✓	-	✓
	Organization	✓	-	-	✓	-	-	✓
	Change management	✓	-	✓	✓	-	-	-
	Leadership	✓	✓	✓	-	-	✓	✓
	Teamwork	✓	✓	✓	✓	✓	✓	✓
	Planning	✓	-	-	✓	-	-	✓
	Motivation	✓	-	-	✓	✓	-	-
	Decision-making	✓	✓	-	✓	-	-	✓
	Confidence	✓	✓	-	✓	-	-	-
	Analytical Capacity	✓	✓	✓	✓	-	✓	✓
	Working under pressure	✓	✓	-	-	✓	-	-
	Objectivity	-	✓	-	-	-	-	-
	Creativity	✓	✓	-	-	-	-	✓
	Macro view	✓	-	-	-	-	-	-
	Troubleshooting	✓	✓	-	-	-	-	✓
	Conflict management	✓	-	-	-	-	-	-
	Flexibility	✓	-	-	-	-	-	-
	Multicultural awareness	✓	-	-	-	-	-	-
	Initiative	-	-	-	-	✓	-	✓
	Learning	-	-	-	-	✓	-	✓
	Adaptation	-	-	-	-	-	-	✓
	Autonomy	-	-	-	-	-	-	✓
	Curiosity	-	-	-	-	-	-	✓
	Dynamism	-	-	-	-	-	-	✓
	Focus on Results	-	-	-	-	✓	✓	✓
	Innovation	-	-	-	-	-	-	✓
	Critical Thinking	-	-	-	-	-	-	✓
	Persuasion	✓	-	-	-	-	-	✓
	Proactivity	-	-	-	-	-	-	✓
	Resilience	-	-	-	-	-	-	✓
	Responsibility	-	-	-	-	-	-	✓

3.4.2 Content analysis of job advertisements

Categorical variables were created for each advertisement, according to Bourlakis et al. (2013), namely: (1) industry sector, (2) minimum experience level, and (3) professional qualification requirements.

The data obtained allows us to conclude that the predominant sector is the logistics sector, with 36%, followed by the industrial sector, with 21%, and the retail sector, with 9% (Figure 3.2).

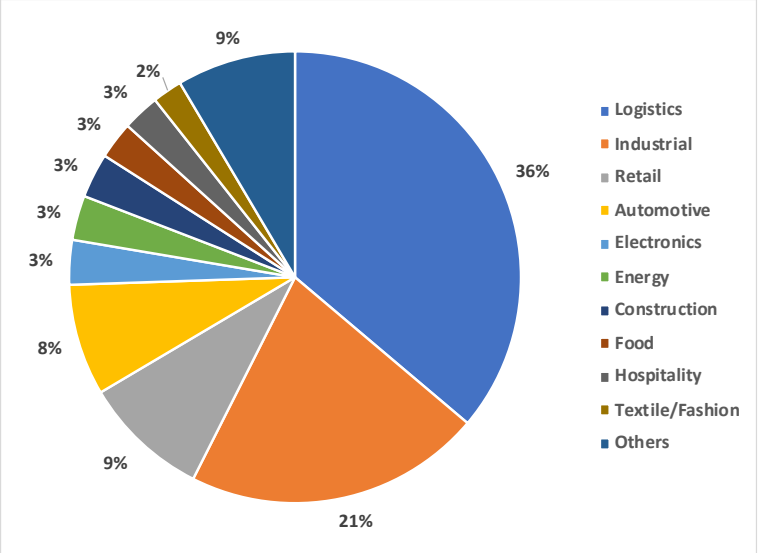

Figure 3.2- Sectors in which companies operate

With regard to the length of experience, the most demanded was between 3 and 5 years in 111 ads. Time between 0 and 2 years was present in 45 ads, and this was reduced to 33 ads for more than 5 years' experience in the sector (Figure 3.3).

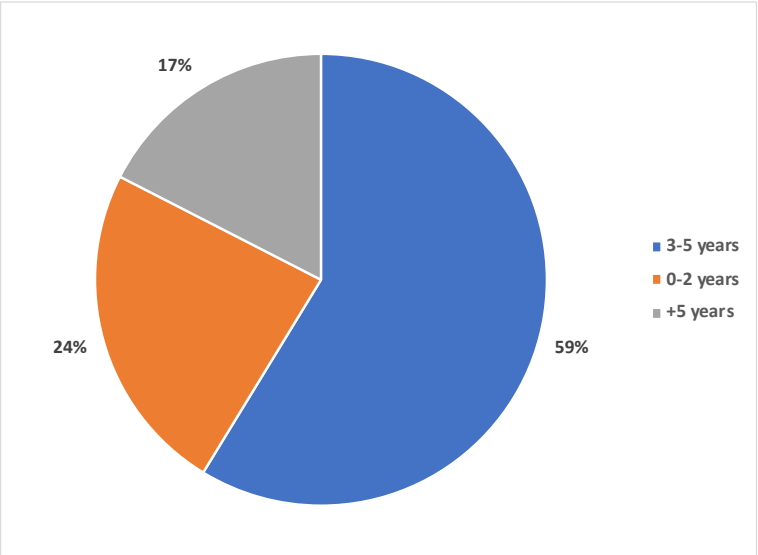

Figure 3.3 - Length of experience required

With regard to the educational requirements of the job advertisements, it was found that 285 advertisements required candidates with at least an undergraduate degree, and only 15 advertisements wanted candidates with a postgraduate degree (Figure 3.4). There was a great diversity in the areas of training required: 24 different areas of training were cited. The most cited degrees were management (150), logistics (133) and engineering (109) (Figure 3.5).

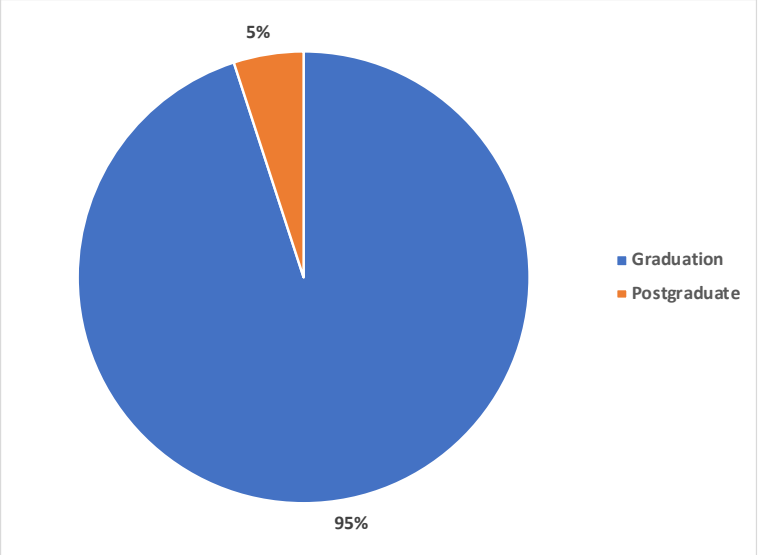

Figure 3.4 - Training requirements for candidates

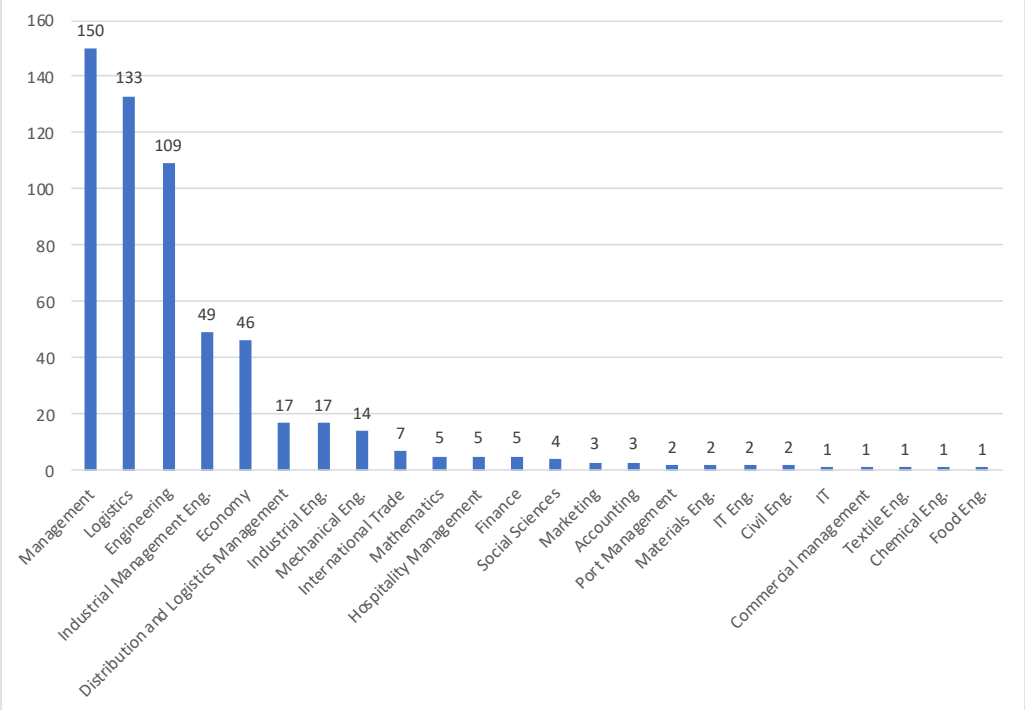

Figure 3.5 - Degree areas required in the advertisements

Finally, the most frequently mentioned position in the ads was specialist (69%), and the least frequently was director (1%) (Figure 3.6).

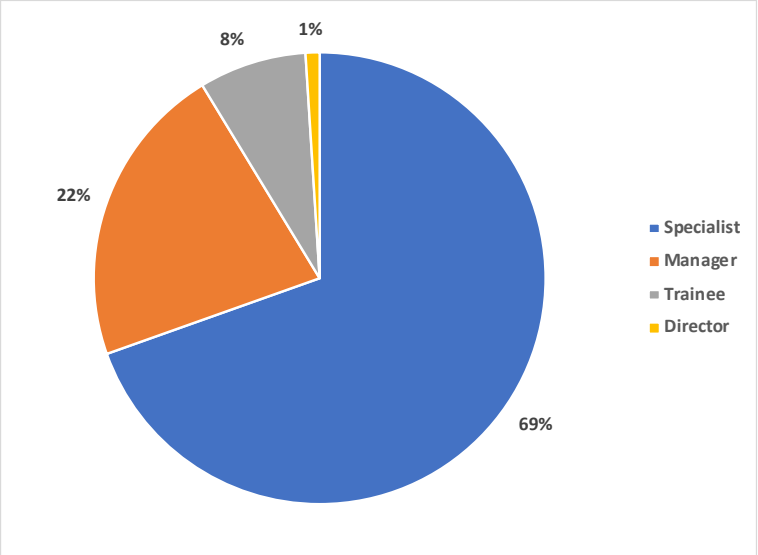

Figure 3.6 - Positions and functions mentioned in job advertisements

Drawing up treemap graphs for the hard and soft skills allowed for an analysis of proportions and comparison within the skill sets. The size of each rectangle reflects the frequency of the skills that appeared in the ads. By observing the relative sizes of the rectangles, we can understand the importance or impact of each skill.

Among the hard skills, 18 different competencies were identified. The skills most identified in the advertisements were: foreign language (English, French, German and Spanish) and use of microcomputers, i.e., use of software such as MS-Word, MS-Excel, Outlook, among others (Figure 3.7).

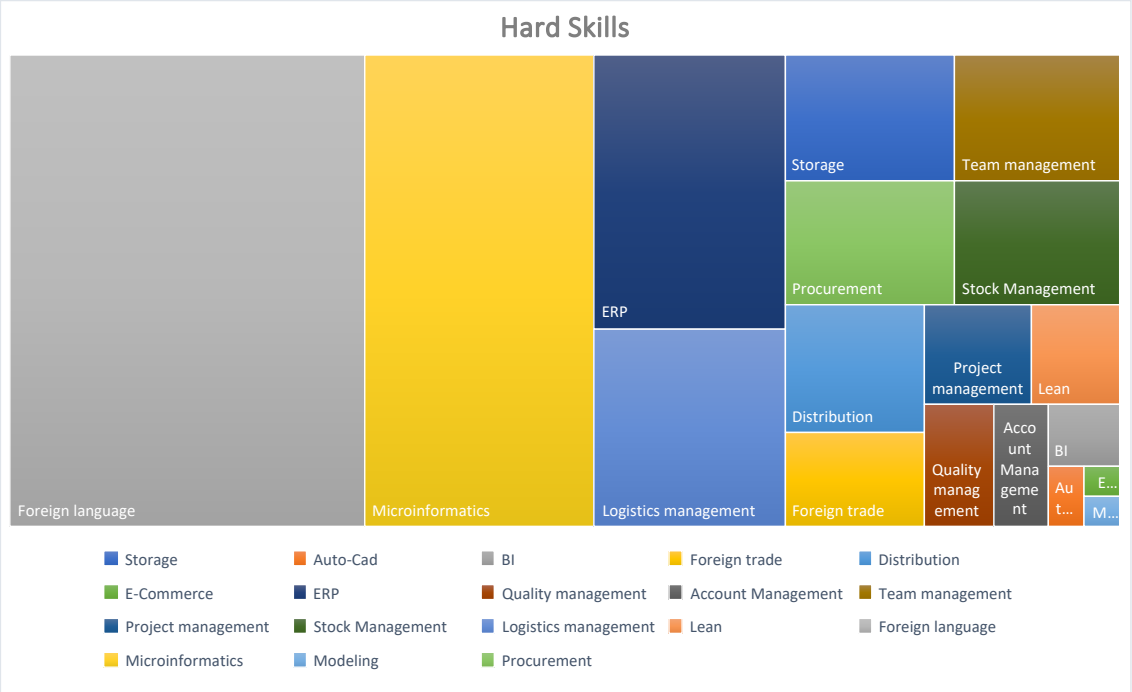

Figure 3.7 - Hard skills identified in job advertisements.

20 different competencies were identified in soft skills. It should be noted that there is a more even distribution among the soft skills, with communication, organization, teamwork, and analytical skills being the most frequently identified (Figure 3.8).

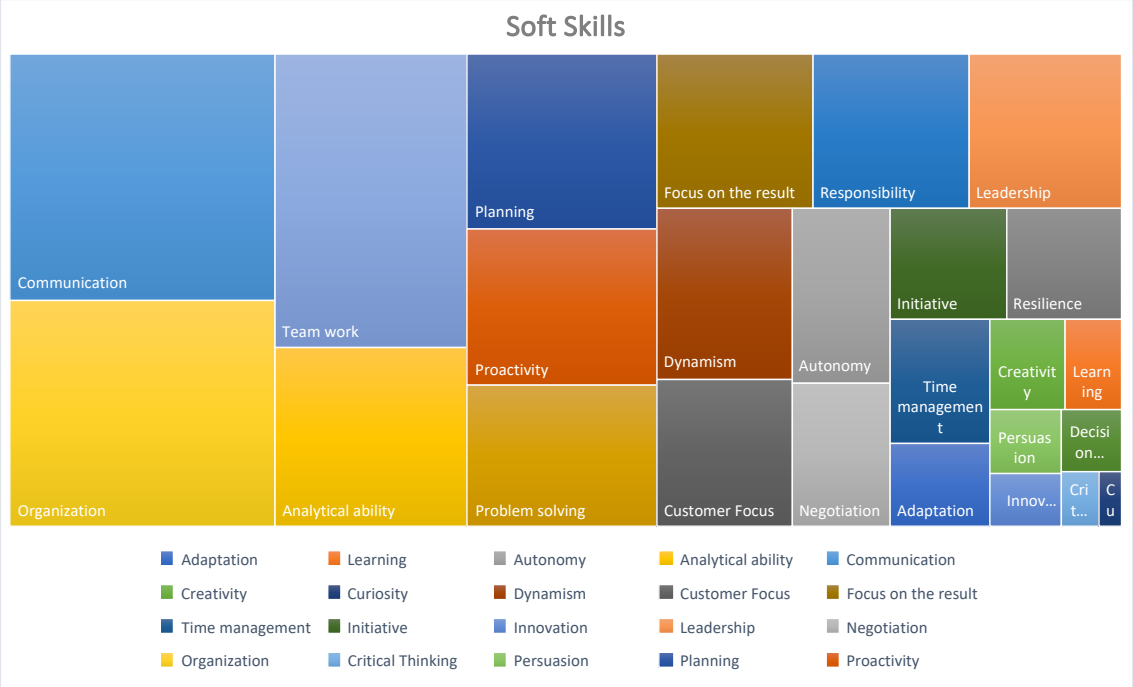

Figure 3.8 - Soft skills identified in job advertisements.

3.4.3 Skills Analysis

The results in Table 3.1 are partially translated into two graphs (Figure 3.9 and Figure 3.10), where we can see a balance between soft and hard skills, with 36 competencies appearing in each category. However, only two skills appear in all the articles and advertisements: supply chain management (hard skills) and teamwork (soft skills).

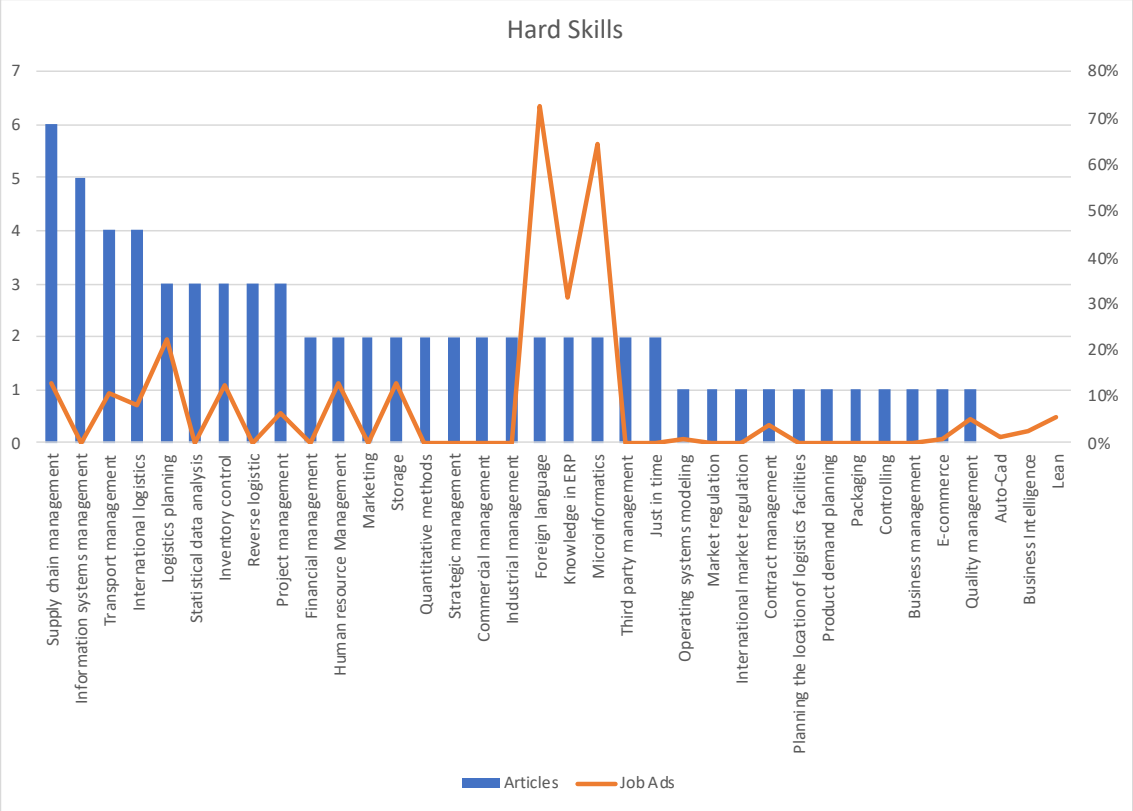

Figure 3.9 - Hard Skills identified in articles and advertisements

With regard to hard skills, the advertisements only show 18 of the 36 competencies listed. The 5 hard skills that appeared the most in the ads were: foreign language, microcomputing (which means using software that is common in everyday business life. For example, MS Word, MS Excel, MS Access, among others), knowledge of ERPs (Enterprise Resource Planning), logistics planning and warehousing. The most cited competencies in the articles are supply chain management, information systems management, transportation management, international logistics, and logistics planning.

This analysis highlighted a difference between the hard skills most cited in the advertisements and articles. Only the logistics planning skill appears among the 5 most cited in the advertisements and articles. Microcomputing skills are identified by Meyer et al. (2015) as relevant to the present and future of organizations. At the same time, ERP

knowledge skills are listed by Leopold et al. (2018) as being important for employability. Storage competence is ranked as the second most important for SCM professionals, according to M. A. da S. Reis et al.(2021). Logistics planning, which appears among the most cited in both advertisements and articles, is identified by Flöthmann et al. (2018) as the most important skill for SCM professionals.

Foreign language was the hard skill most cited in the ads, but it only appeared in two articles. This difference may be due to the fact that the articles were written in English-speaking countries, i.e., the language used in international transactions, while the advertisements relate to Portugal, a Portuguese-speaking country, thus requiring competence in other languages to be able to carry out activities with other countries.

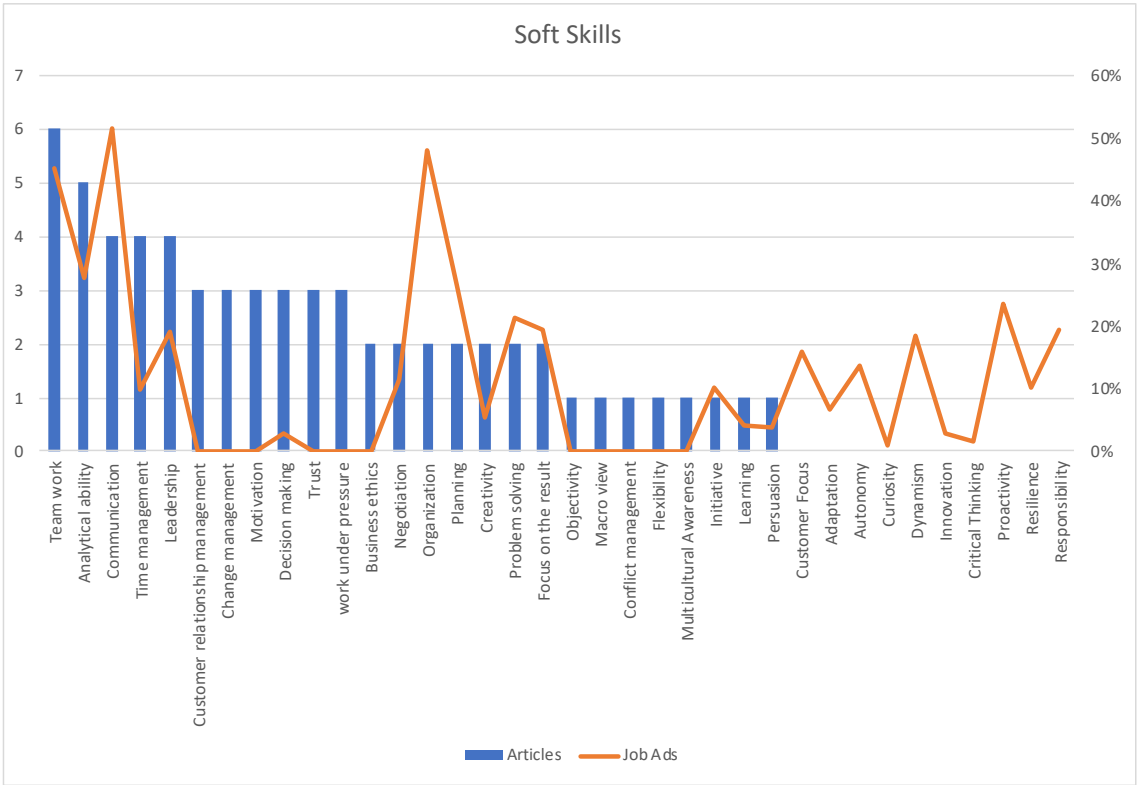

Figure 3.10 - Soft Skills identified in articles and advertisements

With regard to soft skills, we found that 10 new competencies are only listed in the ads (responsibility, resilience, proactivity, critical thinking, innovation, dynamism, curiosity, autonomy, adaptation, and customer focus). This can be explained by the fact that SCM professionals increasingly require soft skills (Derwik et al., 2016; Onar et al., 2013; Wu et al., 2013). The 5 soft skills that appeared the most in the articles were teamwork, analytical skills, communication, time management, and leadership, while in

the advertisements, they were communication, organization, teamwork, analytical skills, proactivity, and problem-solving.

Emerging skills, such as proactivity and problem-solving, seem to be directly related to challenges faced by Portuguese companies, such as the difficulty in filling certain positions that require these specific skills.

Table 3.2 directly compares the skills most frequently mentioned in job advertisements versus those in academic literature, highlighting important discrepancies and convergences.

Table 3.2 - Comparative table of skills most frequently mentioned in articles and job advertisements

Hard Skills						Soft Skills					
Articles			Job Ads			Articles			Job Ads		
P.	Skills	%	P.	Skills	%	P.	Skills	%	P.	Skills	%
1	Supply chain management	100%	1	Foreign language	72%	1	Team work	100%	1	Communication	52%
2	Information systems management	83%	2	Microinformatics	64%	2	Analytical ability	83%	2	Organization	48%
3	Transport management	67%	3	Knowledge in ERP	31%	3	Communication	67%	3	Team work	45%
4	International logistics	67%	4	Logistics planning	22%	4	Time management	67%	4	Analytical ability	28%
5	Logistics planning	50%	5	Storage	13%	5	Leadership	67%	5	Planning	26%
6	Statistical data analysis	50%	6	Supply chain management	13%	6	Customer relationship management	50%	6	Proactivity	24%
7	Inventory control	50%	7	Human resource Management	13%	7	Change management	50%	7	Problem solving	21%
8	Reverse logistic	50%	8	Inventory control	12%	8	Motivation	50%	8	Focus on the result	19%
9	Project management	50%	9	Transport management	11%	9	Decision making	50%	9	Responsibility	19%
10	Financial management	33%	10	International logistics	8%	10	Trust	50%	10	Leadership	19%
11	Human resource Management	33%	11	Project management	6%	11	work under pressure	50%	11	Dynamism	18%
12	Marketing	33%	12	Lean	5%	12	Business ethics	33%	12	Customer Focus	16%
13	Storage	33%	13	Quality management	5%	13	Negotiation	33%	13	Autonomy	14%
14	Quantitative methods	33%	14	Contract management	4%	14	Organization	33%	14	Negotiation	11%
15	Strategic management	33%	15	Business Intelligence	3%	15	Planning	33%	15	Initiative	10%
16	Commercial management	33%	16	Auto-Cad	1%	16	Creativity	33%	16	Resilience	10%
17	Industrial management	33%	17	Operating systems modeling	1%	17	Problem solving	33%	17	Time management	10%
18	Foreign language	33%	18	E-commerce	1%	18	Focus on the result	33%	18	Adaptation	7%
19	Knowledge in ERP	33%	19	Information systems management	0%	19	Objectivity	17%	19	Creativity	5%
20	Microinformatics	33%	20	Statistical data analysis	0%	20	Macro view	17%	20	Learning	4%
21	Third party management	33%	21	Reverse logistic	0%	21	Conflict management	17%	21	Persuasion	4%
22	Just in time	33%	22	Financial management	0%	22	Flexibility	17%	22	Decision making	3%
23	Operating systems modeling	17%	23	Marketing	0%	23	Multicultural Awareness	17%	23	Innovation	3%
24	Market regulation	17%	24	Quantitative methods	0%	24	Initiative	17%	24	Critical Thinking	2%
25	International market regulation	17%	25	Strategic management	0%	25	Learning	17%	25	Curiosity	1%
26	Contract management	17%	26	Commercial management	0%	26	Persuasion	17%	26	Customer relationship management	0%
27	Planning the location of logistics facilities	17%	27	Industrial management	0%	27	Customer Focus	0%	27	Change management	0%
28	Product demand planning	17%	28	Third party management	0%	28	Adaptation	0%	28	Motivation	0%
29	Packaging	17%	29	Just in time	0%	29	Autonomy	0%	29	Trust	0%
30	Controlling	17%	30	Market regulation	0%	30	Curiosity	0%	30	work under pressure	0%
31	Business management	17%	31	International market regulation	0%	31	Dynamism	0%	31	Business ethics	0%
32	E-commerce	17%	32	Planning the location of logistics facilities	0%	32	Innovation	0%	32	Objectivity	0%
33	Quality management	17%	33	Product demand planning	0%	33	Critical Thinking	0%	33	Macro view	0%
34	Auto-Cad	0%	34	Packaging	0%	34	Proactivity	0%	34	Conflict management	0%
35	Business Intelligence	0%	35	Controlling	0%	35	Resilience	0%	35	Flexibility	0%
36	Lean	0%	36	Business management	0%	36	Responsibility	0%	36	Multicultural Awareness	0%

The difference between the soft skills most cited in the ads and the articles is smaller than in the hard skills, the 3 soft skills that are the most quoted in ads: communication, analytical ability and teamwork are also among those that appeared most in ads. This shows that despite the difference in time between the comparative data, these skills continue to be relevant for SCM professionals. The results we obtained are similar to those presented by other authors. Communication is the skill most emphasized by Hecklau et al. (2017) as the most important soft skill for digital transformation. Meanwhile, Flöthmann et al. (2018) point out that analytical skills are the second most important soft skill for SCM professionals. Hecklau et al. (2016) identify that teamwork is relevant for SCM professionals, but there is a large gap between what is desired and what is presented by professionals.

Among the skills that are among the most cited in the advertisements but which are not among the most cited in the articles, we highlight organization, proactivity, and problem-solving. Derwik et al. (2016) point out that organization is among the skills SCM professionals require in the digital transformation, as they are being forced to multitask in their daily lives. Proactivity competency is highlighted by Erol et al. (2016) as very relevant to the digitalization process, as professionals need to work more autonomously. Problem-solving competence is relevant because employees must be able to identify sources of errors and be able to improve processes (Hecklau et al., 2017).

3.4.4 Cluster Analysis

Hierarchical agglomeration is characterized by establishing a hierarchy or tree-like structure and interconnecting objects according to their associations, producing a graphic representation called a dendrogram, where similar objects, according to the variables studied, are grouped together. For agglomeration procedures, a specific method must be chosen. This study used the Complete Linkage method for hierarchical clustering and the Jaccard coefficient as a similarity measure.

To define the groups in the dendrogram, we set a cut-off point at distance 15. This approach allowed us to analyze relationships at different hierarchical levels, providing a complete and contextualized understanding of the data. After analyzing the dendrogram, we identified 29 groups and highlighted 10 groups, as shown in Figure 3.11, where each group contains competencies with similar characteristics.

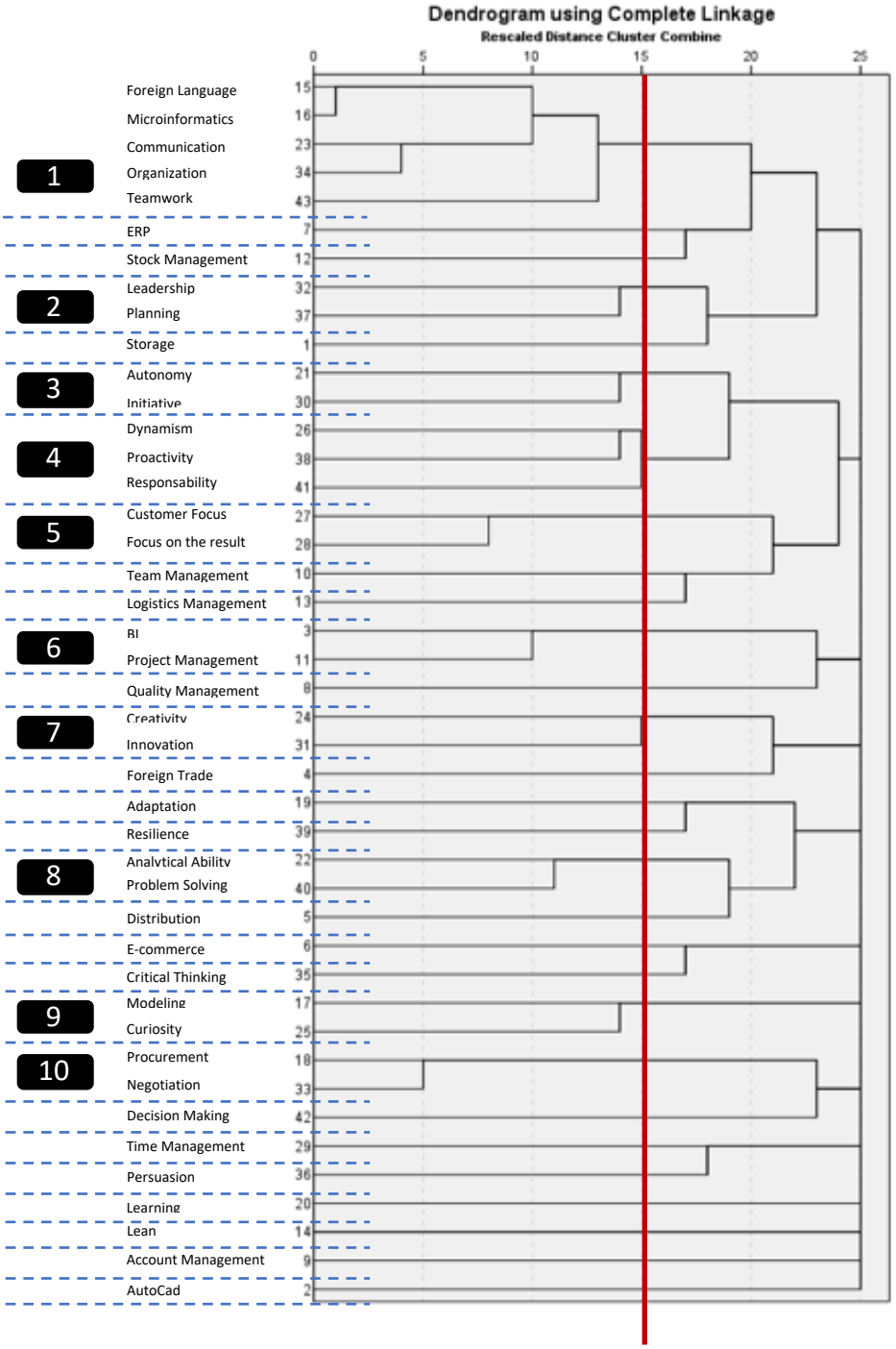

Figure 3.11 - Dendrogram grouping

Looking at the grouped competencies, we can see some trends. Group 1 is where the skills are grouped at a lower level. Foreign language and microcomputing are the hard skills that appear most in advertisements, while organization, communication, and teamwork are the soft skills most identified in the ads.

In Group 2, it is possible to identify that the competencies share similar characteristics. Leadership and planning are interdependent, as effective leaders translate visions into strategic actions, using planning as an essential tool for achieving goals and motivating teams. In Group 3, we can see that the competencies of autonomy and initiative are related, representing the ability to act independently and proactively to carry out tasks and make decisions, showing a self-confident and entrepreneurial professional.

In Group 4, it can be seen that the competencies share similar characteristics. Dynamism, proactivity, and responsibility are important professional skills in a dynamic environment. In Group 5, customer focus and focus on results are fundamental competencies for business success. In Group 6, we see that BI and project management skills are relevant to boosting or improving the performance of organizations. In Group 7, innovation and creativity have similar characteristics.

In Group 8, we can identify similarities between the competencies: analytical skills and problem-solving are interrelated, the former essential for breaking down complex information and the latter for applying analysis to find practical and effective solutions. In Group 9, it is possible to see a relationship between modeling skills and curiosity. The negotiation skill in Group 10 is important for carrying out the procurement activity.

3.4.5 Chi-squared tests

Following this work, we conducted a data analysis, performing chi-squared tests of independence on the variables representing the skills found in the 300 advertisements collected. R software was used to carry out these tests.

We formulated 3 research hypotheses and applied chi-square tests to evaluate them.

Hypothesis 1: Is there an association between skills and sectors of activity?

Hypothesis 2: Is there an association between skills and length of experience?

Hypothesis 3: Is there an association between skills and job title?

Table 3.3 - Chi-Square Test Skills and Sector

Skills	31
Categories	Logistics
	Industrial
	Other Sectors
Pearson Chi-Square	
Value	161,26
df	90
pvalue	0,005939

The result of the chi-squared test for the cross-referencing of competencies (31 soft and hard skills) with the sector of activity (with 3 categories: logistics, industrial, and other sectors) (qobs=161.26; p-value=0.005939<0.05) allows us to conclude that, at a significance level of 5%, hypothesis H_0 of independence between competencies and sectors is rejected. The assumptions for applying the test were validated, as only 16% of the cells resulted in expected frequencies of less than 5 and no expected frequencies of zero. We can conclude that there is an association between competencies and sectors (Table 3.3).

The skills most frequently mentioned by all sectors (including Logistics and Industrial) were foreign language, microcomputing, communication, teamwork, and organization. However, of all the skills mentioned, foreign language, microcomputing, communication, logistics management, focus on results, customer focus, negotiation, distribution, initiative, and foreign trade are most valued in the logistics sector. At the same time, teamwork, planning, proactivity, leadership, dynamism, autonomy, warehousing, stock management, resilience, adaptation, project management, and lean are most valued in the industrial sector. As for other sectors, organization, ERP, analytical skills, responsibility, team management, procurement, stock management, and time management are the more valued characteristics. Even more, lean competence was not valued in the logistics sector. Although initiative is more significant in the logistics sector, it is equally significant in the industrial sector. As for team management, it is more prevalent in sectors other than logistics. In turn, planning stands out as a competence with greater expression in the industrial sector than in the other sectors. Finally, the focus on results in the industrial sector is not very significant compared to the other sectors.

Table 3.4 - Chi-Square test between competence and length of experience

Skills	31
Categories	0-2 years
	3-5 years
	+5 years
Pearson Chi-Square	
Value	75,593
df	90
pvalue	0,8614

The result of the chi-square test for the cross-referencing of skills (31 soft and hard skills) with length of experience (with 3 categories: between 0 and 2 years, between 3 and 5 years and more than 5 years) (qobs=75.593; p-value=0.8614>0.05) leads to the conclusion that, at a significance level of 5%, the hypothesis of independence between

skills and length of experience is not rejected, so there is no evidence of an association between skills and length of experience (Table 3.4).

Table 3.5 - Chi-Square test between skills and job title

Skills	31
Categories	Director and Managers
	Specialists and Trainees
Pearson Chi-Square	
Value	61,005
df	60
pvalue	0,4396

Finally, the result of the chi-squared test for the crossing of competencies (31 soft and hard skills) with job title (with 2 categories: director and managers; specialists and trainees) (qobs=61.005; p-value=0.4396>0.05) allows us to conclude that, at a significance level of 5%, the hypothesis of independence between competencies and job title is not rejected. Given this result, it can be concluded that competencies and job titles are not associated (Table 3.5).

3.5 Discussion

Existing research on competency structures in the logistics area is fragmented, with no clear standard on how logistics competencies can be grouped. It is clear that SC researchers do not have standardized names for the competencies identified over time, thus making it difficult to compare competencies from one study to another.

Existing research on competency frameworks in logistics is fragmented, with no clear pattern on how logistics competencies can be grouped and which framework is appropriate for the sector. This study sought to compare the advertisements with an existing logistics competency framework: the frameworks identified include the BLM by Murphy & Poist (2007), the T-shaped competency framework developed by Mangan & Christopher (2005), the model developed by Gammelgaard & Larson (2001) which highlighted the importance of supply chain management competencies. While Myers et al. (2004) identified that soft skills are essential for managing contemporary supply chains. Another framework that has received some attention in the literature is the hard and soft skills of Bourlakis et al. (2013). In addition, Lutz & Birou (2013) present a framework that groups competencies into 5 groups to analyze logistics education. The

variety of existing frameworks with different numbers of competencies does not provide adequate guidance for professionals or the industry.

This study aims to identify the skills demanded by the logistics market in the context of digital transformation. However, it is impossible to determine precisely the level of digitalization currently achieved by advertising companies, as no specific survey has been carried out with these organizations. The key competencies required during the digital transformation process in the organization differ depending on the stage of the process (Benešová & Tupa, 2017). In the early stages, technical skills are more in demand to the detriment of personal and social skills. In the final stages, however, the demand is reversed, as these skills are more important than technical skills.

Analyzing the results of our sample, where we obtained an equality between soft skills and hard skills desired by advertisers, we can perhaps conclude that organizations are in the process of digitization due to the amount of soft skills required. However, we cannot define their digitization level, and companies may be at different stages of this process.

We propose a model that categorizes professional skills into soft skills and hard skills, subdividing the latter into Supply Chain Management, General Knowledge, and Technology & Systems. By graphically representing this classification, we show that the demands for different types of skills vary throughout the digital transformation process. Organizations in the early stages, for example, tend to prioritize knowledge in Supply Chain Management and General Knowledge, while those that are more advanced look for professionals with a strong command of Technology & Systems and a robust set of soft skills. Figure 3.12 illustrates this relationship between the level of digitalization and the ideal skills profile.

The model presented reveals that the skill set needed to work in the logistics sector constantly evolves. In addition to traditional technical skills, such as stock management and logistics management, logistics professionals must develop skills such as business intelligence and critical thinking. This transformation requires continuous investment in education and professional development.

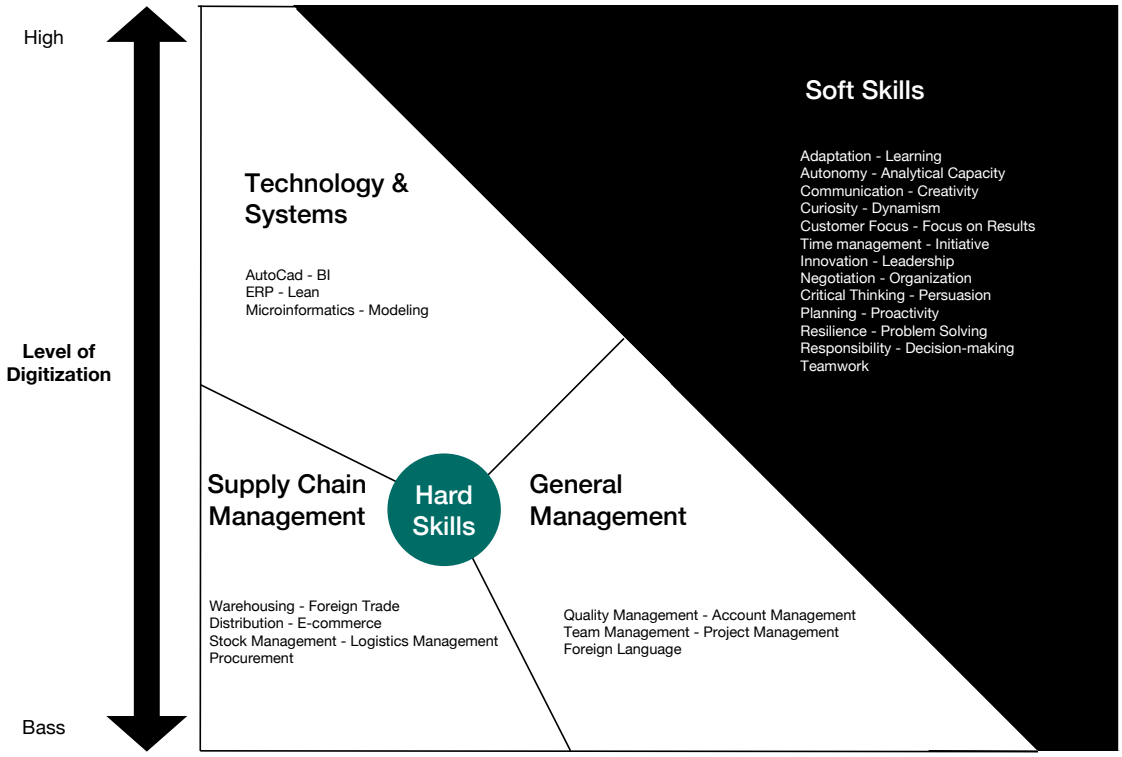

Figure 3.12 - Skills in the transformation process digital

3.6 Conclusion and Future Research

The study analyzed job advertisements, combined with a systematic literature review, and made it possible to develop a comprehensive set of hard skills and soft skills required by logistics professionals in the context of digital transformation.

The results show an evolution in the skills required, with greater emphasis on technical skills related to information technology, such as the use of specific software and the ability to process large amounts of information. At the same time, interpersonal skills such as communication, teamwork, and flexibility are highly valued.

The comparative analysis of the data from the job advertisements and the literature revealed some differences and consistencies. While the literature emphasizes the importance of management skills and in-depth technical knowledge, the job advertisements also emphasize the need for more practical skills related to day-to-day logistics operations. This difference can be explained by the more pragmatic nature of

the advertisements, looking for candidates with immediate qualifications to fill the vacancies.

Digital transformation is driving significant changes in the logistics industry's profile. Companies are increasingly looking for employees with diverse skills, including technical and interpersonal skills. This study contributes to understanding the demands of the labor market and can form the basis for national policies and training programs to prepare workers for the future challenges of logistics. Therefore, logistics education should provide diverse know-how and skills needed for the job market. Structuring university curricula could increase the employability of graduates.

From a practical perspective, the results reinforce that as digital transformation advances, soft skills are becoming the most relevant. On the technical side, while professionals must be proficient in basic technical logistics skills, business skills focused on customer centricity and analytical skills, they also need to be up to date on technologies that support digital transformation. In addition, our study can serve as a guide in the search for new talents and in the training of SCM professionals.

Finally, the results obtained in this study can help higher education institutions to update their curricula, creating new content or specializations in terms of the demands of companies in the logistics market. Therefore, a suggestion for future work is the analysis of educational and professional training programs related to logistics at the European level regarding skills. Such programs would prepare the logistics professionals of the future to meet future challenges in the field of SCM.

Several limitations and unanswered questions warrant further discussion. Firstly, this study was limited to Portugal. Recommendations for further research would be to include other countries. Secondly, the skills and competencies were identified in the area of logistics, so using this approach to study others, such as accounting, finance, and health, could be interesting for future academic work.

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Appendix 1

Table 3.6 - Competencies in Supply Chain Management

Skills	Skills	Skills	Skills
Ability to learn quickly	EDI	Manage relationships	Quantitative athlete
Ability to perform under pressure	Enterprise resource planning	Manage relationships with suppliers	Quantitative methods
Ability to prioritize planning and organizing	Enthusiasm	Management control	Receiving and fulfilling orders
Ability to see the big picture	Entrepreneurship	Management/Strategy	Reconfiguration of supply chain structures
Ability to work under pressure	ERP	Marketing and Distribution Channels	Recruit/Hire
Account Management	Ethical Awareness	Marketing management	Regional Planning
Accounting	Extroverted personality	Material Handling	Registration Information Management
Achieve goals	Finance	Meeting facilitation	Regulations related to registrations
Acquisition	Financial management	Metrics and performance	Relative performance
Adapt to change	Flat	Microeconomics	Resilience
Adaptation	Flexibility	Microinformatics	Responsibility
After-sales service and support	Focus on processes/Flows	Modeling	Reverse logistics
Ambition	Focus on the result	Motivate others	Sale
Analytical	Forecast	Motivation	Schedule
Analytical ability	Foreign language	MRP	Scheduling
Analytical reasoning	Foreign Language\English	Multicultural Awareness	Scrap recovery and disposal
Assertiveness	Foreign Language\French	Multifunctional Awareness	Self confidence
Auto-Cad	Foreign Language\German	Multifunctional coordination	Self motivation
Autonomy	Foreign Language\Spanish	Multimodal logistics	Self-directed learning
Awareness of Organizational Culture	Foreign trade	Negotiate	Self-discipline
Barcode and data scanning	Future threats/options	Negotiation	Shopping
Basic IT	General Business Administrator	Objectivity	Software knowledge
Benchmarking	General Performance	Operational logging tasks	Spreadsheet and database
BI	Global Issues	Operations/SCM	Spreadsheet Skills
Business and Government	Globalization of transport and logistics	Oral communication	Statesman
Business and Society	Handling of returned goods	Order Management	Statistical analysis
Business Ethics	Hearing Capacity	Organization	Statistics
Business History	Human resource Management	Organizational outsourcing and alliances	Stock Management
Business Law	Industrial engineer	organizational psychology	Storage
Business strategy	Industrial Sociology	Outsourcing Problems	Storage Management
Change management	Industry Knowledge	Packaging	Supervise other people
Change management	Information and electronic environments	Pan-European logistics	Supplier selection and evaluation
Choosing the mode of transport	Information flow integration	Parts and service support	Supply Chain Awareness
Commercial Writing	Information systems management	People management	Supply chain location and design
Communication	Initiative	Performance measurement	Supply chain management
Computer athlete	Innovation	Personal cares	Supply of Materials
Computer Programming	Insurance and Real Estate	Personal creativity	Systems concept
Computer Science	Integration of information flow and external	Personal dress	Team
Conflict management	International Business	Personal Integrity	Team Management
Creative	International logistics	Personnel Movement	Team work
Creativity	Interpersonal	Persuasion	Term
Critical Reasoning	Interpersonal Relationship	Planning	Time management
Critical Thinking	Inventory Management	Postponed manufacturing	Time management
Cross docking	IT	Presentation skills	To delegate
Curiosity	JIT	Priorities	Tracking
Customer Focus	Knowledge of the latest techniques	Prioritization	Train/mentor
Customer response	Leadership	Proactivity	Training
Customer service	Lean	Problem Analysis	Transport and Traffic Management
Database Capacity	Learn new procedures	Problem solving	Transport Engineer
Dealing with stress	Learning	Procurement	Transport planning
Decision making	Legal, security and international trade	Product Projects and New Product Introduction	Transportation and logistics
Decision power	Listen and empathize	Production Management	Trust
Decision-making ability	Listening	Production schedule	Trusting
Depends on Insights	Location of facilities	Project	Voice communications
Development of IT systems, ERP	Logistics in emerging markets	Project management	Warehouse Design
Distribution	Logistics management	Public relations	Warehouse Management
Dynamism	Macroeconomics	Push and pull system	Work relationships
E-commerce	Maintenance and repair	Quality management	Written Communication
Economic geography	Manage customer relationships		

Appendix 2

Table 3.7 - Hard Skills Dictionary

Hard Skills	
Skill Category	**Descriptions**
Storage	Knowledge in warehouse management
	Warehouse management expertise
	Manage and optimize the activities of reception, storage and shipment of finished products
	Experience in the Logistics Management of a warehouse
	Prepare, monitor and secure loading and unloading
	Supervise and manage warehouse logistics flows
	Manage the activities of reception, storage and shipment of finished products and/or raw materials
	Coordination of warehouse logistics flows (reception, storage and delivery)
AutoCad	Notions of Auto-Cad
	Knowledge of reading and interpreting technical drawings
BI	Power BI, Access, and Navision
	Knowledge of Power BI
	Knowledge of Powertools and/or Power BI
Foreign Trade	Experience in International Trade
	Knowledge of cargo activity and freight forwarders
	Knowledge of Customs Legislation and Documentation
	Experience in the three types of operations will be valued: Sea/Air/Land
	Knowledge in import and export processes
	Knowledge of incoterms for export within the European Union
Distribution	Distribution and logistics management
	Experience and knowledge of the transport and logistics sector
	Organize and plan routes and shipments
	Distribution operation for sales channels
	Relevant professional experience in functions in the area of national distribution
	Experience in transport management
E-Commerce	Experience in Logistics ideally in the retail/e-commerce sector
	Have knowledge of E-Commerce and Digital Marketplace platforms
ERP	SAP
	SAGE X3
	SAP MRP
	SAP ERP/PP/iPPE or MES System
	Knowledge of ERP – M3 or SAP
	Primavera
	Experience in the use of information systems in the logistics area.
	Knowledge of ERP SAGE
	PHC
Quality Management	Optimization of the logistics process
	Design and develop improvement projects
	Knowledge of IATF16949, ISO 9001
	Experience in analysis of quality management procedures in production processes
	Knowledge FSC, CIPR, ISO 9001 and 14001, 45001
Account Management	Customer Service Roles
	Experience in Large Account Management
	Experience in contact with customers of different sizes and complexity
	Customer Management
	Experience in the field of customer support
Team Management	Leadership and team management skills and motivation
	Team management
	Experience in team leadership
	People development
	Proven experience in leading teams
	Experience in leading teams
Project Management	Knowledge in Project Management methodologies
	Experience in Project Management and Logistics
	Excellent project management skill set
Stock Management	Get to know stock management tools
	Domain of Stock Management and Management of Flows and Materials
	Control of stocks, expirations, obsolete and products in stock
	Ensure the supply of a range of items, ensuring efficient management
	Knowledge of costing systems associated with stock management and logistics
	Movement/invoicing and inventory control
Logistics Management	Knowledge of value chain management and logistics
	Knowledge in the field of logistics
	Experience in the area of Logistics Management (internal logistics and/or customers and suppliers
	Support activities related to supply chain optimization, efficiency and effectiveness
	Experience in the logistics sector
	Coordinate Supply activities with the Production & Engineering and Logistics areas
	Competencies in Logistics, Management and International Trade
Lean	Knowledge of Lean methodologies
	Continuous Improvement / Lean / Kaizen Knowledge
	Application of LEAN tools
	Lean/SixSigma Education
	Knowledge of Lean/Kaizen quality tools and improvement projects
Foreign Language	German
	German language
	Fluent in German
	Spanish
	Spanish Language
	Fluent in Spanish
	French
	Knowledge of the French language
	Proficiency in the French language
	Fluent in French
	English communication skills
	English
	Fluency in English
	Good knowledge of the English language
	Written and spoken fluency in English
Microinformatics	Computer skills, at the level of Excel, Word and Outlook
	Good knowledge of Microsoft Office tools
	Solid knowledge in MS Office software (Especially in Excel
	Interest in computer science and knowledge at the MS-office level
	Knowledge of Excel
	Good computer skills from the user's perspective
	Solid computer knowledge, namely Advanced Excel
	MS Office, Pptx and Excel
	Good knowledge in the use of Microsoft Office and Google tools
	Strong computational skills, including Microsoft Office applications (Word, PowerPoint, Excel)
Modeling	Good knowledge of SIMIO, SIMUL8 simulation software
	Modeling
Procurement	Shopping experience
	Consolidated experience in strategic procurement functions
	Procurement
	Experience in purchasing, procurement and negotiation processes
	Supplier portfolio management
	Global sourcing experience
	Promote optimal relationships between suppliers and the company
	Contact and select suppliers

Table 3.8 - Soft Skills Dictionary

Soft Skills	
Skill Category	**Descriptions**
Adaptation	Ease of adaptation
	Adaptability
	Flexible person
	Adaptability
Learning	Great capacity for learning and assimilation of content
	Eager to learn how to work with new tools
	Willingness to learn
Autonomy	Ability to work independently
	Autonomy
	Standalone profiles
Analytical Capacity	Analytics
	Analytical skills
	Operational data analysis capability
	Ease in managing a high volume of information and correlating complex processes
	Critical analysis and in constant search for process improvement
	Strong analytical competence
	Analytical thinking
Communication	Communication
	Communication Skills
	Ease of communication
	Excellent communication skills (verbal and written)
Creativity	Creativity
	Creative person
	Thinking outside the box
Curiosity	Curious
	Intellectual curiosity
Dynamism	Dynamic
	Dynamism
Customer Focus	Strong customer and results-oriented
	Customer focus
	Customer knowledge
	Be customer-focused
Focus on Results	Results-oriented
	Results-oriented
	Ability to work for objectives
	Focus on results
Time Management	Demonstrated ability to prioritize tasks and have effective time management
	Time management
	Ability to handle multiple tasks, set priorities, and negotiate successful solutions
	Efficient time management skills
	Good time and priority management
Initiative	Initiative
	With a spirit of initiative
	Capacity for initiative
Innovation	Being innovative
	Innovation
	Openness to Change and Innovation
Leadership	Leadership and team management skills and motivation
	Leadership
	Leadership Skills
	Team development and leadership
	Ability to lead
Negotiation	Excellent trading skills
	Negotiation
	Strong negotiation skills
	Strong aptitude for trading
Organization	Organization
	Organizational capacity
	Task organization
	Organized
	Good organizational and coordination skills
Critical Thinking	Solution-oriented
	Critical spirit
	Attention to detail and critical thinking
Persuasion	Persuasion
Planning	Planning
	Planning capacity
	Strategic planning and execution thinking
Proactivity	Proactive
	Proactivity
	It is intended to be proactive
	Proactive spirit
Resilience	Resilient
	Resilience
	Excellent resilience
Problem Solving	Troubleshooting
	Good problem-solving skills
	Problem-solving and pressure-based work skills
	Easy problem solving and rapid design of innovative solutions
	Problem-solving skills
	Problem management
Responsibility	Sense of responsibility
	Responsibility
	Responsible person
	Accountable
Decision Making	Decision making
	Decision-making capacity
	Decision-making capacity
	Decision-making power
Teamwork	Teamwork
	Ease of working in a team
	Team spirit
	Ease and enjoyment of teamwork
	Ability to relate, work in a team
	Team player

4 DEVELOPMENT OF SOFT SKILLS AMONG LOGISTICS STUDENTS IN HIGHER EDUCATION IN PORTUGAL

Abstract

Higher education institutions (HEIs) have been criticized for their approaches to developing students' skills. For a university graduate to be successful, they must have sufficient technical and interpersonal skills. The study has two objectives: Firstly, to identify which and how soft skills are being considered in higher education in Portugal for logistics professionals. Secondly, we propose an incremental and coordinated framework for gradually developing soft skills throughout the student's university period in pursuit of their qualification. To achieve our research objectives, we carried out three approaches: (1) a content analysis of the syllabuses of degree courses in logistics, management, and industrial management engineering, (2) a discourse analysis of semi-structured interviews with the coordinators of degree courses in logistics, management, and industrial management engineering, (3) a focus group with logistics professionals. The results show that to prepare graduates for the job market, institutions must implement their soft skills development strategy in an organized, systematic, and comprehensive manner.

Keywords: Competences, Soft Skills, Framework, Logistics

4.1 Introduction

The logistics sector is undergoing rapid transformation due to technological advancements and global digitalization. Digital transformation not only redefines business models but also reshapes the required competencies of professionals in the field (Abu-AlSondos et al., 2024; Alqararah et al., 2025). In this new landscape, logistics professionals must exhibit not only technical knowledge but also flexibility, emotional intelligence, and communication skills. These soft skills have become increasingly critical in enabling professionals to navigate uncertainties, manage teams effectively, and

integrate digital tools into their everyday operations.

Higher education institutions (HEIs) are facing mounting pressure to adapt their curricula to these evolving market demands. Traditional programs have focused heavily on technical expertise, often neglecting the interpersonal competencies increasingly valued in contemporary workplaces (Ehlers, 2020). The urgency of reform is particularly acute in Portugal, where logistics education remains deeply rooted in conventional paradigms that undervalue non-technical competencies (Woschank & Pacher, 2020).

This article explores how Portuguese HEIs address the development of soft skills in logistics-related programs and proposes a framework to enhance their integration. It aims to fill a gap in both academic literature and educational policy by offering practical recommendations aligned with labor market expectations. By aligning education with industry needs, HEIs can better prepare students to become adaptable professionals capable of responding to the dynamic nature of logistics.

4.2 Literature Review

There is growing recognition globally that technical expertise alone is insufficient for workplace success. Numerous studies have underscored that soft skills, such as teamwork, communication, leadership, adaptability, and critical thinking, are essential for employability and long-term career development (Börner et al., 2018; Gruzdev et al., 2018).

In the logistics sector, soft skills are particularly significant. Logistics professionals often operate in fast-paced environments that require coordination across departments and with external partners. As logistics processes become increasingly automated and data-driven, the ability to interpret insights, manage teams, and adapt to new technologies has emerged as a key differentiator (Koh & Yuen, 2022; Petrunya & Pasichnyk, 2018). Soft skills complement hard skills by enhancing collaboration and decision-making, particularly in roles that involve negotiation, crisis management, or customer relations.

Despite this, higher education systems have struggled to integrate soft skills into their existing curricula effectively. In Portugal, research has largely overlooked the sector-specific demands of logistics education. Some initiatives have emerged in engineering (Caeiro-Rodriguez et al., 2021), accounting (Carvalho & Almeida, 2022), and entrepreneurship (Garcez et al., 2023), but logistics remains underrepresented. Moreover, most existing frameworks are generic and do not account for the progressive development of competencies throughout the academic cycle (Ra et al., 2019).

The theoretical foundation for this research is grounded in constructivist and experiential learning theories. Cognitive constructivism emphasizes active knowledge construction, while social constructivism values collaboration and peer learning (Zhan et al., 2011). Experiential learning approaches, such as internships and project-based learning, offer students opportunities to develop soft skills in realistic settings (Ragonis et al., 2020). These theoretical models support a pedagogical shift from passive knowledge absorption to active, student-centered learning, aligning with the realities of the workplace.

Integrating these theories into logistics education requires a rethinking of curriculum design. Programs must create meaningful learning experiences that simulate real-world logistics challenges. Active learning strategies, including case studies, role-plays, and team-based projects, have been proven effective in cultivating communication, leadership, and problem-solving abilities (Dell'Aquila et al., 2017). These approaches encourage students to apply theory to practice and reflect on their professional development.

4.3 Methodology

To achieve our objectives, this research employs a mixed-methods approach to comprehensively assess the alignment of curriculum content with the needs of logistics professionals. The methodology integrates content analysis of curriculum plans, semi-structured interviews with undergraduate course coordinators, and a *focus group* with logistics professionals, ensuring a robust and triangulated understanding of the subject (Johnson et al., 2020) (Figure 4.1).

The first phase of the research involves a detailed content analysis of the syllabuses for the logistics, management, and industrial management engineering degree courses of a carefully selected sample of 15-degree programs (Daud & Ahmad, 2011). We selected logistics, management, and industrial management engineering degree courses because they are the most frequently requested courses in job advertisements in the logistics sector in Portugal (Rêgo et al., 2025). A total of 15 courses were analyzed, and we selected the courses with the highest number of graduates in Portugal in 2022 (Ciências, 2022). To ensure a diverse sample, we selected courses from both public and private institutions, as well as from universities and polytechnic institutes. The final sample consisted of 3 logistics courses (70% of trainees and 60% of courses), the other two institutions that offer logistics courses did not make the study plans and course syllabi available for analysis, six management courses (24% of trainees and 11% of

courses), and six industrial management engineering courses (75% of trainees and 43% of courses). Due to the limited number of programs dedicated to logistics, only three, we decided to analyze six management programs and six industrial engineering programs to ensure that the analysis remained representative of the logistics field.

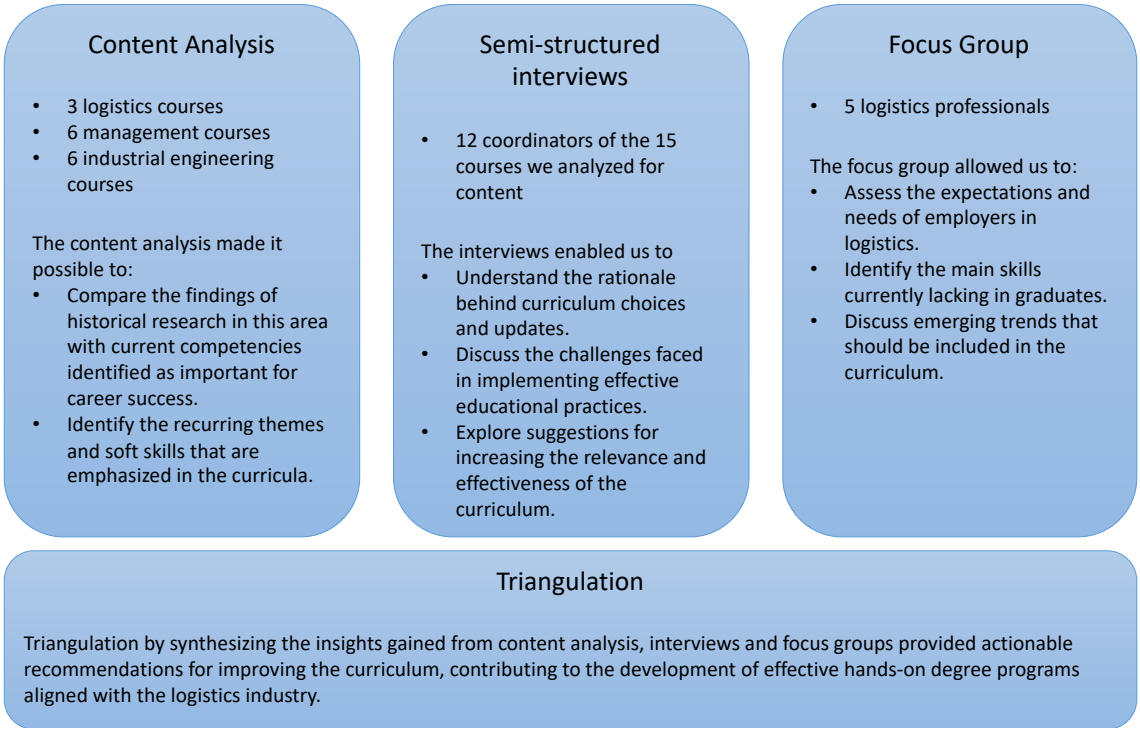

Figure 4.1 - Research methodology

The content analysis involved systematically examining syllabuses, course descriptions, and assessment materials to identify the presence and emphasis of various soft skills. The content analysis was conducted through a documentary analysis of the syllabuses for degree courses in logistics, management, and industrial management engineering. This analysis allowed us to compare historical research findings in this area with the current skills identified as important for career success. By examining syllabuses, course descriptions, and assessment materials, we sought to identify the recurring themes and social competencies emphasized in the curricula.

The second phase involved conducting semi-structured interviews with the coordinators of the 15 selected undergraduate courses, aiming to gather in-depth perspectives on curriculum design, program objectives, and perceived alignment with market needs. However, we conducted only 12 interviews because three coordinators were unavailable to participate in the research. The interview protocol was designed to obtain detailed information about the rationale behind curriculum choices, the

incorporation of market feedback, and the programs' perceived strengths and weaknesses. The interview data were analyzed using content analysis techniques within the ATLAS.ti® software (version 24). Content analysis begins with a preliminary review of the interviews to establish a fundamental understanding of the content (Nkporbu et al., 2023). A coding scheme was developed based on a comprehensive literature review of the skills requirements of the logistics field and relevant academic competencies (Woschank & Pacher, 2020c). The coding scheme is crucial for ensuring the reliability and validity of the content analysis, as well as for providing a structured approach to interpreting the data (Nkporbu et al., 2023).

In the third phase, a focus group was held with 5 participants (Krueger & Casey, 2009), professionals working in the logistics sector in Portugal, to provide a platform for elucidating the collective views on a series of themes identified in interviews with undergraduate coordinators. The *focus group* was designed and carried out according to widely established and cited protocols, as recommended by Kitzinger (1995), Morgan et al. (1998), and Tracy (2012). Before the session began, we presented (1) background information on the research, (2) an overview of the preliminary interview results, and (3) outlined the objectives of the *focus group* session to all participants.

According to the recommended *focus group* methodology (Morgan et al., 1998), a semi-structured interview guide was employed to direct the discussion. The moderator's role was to (1) disseminate and ensure adherence to the basic rules of the *focus group*, (2) facilitate and lead the discussion regarding the themes contained in the interview guide, and (3) manage the group dynamics. Before making their initial contribution, participants were instructed to briefly introduce themselves to the other *focus group* members by stating their name, the company they work for, and their role within the organization. At the end of the *focus group* session, the researcher recorded the significant *insights* and observations elicited during the session.

The data collected in these three phases will be triangulated to provide a holistic understanding of curriculum alignment and sector relevance. The integration of qualitative and quantitative data will enable a nuanced interpretation of the results, allowing for the identification of strengths and weaknesses in current curriculum offerings. By synthesizing insights gained from content analysis, interviews, and focus groups, this research aims to provide actionable recommendations for curriculum improvement, thereby contributing to the development of more effective degree programs aligned with the logistics industry.

Integrating these different data sources through a mixed-methods approach allows researchers to triangulate findings, thereby increasing the credibility and transferability of the research results (Tariq & Woodman, 2013). Triangulation, which combines

methodologies to study the same phenomenon, helps reduce biases and increase the reliability of results (Doorenbos, 2014). In addition, the intentional integration of quantitative and qualitative data is a central activity that enhances conceptualization and operationalization, ensuring the research is rigorous and relevant (Lorenzini et al., 2024; Saraswati & Devi, 2023). The ability of mixed methods to bridge the gap between qualitative and quantitative findings is particularly crucial for validating small-scale studies for larger applications (Schoonenboom & Johnson, 2017).

Ultimately, this research aims to bridge the gap between academia and industry, equipping graduates with the skills and knowledge needed to thrive in the rapidly evolving professional landscape while acknowledging potential biases in the study's methodology. Triangulation of data sources and the use of a mixed-methods approach is intended to mitigate the impact of any biases; however, it is essential to acknowledge that results may be influenced by factors such as program and participant selection, the subjectivity of qualitative interpretations, and the potential for respondent bias. Efforts will be made to address these methodological limitations through transparency, reflexivity, and a critical examination of the research process and its implications.

4.4 Results

4.4.1 Content Analysis of Syllabuses

The selection of courses analyzed aimed to ensure diversity between universities and polytechnics, as well as between public and private institutions. When analyzing the syllabuses, we found that 40% of the degree courses include at least one subject on soft skills. However, none of the industrial management engineering courses analyzed offer subjects on soft skills, which represents a significant gap in the training of these professionals. To address the increasing importance of soft skills in the labor market, many higher education institutions are incorporating courses and modules to develop these competencies, aiming to enhance their students' employment prospects and equip them with a comprehensive and adaptable set of skills (Patacsil & Tablatin, 2017).

Although 40% of the courses include subjects on soft skills, these account for only 4.3% of the total ECTS credits. This percentage was calculated by summing the ECTS credits explicitly allocated to soft skills subjects across all programs and comparing it to the overall total of ECTS credits offered. The result highlights the relatively minor role that soft skills currently play within the curricula. The variety of soft skills taught is limited, with a primary focus on communication and leadership. This indicates that the integration of transversal themes and soft skills in the disciplines is limited, and there is a need to

expand the range of soft skills developed, as the job market demands more than what is currently offered (Succi & Canovi, 2019).

When we analyze whether soft skills are taught in hard skills subjects, the results differ: 27% of the courses include hard skills subjects that assess the development of soft skills. None of the logistics courses teach soft skills in hard skills subjects. We notice a contradiction when analyzing the inclusion of soft skills development activities in logistics courses for higher education. Since the 1990s, studies have emphasized the importance of developing both soft and hard skills (de Resende et al., 2021). Hard skills, demonstrated by diplomas, contrast with soft skills, which are linked to personality and evident in daily interactions. Digital transformation, driven by technology and a global market, alters the knowledge required in various areas, including logistics (Alt et al., 2023).

4.4.2 Interview Discourse Analysis

The interview analysis followed a four-stage coding process using ATLAS.ti®. First, transcripts were read multiple times, and first-order codes were created based on frequently used words and expressions. In the second stage, similar codes were grouped into broader themes, forming coherent categories related to the challenges faced by HEIs.

In the third stage, these themes were elevated to aggregate dimensions by integrating insights from the literature on logistics education and digital transformation. Finally, in the fourth stage, these dimensions were analyzed comparatively to identify interconnections. This process resulted in six key categories: (1) digital transformation, (2) required skills, (3) labor market alignment, (4) curriculum adequacy, (5) challenges in teaching soft skills, and (6) resistance from faculty and students (Figure 4.2).

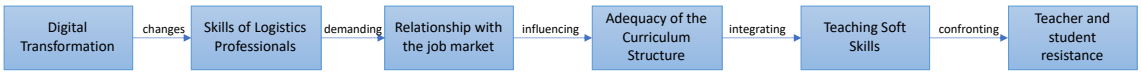

Figure 4.2 - Categories of analysis from the semi-structured interviews

In the Digital Transformation category, interviewees noted that digitalization is causing significant organizational changes, especially in logistics and the supply chain. Companies are investing in digitalization and technology to optimize processes and increase efficiency, as evidenced by the statements of the interviewees. Digitalization also impacts education by introducing new technologies into the educational process (Figure 4.3).

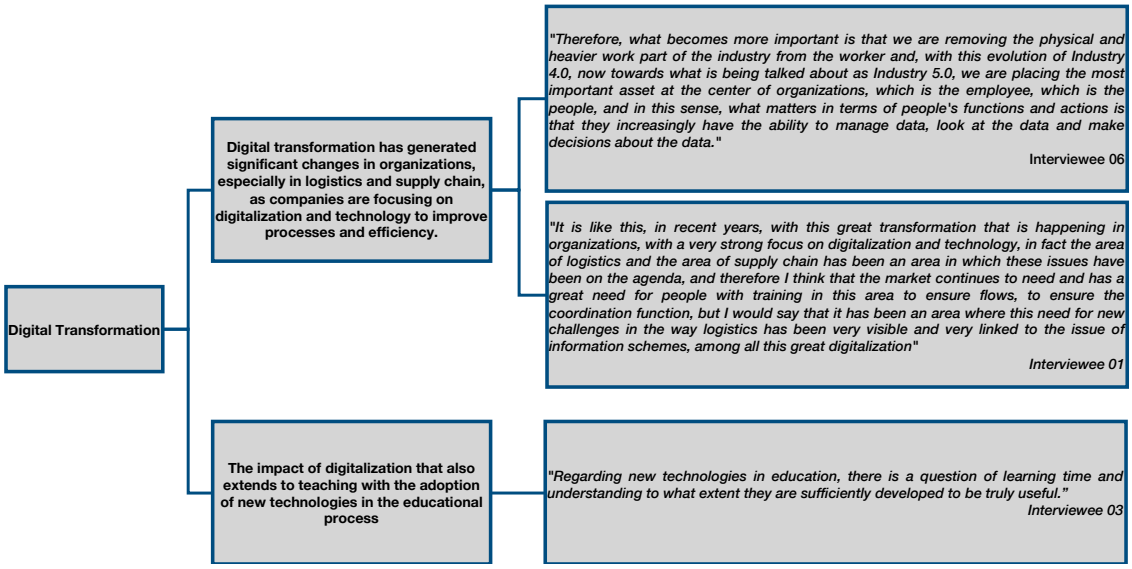

Figure 4.3 - Quotes on digital transformation

In the category Skills of Logistics Professionals, we identified various skills mentioned by the interviewees, which can be grouped into Soft Skills, Hard Skills, and Skills in Technologies and Systems. Soft skills encompass interpersonal skills, including communication, teamwork, and leadership. Hard skills include logistics and management. Continuous training in emerging technologies is essential, as adaptation is crucial for competitiveness. Sustainability is also relevant, with sustainable practices being valued (Figure 4.4).

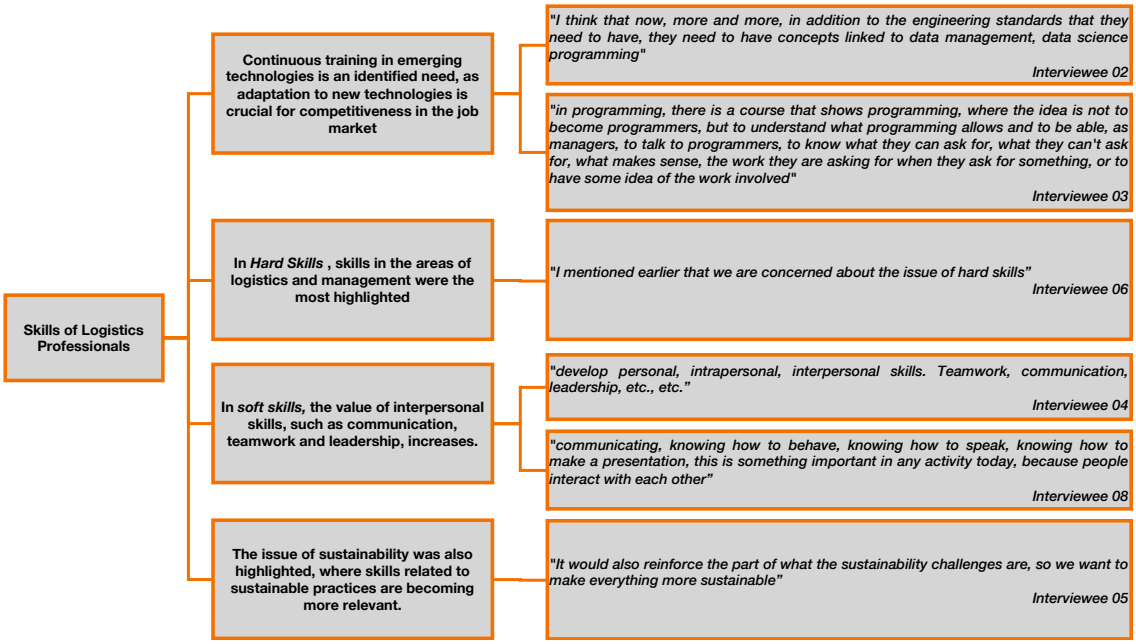

Figure 4.4 - Quotes on the competencies of logistics professionals.

Another category focuses on the relationship with the labor market, where the weak link between educational institutions and the market is particularly notable. The lack of alignment between the academic curriculum and the sector's needs can jeopardize the employability of graduates. Students' interaction with the market is fundamental, and identifying market trends helps shape academic training and students' expectations. The presence of companies on campus offers opportunities for *networking* and practical learning (Figure 4.5).

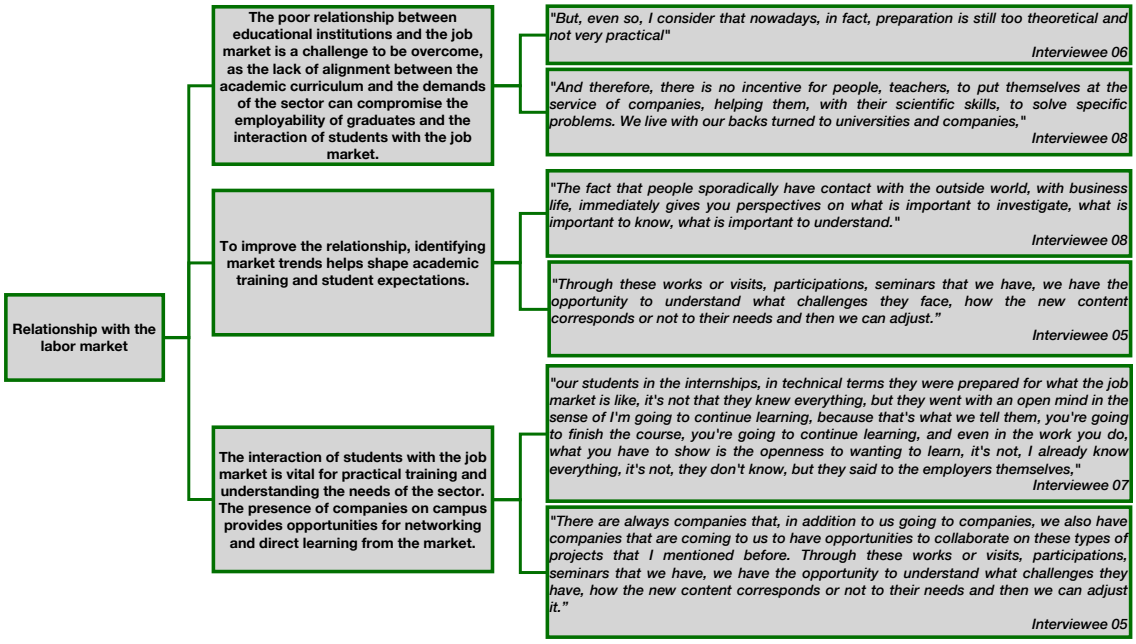

Figure 4.5 - Quotes about the relationship with the job market

In the category of adequacy of the curriculum structure, the following stand out: continuous evaluation and restructuring to meet market needs; consideration of A3ES recommendations during accreditation; inclusion of soft skills subjects due to the difficulty in developing them; and integration of soft skills into traditional subjects for practical application (Figure 4.6).

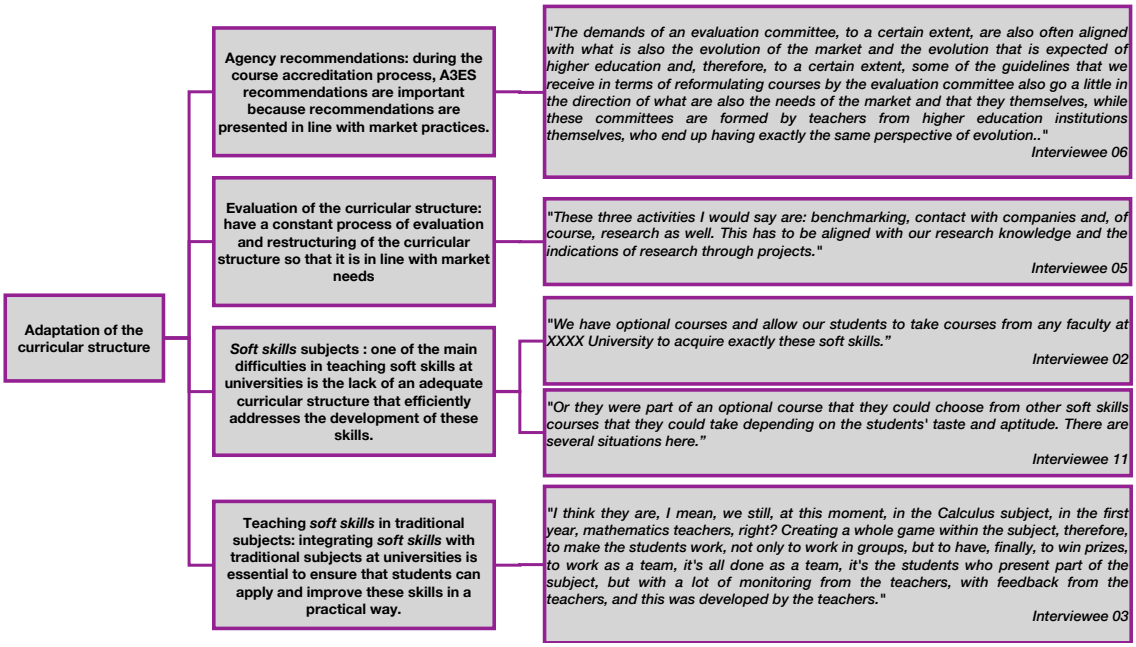

Figure 4.6 - Quotes about the adequacy of the curriculum structure

We have a category that addresses the challenges in teaching soft skills, emphasizing the need for new pedagogical models and changes in the physical structure of institutions. Examples include integrative projects, extracurricular activities, and the importance of student self-awareness in developing these skills.

The assessment of soft skills is another relevant point, with subjective methods, such as interviews and performance reports, complementing more objective tools, including psychometric tests and 360-degree evaluations (Figure 4.7).

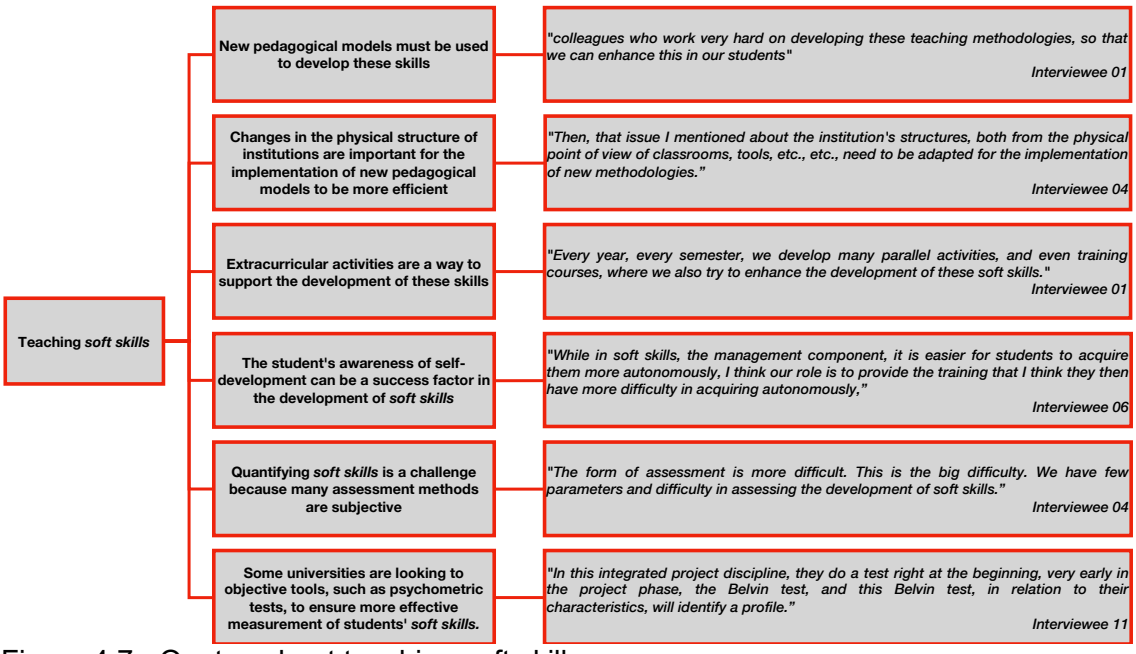

Figure 4.7 - Quotes about teaching soft skills

Teachers' and students' resistance to teaching soft skills is a challenge, as many are accustomed to the traditional model. The low perception of the importance of soft skills and the need for teachers to be updated are also barriers to be overcome (Figure 4.8).

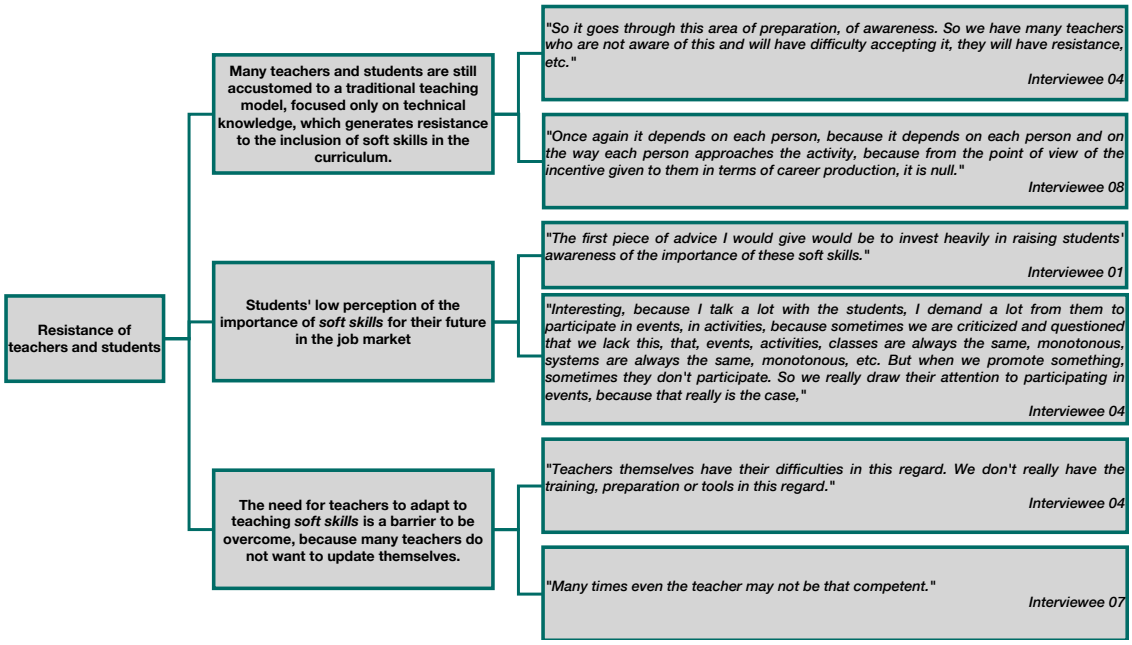

Figure 4.8 - Quotes about resistance from teachers and students

4.4.3 Focus Group Analysis

The focus group analysis followed a structured process using ATLAS.ti®. Recordings were transcribed, anonymized, and systematically coded. Thematic analysis was conducted to identify key patterns and insights regarding the development of soft skills in logistics education.

The focus group, informed by the literature review and prior data collection, confirmed that digital transformation is reshaping logistics, requiring professionals to be adaptable, communicative, and technologically fluent. Participants emphasized that, beyond technical knowledge, logistics professionals need interpersonal skills, problem-solving abilities, strategic thinking, and emotional intelligence.

Several challenges were identified. Internships are often insufficiently structured, failing to bridge the gap between academic theory and workplace demands effectively. Participants called for stronger partnerships between HEIs and companies to ensure meaningful, practical training aligned with industry needs.

The group also noted that many faculty members lack practical experience, which limits the relevance of their teaching. This disconnect reinforces a theoretical bias, making it difficult for students to develop real-world competencies. Moreover, both students and teachers may resist integrating soft skills into curricula due to a lack of understanding and undervaluation.

Continuous professional development was highlighted as essential, with companies expected to support internal training while professionals must also take personal initiative. Ultimately, participants agreed that thriving in the evolving logistics sector requires constant learning, particularly in areas such as AI, adaptability, and collaboration.

4.5 Discussion

This investigation started from the premise that higher education in logistics remains considerably based on technical-rational models, in which the mastery of hard skills and the emphasis on operational skills stand out. However, the digital transformation and the recent paradigms of Logistics 4.0 necessitate substantially restructuring the desired professional profiles, demanding interpersonal, communicative, and cognitive skills that transcend technical competence (A. Piccinini et al., 2015; Sun & Song, 2018).

The empirical data collected and analyzed, including interviews with course coordinators, a detailed analysis of curricula, and *focus groups*, revealed several impediments that hinder the consistent integration of soft skills in logistics degree programs in Portugal. These obstacles include the rigidity of curricular structures, the lack of formal instruments for assessing these skills, insufficient specific training for teaching staff, and resistance on the part of students, who do not always immediately recognize the importance of socio-emotional skills for the development of their careers (Patacsil & Tablatin, 2017; Shahzadi et al., 2017).

Given this scenario, the study proposed a soft skills development framework anchored in four structuring pillars, represented in Figure 4.9: (1) reducing resistance from teachers and students, (2) strengthening the relationship with the job market, (3) adapting the curriculum structure and (4) progressively integrating the teaching of these skills throughout the course.

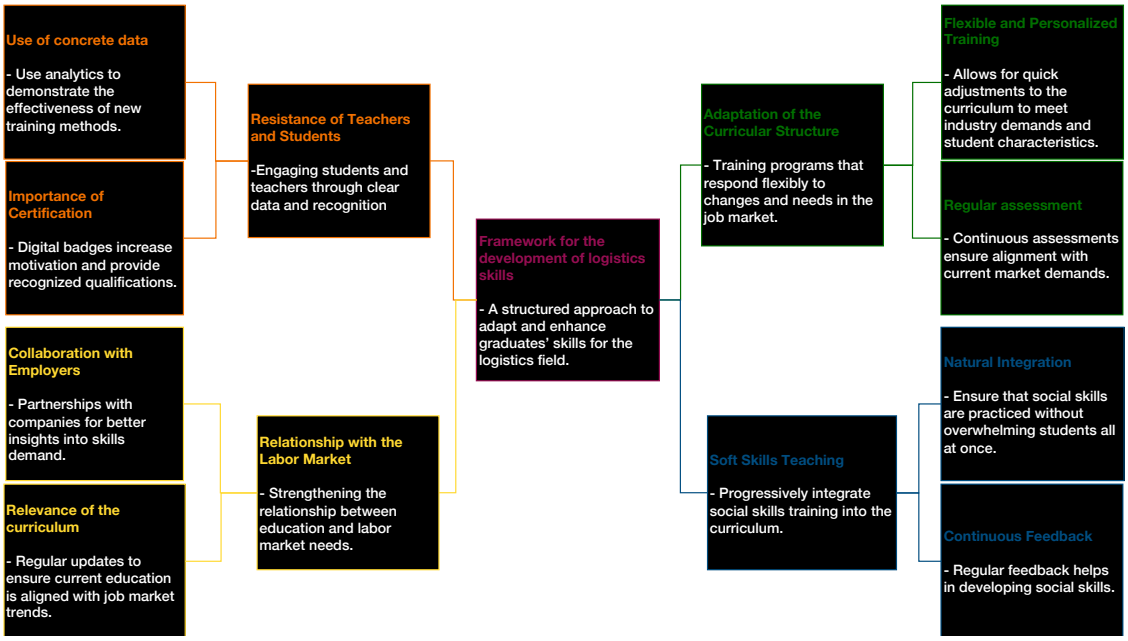

Figure 4.9 - Mind map for drawing up the Framework.

Initially, it is essential to mitigate institutional resistance, recognizing the importance of the teaching staff as a training agent and also the importance of socio-emotional competencies. Implementing communities of practice, continuous professional development programs, and institutional recognition systems are essential for engaging teachers in this process. At the same time, it is essential to target students' perceptions by demonstrating the practical relevance of soft skills through applied projects, collaborative activities, and measurable performance indicators.

The second pillar converges on the urgent need to consolidate links between academia and the productive sector, with a view to harmonizing work demands with teaching practices. Incorporating authentic case studies, logistics simulations, and supervised internships provides students with concrete experiences and encourages the assimilation of multifaceted skills.

Regarding the third pillar, there is a pressing need to make curricula more flexible by implementing a modular structure that enables content to be updated quickly, in line with technological developments and market dynamics. Introducing active methodologies and formative assessment practices expands the opportunities for developing skills such as problem-solving, empathy, communication, and critical thinking.

Finally, the fourth pillar emphasizes the importance of gradually incorporating soft skills throughout the educational process rather than allocating them exclusively to isolated modules or complementary activities. Implementing methods such as project-

based learning, simulations, and group work encourages the development of these skills in authentic and relevant scenarios.

4.5.1 Framework

Based on these pillars, the proposed Framework is organized into seven interconnected operational stages, as summarized in Figure 4.10: diagnostic assessment, identification of *gap skills*, construction of the Individual Development Plan (IDP), carrying out development activities, setting goals and recognition through *digital badges*, annual review of the plan and pedagogical support actions.

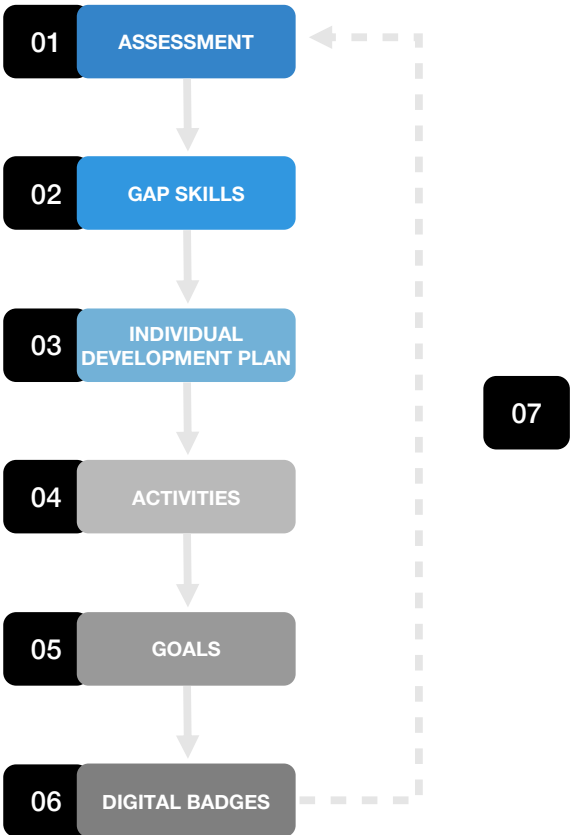

Figure 4.10 - Framework for developing soft skills.

1. Assessment - This stage aims to raise students' awareness of the gaps between their current skills and those required by the job market. Systematic assessments are conducted at the beginning of each academic year using digital tools to map and compare existing and desired skills.
2. *Gap Skills* - This stage aims to raise students' awareness of the gaps between their current skills and those required by the job market. Systematic assessments

are conducted at the beginning of each academic year using digital tools to map and compare existing and desired skills.

3. Individual Development Plan (IDP) - This stage aims to raise students' awareness of the gaps between their current skills and those required by the job market. Systematic assessments are conducted at the beginning of each academic year using digital tools to map and compare existing and desired skills.
4. Development activities - This stage aims to raise students' awareness of the gaps between their current skills and those required by the job market. Systematic assessments are conducted at the beginning of each academic year using digital tools to map and compare existing and desired skills.
5. Goals - Setting and achieving goals is crucial for personal growth and development. It provides motivation, a sense of accomplishment, and strengthens self-confidence. Successful goal attainment also enables the establishment of new objectives and fosters continuous growth.
6. Digital Badges - Digital badges are online credentials that certify specific achievements or skills. They can be used in academic and co-curricular settings and shared with employers. In fields such as logistics, they offer a detailed representation of interdisciplinary competencies. However, their effectiveness depends on recognition by institutions and employers, requiring clear standards and alignment with industry needs. Examples of implementation include Beuth University of Applied Sciences Berlin, which has issued BeuthBadges since 2013 to certify transversal competencies such as teamwork, intercultural communication, and digital skills. Similarly, the Technical University of Applied Sciences Augsburg awards DMZ-Badges to students and staff who participate in internal training programs in areas such as academic writing, media literacy, and language learning.
7. Review - The annual review of the IDP is vital for monitoring student progress, reassessing goals, and making necessary adjustments. This stage ensures alignment between academic training and job market requirements, fostering continuous professional development.

In conclusion, the Individual Development Plan (IDP) is crucial for personal and professional growth. Setting realistic and measurable goals, along with clear strategies for achieving them, is fundamental to the success of the IDP. Tracking and evaluating progress over time is essential to achieving goals. Additionally, overcoming any obstacles and challenges that may arise along the way is crucial. The positive impact of achieving goals on individual development is undeniable, as it provides a sense of achievement and motivation to continue seeking personal growth and improvement.

4.5.2 Implementing the Framework

Implementing the proposed Framework for soft skills development in undergraduate logistics programs requires an integrated, adaptive approach involving assessment, pedagogy, and institutional support.

First, a digital tool should be used at the start of each academic term to assess students' soft skills. The results will inform an Individual Development Plan (IDP) outlining personalized goals and improvement strategies.

An online platform integrated with the institution's learning environment should support IDP execution by enabling individualized training paths, progress monitoring, and feedback.

Curricula must be restructured to embed soft skills into technical content through updated learning outcomes, active learning methods (e.g., simulations, project-based tasks), and assessments such as portfolios and peer reviews.

Faculty training is essential to this transition. Instructors must be equipped to teach and assess soft skills using innovative tools and methods. Creating communities of practice among educators can further enhance consistency and collaboration, ultimately benefiting the educational experience.

Student progress can be recognized with digital badges—certifications awarded based on objective, industry-aligned criteria that validate competencies in areas such as teamwork or communication.

Ultimately, implementation demands institutional commitment. This goes beyond adding new content and requires a cultural shift toward holistic education that aligns with the evolving needs of the logistics sector. The Framework offers a practical model for institutions aiming to prepare students for the digital economy and complex work environments.

4.6 Conclusion and Future Research

The changes in the field of logistics brought about by digital transformation put higher education under increasing pressure to train graduates with the skills desired by the job market. To achieve this goal, HEIs must impart the specific knowledge and skills of each discipline or profession and develop competencies and attributes that are transferable to many professional situations and areas.

Despite the importance of developing soft skills for an individual's growth and development, as well as for the advancement of society and the country, most higher

education curricula in Portugal do not effectively meet these objectives. Consequently, it can be assumed that, in higher education, the level of soft skills development is unsatisfactory. Most students are transferred to the job market without acquiring the skills that significantly contribute to their competitiveness, both in the job market and in their career development.

HEIs must be willing to invest in the development of soft skills to effectively implement a change in the curriculum to focus on building interpersonal skills. HEIs should design curricula that focus on imparting basic and social skills to students since they are equally important for students' professional success. In line with this, curriculum development and revisions should consider the opinions of other stakeholders, especially employers. Students should also find different mechanisms to help them acquire skills that complement what they are taught at HEIs.

However, our article is not without its limitations. This is a theory-based position and does not include any empirical implementation results from a study demonstrating the application of this model. The methods for assessing the student and the results of implementing the proposed model are beyond the scope of this article. While we consider this a viable approach to developing soft skills, we recognize that the influence of contextual factors in different environments can make this approach complex and nuanced. However, this article aims to initiate a theoretical discussion on how to rethink practical approaches to developing soft skills.

The study has methodological limitations, including a relatively small sample size, which may limit the generalizability of the results to other populations and contexts. This is a common challenge in qualitative research and case studies, where the focus is on an in-depth understanding of a specific phenomenon rather than a statistically significant representation of a broader population. While the results may not be directly generalizable, they can provide valuable insights and form the basis for future, larger-scale studies that can test the validity and applicability of the findings in various settings.

The proposed Framework exists within a larger ecosystem. Therefore, additional research is needed to assess the possibility of successful implementation. Firstly, there is a dearth of research on the role of educators in developing soft skills (Rebels & St. Pierre, 2019). Low knowledge and divergent beliefs about the importance of soft skills can lead to poor implementation and a lack of continuity. Research should also include the perceptions of institutional policymakers, who play a key role in driving the development of soft skills in HEIs. Pilot studies or demonstration projects that assess the feasibility and acceptability of this model are crucial for informing evidence-based policy in various educational settings. Additionally, future research could investigate how

institutional constraints, such as rigid curricula or inadequate teacher training, impact the implementation of soft skills programs.

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5 CONCLUSION

5.1 Final Considerations

This thesis aimed to comprehensively investigate how digital transformation has reshaped the skill set required in the logistics sector, arguing that the integration of technology necessitates a parallel evolution in human skills. It also examined the role that higher education institutions currently play—or should play—in equipping future professionals for this evolving scenario. The study was based on the premise that the digitalization of logistics requires not only technological upgrades but, more importantly, a fundamental shift in approaches to human capital development. This change requires a proactive adaptation of educational structures to meet the emerging demands of the sector.

The digital transformation in supply chains and logistics, driven by advancements such as Industry 4.0, necessitates a proactive approach to change management if companies are to remain competitive. This transformation involves integrating technologies such as big data analytics, IoT, and cloud computing to improve decision-making, efficiency, and sustainability. As logistics undergoes rapid change with increased automation, data analysis, and digital platforms, professionals need to utilize these technologies effectively while possessing strong communication and interpersonal skills. To keep pace with the evolution of the logistics sector, organizations must quickly adopt digital processes, products, and services. It is essential to develop a technically qualified workforce that possesses a robust set of soft skills.

The results indicated a notable discrepancy between the skills demanded by the industry and those provided by higher education programs, particularly in terms of soft skills— those interpersonal, behavioral, and cognitive skills crucial to navigating dynamic, uncertain, and highly digitized environments. This gap underscores the pressing need for educational reforms that prioritize the development of these essential skills.

Universities around the world are increasingly offering courses to develop social skills, thereby improving students' employability. In addition, academic environments, which traditionally emphasize quantitative knowledge, need to integrate soft skills into logistics programs, illustrating their practical application. The importance of soft skills in technology-oriented fields is growing, with employers seeking individuals who possess analytical thinking, problem-solving, and communication skills. While technical

knowledge remains key, the ability to interact effectively with colleagues, clients, and stakeholders, along with the ability to solve problems creatively and respond quickly to unforeseen challenges, distinguishes high-performing logistics professionals in today's interconnected world. The integration of soft skills into curricula should demonstrate their relevance and practical application in logistics contexts, rather than treating them as separate modules. Additionally, these skills are essential for maintaining competitiveness in the logistics sector, as they enable professionals to manage relationships with customers, suppliers, and stakeholders effectively. In light of these changes, there is growing recognition that logistics education must evolve to equip students with the soft skills needed to navigate the complexities of the modern supply chain.

Employing a rigorous methodology, the research culminated in a proposal for an incremental and coordinated model for cultivating soft skills in logistics-related higher education in Portugal. This model makes a valuable contribution, both conceptually and practically, to better aligning university education with employability, suggesting a way forward for other regions facing similar challenges.

5.2 Research Contributions

This thesis makes a significant contribution to the growing body of literature on professional competencies in the digital age. It achieves this by highlighting the vital importance of comprehensive educational approaches in adequately preparing students for the demands of the professional sphere. To ensure that graduates are adequately prepared for the multifaceted challenges inherent in the logistics sector, these strategies must seamlessly incorporate both technical and interpersonal skills from the outset of their higher education. The framework outlined here provides a valuable resource that educational institutions can choose to adopt or modify, thus facilitating the cultivation of an educational environment more in line with the pragmatic demands of the logistics sector.

Furthermore, the research aims to stimulate future research and improvements in logistics education, calling for the continued involvement of education providers to develop curricula that adequately address the ever-changing needs of the industry. This study identifies key aspects of logistics and supply chain talent by analyzing courses and teaching methods. It provides academics and practitioners with a guide to the existing literature on the topic. It provides a helpful roadmap for educators and industry professionals to collaborate and address these issues, highlighting the need for an integrated approach to management development.

5.3 Research Limitations

This study acknowledges some intrinsic limitations, primarily its geographical confinement to the Portuguese context and its specific focus on the logistics sector. Furthermore, the practical applicability of the proposed model is subject to rigorous validation through authentic curricular applications, which is imperative in order to ascertain its real effectiveness. Future research should utilize larger and more diverse samples to confirm the generalizability of the study's conclusions across different countries and cultural contexts, thereby enhancing the scope and relevance of the findings.

In addition, longitudinal studies could be conducted to track the career trajectories of students who have undergone the curricula, with a focus on the impact of soft skills training on career progression and job satisfaction.

5.4 Suggestions for Future Research

Future research should consider: applying and evaluating the proposed framework in higher education contexts to determine its effectiveness in different academic environments; broadening the scope of the analysis to include various economic sectors, thus evaluating the applicability of the framework in various industries; conducting comparative studies across international borders to understand cultural and regional influences on the development of social skills and graduate employability; and investigating the longitudinal effects of social skills on graduate employability to establish long-term benefits and career progression patterns.

5.5 Final Considerations

In an era marked by rapid technological advancements, university education must extend beyond the purely technical. The development of interpersonal skills is crucial for cultivating adaptable, well-rounded professionals who are prepared to meet the evolving demands of the workplace. Therefore, this dissertation makes a strong case for a holistic, adaptive, and humanistic approach to professional development, offering a practical framework for its implementation in higher education institutions. This framework is designed to serve as a guide for educators, policymakers, and industry stakeholders who are committed to cultivating a generation of logistics professionals prepared to navigate

and excel in the complexities of the global marketplace. The collaborative integration of industry insights, technological advancements, and human-centered education will ensure that graduates not only succeed in their careers but also become leaders and innovators in their respective fields.