

A review of employability skills for graduates in the construction sector

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Abstract

Purpose – The construction industry, characterised by its dynamic nature, demands graduates equipped with diverse skills beyond academic proficiency. Recognizing the significance of employability skills, this study aims to provide a comprehensive overview of the employability skills to meet the evolving demands of the construction industry.

Design/methodology/approach – Utilizing Web of Science, this review focuses on articles published from 2013 to the research completion date (December 2023), resulting in the selection of 94 highly relevant papers. Then, a combination of bibliometric analysis and in-depth content analysis of the top ten most-cited papers was conducted to examine research trends in this field.

Findings – “Soft skills” are identified as the strongest citation bursts between 2014 and 2016. And the emerging research frontiers are adaptability, communication skills and contextual supports. Additionally, the employability skills identified from this study can be categorized into seven groups: profession; personal capital; soft skills; career proactivity and adaptability; personality; emotional intelligence and work ethics.

Originality/value – This research advances the body of knowledge on employability skills in the construction field. Moreover, the findings offer actionable strategies. For example, for educators, this includes incorporating real-world case training and workshops focused on developing these skills; for researchers, it suggests focusing on digital skills; for policymakers, it recommends creating work-integrated learning opportunities.

Keywords Employability, Construction, Review, Soft skills, Education

Paper type Literature review

1. Introduction

Graduate employability refers to the collection of skills and abilities essential for individuals to secure and sustain employment (Okay-Somerville and Scholarios, 2017). Despite extensive research on employability, concerns persist due to the evolving dynamics of the graduate labour market, characterized by increasing student enrolments, heightened qualification requirements and intensified competition among graduates (Finch *et al.*, 2016; Gallagher, 2022). In this competitive context, holding a degree alone is insufficient to meet industry expectations. The World Economic Forum (2023) has reported significant skill gaps in graduate readiness for employment. The construction industry, a key contributor to the global

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economic growth, is uniquely impacted by these challenges. Given its dynamic and rapidly changing nature, this sector demands a workforce equipped with technical expertise and employability skills for addressing multifaceted problems (Aliu and Aigbavboa, 2023a, b; Fajaryati *et al.*, 2020). These skills include critical thinking, creativity, collaboration, communication and leadership (Aliu and Aigbavboa, 2020, 2023; Succi and Canovi, 2020).

Furthermore, Industry 4.0 revolution has amplified the need for such competencies of graduates, as construction projects increasingly integrate advanced technologies and innovative practices. In particular, emerging construction technologies like building information modelling (BIM), artificial intelligence (AI), circular economy and zero-carbon principles are transforming industry practices (Siddiqui *et al.*, 2023). These advancements require interdisciplinary skills, including data analytics, modelling, programming and sustainability expertise to enhance project efficiency and environmental performance (Ginigaddara *et al.*, 2024). However, a notable gap remains, as current education prioritizes traditional academic knowledge over practical and transferable skills (DeCoito and Myszkal, 2018). For example, Magda (2023) surveyed 600 human resources (HR) professionals in the United States and highlighted 69% of them believe their organisation has a skills gap. Addressing this disparity by anticipating future employment trends and enhancing these skills becomes imperative (Akyazi *et al.*, 2020; Low *et al.*, 2021).

Prior studies have explored employability skills in the construction sector (Succi and Canovi, 2020; Suleman, 2018; Tymon, 2013). Key competencies like career adaptability, communication, leaderships and proactive career behaviours have been emphasized (Chen, 2020; Fajaryati *et al.*, 2020; Jackson, 2017). Additionally, attributes such as emotional and social intelligence have been identified as critical for the construction industry (Allan and Phillips, 2021; Succi and Canovi, 2020; Wen *et al.*, 2020). However, these studies predominantly examined isolated skills, lacking a comprehensive examination of the unique employment within the construction industry. Furthermore, Science, Technology, Engineering and Mathematics (STEM) education, which forms the backbone of modern construction (STEM Education Works, 2022), equips graduates with the foundational knowledge and skills required for innovation and problem-solving. Yet, challenges in STEM education, like misalignment between academic curricula and industry needs, contribute to graduate unpreparedness (DeCoito and Myszkal, 2018).

Thus, a review on graduate employability in the construction industry was conducted. It aims to go beyond the existing isolated skill research by providing an overview of the employability skills and actionable strategies to meet the evolving demands. This is achieved through a bibliometric analysis, an in-depth content analysis and exploration of future directions. By offering this systematic analysis, this research advances knowledge on employability skills by identifying seven skill groups: professional expertise, personal capital, soft skills, personality, emotional intelligence, work ethics and career proactivity and adaptability. From a practical perspective, the findings provide actionable educational strategies and curricula for educators, such as real-world case training or workshops focused on developing these skills; for researchers, including further studies on the skillsets required for life-cycle career development and for policymakers, creating more work-integrated learning opportunities. These efforts help to align STEM education with industry expectations.

2. Research method and process

Recently, systematic literature review (SLR) has gained favour over the traditional narrative review (Zhu *et al.*, 2021). This is because SLR is superior in identifying the most relevant research on a specific question via a rigorous, replicable, scientific and transparent process (Linnenluecke *et al.*, 2020). For this reason, SLR has seen widespread application across various disciplines (Castañer and Oliveira, 2020; Lima *et al.*, 2021; Yang and Chen, 2022). Durach *et al.* (2017) outlined its common procedure as follows: (1) formulating the question; (2) determining the required characteristics of primary literature; (3) retrieving the sample of potentially relevant

literature; (4) selecting pertinent literature; (5) synthesizing the literature and (6) reporting the results. As mentioned earlier, there are several attempts to review the literature on employability skills in the construction sector, like [Fajaryati et al. \(2020\)](#) and [Akyazi et al. \(2020\)](#). However, few of them are conducted in a systematic manner. This research follows the steps of SLR by [Durach et al. \(2017\)](#) to evaluate and aggregate previous research work.

Particularly, a search was conducted using the query, i.e. TITLE-ABS-KEY (“graduate” OR “graduates”) AND (“employability” OR “graduate employability” OR “employment” OR “career”) AND (“construction” OR “construction graduates”) AND PUBYEAR >2013 AND (LIMIT-TO (LANGUAGE, “English”)), resulting in the identification of 876 papers. *Web of Science* was selected as the database due to its extensive coverage in engineering, science, management, social sciences and the humanities, encompassing the vast majority of relevant journals ([Singh et al., 2021](#)). Then, a thorough examination of titles, abstracts and keywords was performed by addressing two criteria: the presence of duplicates and whether the paper addresses graduate employability in the construction industry. Following this screening, 94 papers were selected. Subsequently, a bibliometric analysis was performed via *Citespace* 6.3.R3. Bibliometric is a quantitative and objective method of researching and analysing data obtained from databases in the review studies ([Li et al., 2022](#)). This approach typically covers co-word and document co-citation analysis ([Ding and Yang, 2022](#)). Building upon bibliometrics, this study conducts co-word analysis from three facets: keyword co-occurrence, keyword clustering and keyword burst analysis, thereby facilitating a deep-going understanding of employability skills of graduates in the construction sector. *CiteSpace* 6.3.R3, an information-based visualization software developed by Chaomei Chen using the Java language, is employed to analyse co-occurrence networks derived from extensive bibliometric data ([Chen, 2006](#)). Notably, bibliometric analysis via *Citespace* leverages the intrinsic functionalities of *Web of Science*, which is considered optimal for bibliometric analysis and has been utilized in similar studies by [Chen et al. \(2020\)](#), [Li et al. \(2022\)](#) and [Luo et al. \(2024\)](#). Finally, an in-depth content analysis was conducted on the top ten papers, ranked by citations. Each paper was analysed to extract relevant skills and competencies through open coding, which are further categorized into seven groups based on their relevance. This process will also provide a balanced and objective summary of the research; please see [Figure 1](#).

3. Bibliometric analysis

Keywords serve as essential summaries of research content, and the analysis of co-occurrence identifies and provides research hotspots over different time periods ([Li et al., 2022](#)). In this section, a keyword co-occurrence network analysis, with a further clustering analysis and burst analysis, was conducted. As is recommended by the developer of *CiteSpace* ([Chen, 2006](#)) and in accordance with previous studies ([Chen and Liu, 2020](#); [Ding and Yang, 2022](#); [Li et al., 2022](#)), we used the following settings: The time interval was defined from 2013 to the research completion date (December 2023), with a year per slice set to 1. Then the top 50 high-frequency nodes were selected from each slice, i.e. Top $N = 50$. To reduce waiting time and simplify the network structure, we applied the Pathfinder pruning method when generating different visualization maps.

3.1 Keyword co-occurrence network analysis

Keyword co-occurrence network analysis examines the frequency with which two keywords appear simultaneously in the same article. This method reflects the research evolution and hotspots, thereby revealing changes in the popularity of specific research topics over time. The resulting co-occurrence network through *Citespace* 6.3.R3, consisting of 356 nodes and 1,438 links, is presented in [Figure 2](#). Each node represents a keyword, with its size indicating the frequency of occurrence and the line thickness between nodes reflecting the strength of correlation ([Haiying et al., 2022](#)). The most frequent keywords are “construction industry”,

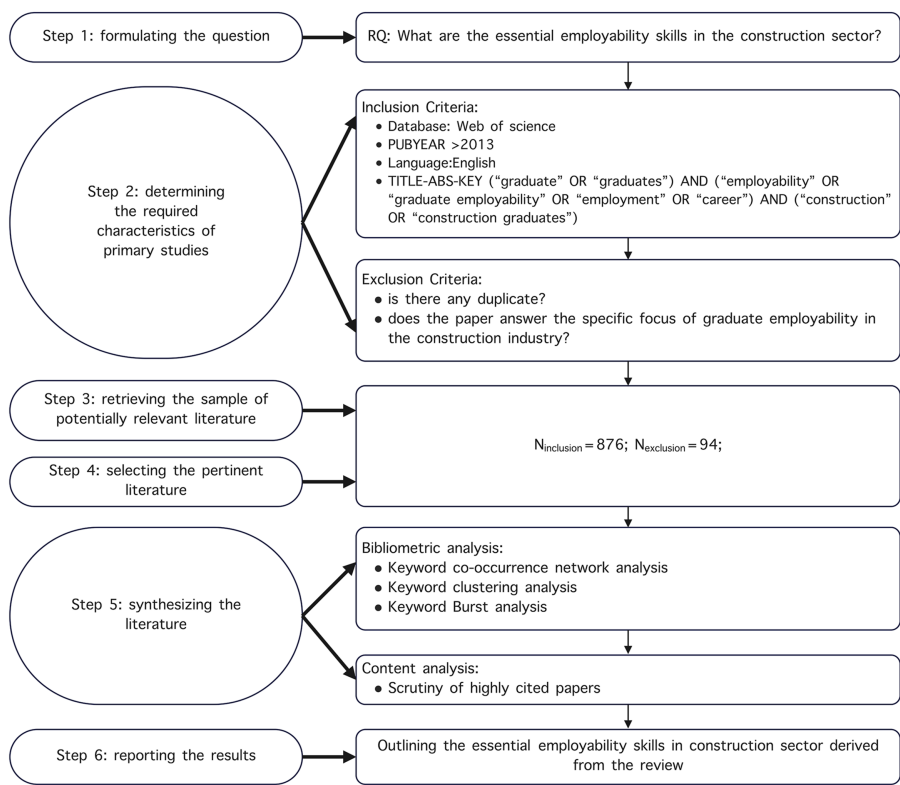


Figure 1. Research processes. Source: Authors' own work

“employability skills” and “graduate employability”, highlighting the focus of this study. The following keywords are “adaptability”, “higher education”, “self-perceived employability”, “work experiences” and “competences”. Specifically, “adaptability”, “work experiences” and “competences” represent the significance of employability skills. These terms highlight the role of higher education in preparing students with the essential skills needed for adapting to industry demands (Low *et al.*, 2021). Graduates are expected to go beyond merely completing their courses; they need to develop competencies to tackle emerging challenges, such as adapting to dynamic work environments (Aliu and Aigbavboa, 2020). “Higher education” emphasizes the necessity of investing in and examining educational approaches to equip students with skills attractive to employers (Aliu and Aigbavboa, 2023a, b). “Self-perceived employability” refers to an individual’s belief in their ability to secure sustainable employment aligned with their qualifications (Rothwell *et al.*, 2008). This concept, which includes personal factors like job-specific skills and the ability to learn as well as external factors such as labour market conditions (Monteiro *et al.*, 2020), highlights the need for empirical research on perceived employability, particularly in organisational contexts.

3.2 Keyword clustering analysis

Identifying the popularity of keywords via co-occurrence analysis is the first step in constructing a knowledge domain. The second step involves analysing these documents to determine key research areas. In *CiteSpace*, the cluster labels are chosen from the top-ranked phrases derived from titles, keywords and abstracts (Bilge and Yaman, 2022). In this study,

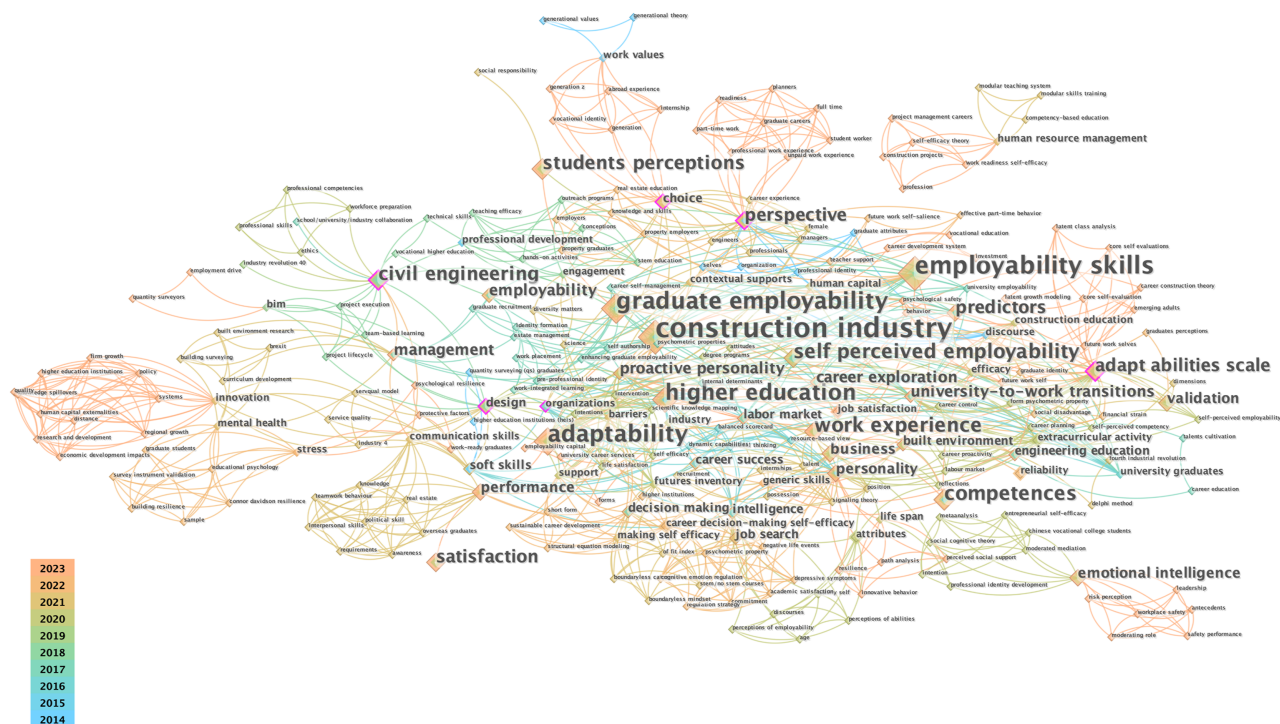


Figure 2. Keyword co-occurring network analysis. Source: Authors' own work

these labels are then ranked based on log-likelihood ratio (LLR), with the top-ranked phrases representing the respective clusters. This statistical approach ensures that the most representative and significant terms to characterize each cluster's thematic focus; please see [Figure 3](#). The largest cluster is labelled as No. 0, while the smallest cluster is labelled as No. 6. The size of each cluster depends on the total number of published papers it contains.

In *CiteSpace*, the cluster labels are chosen from phrases derived from titles, keywords and abstracts ([Bilge and Yaman, 2022](#)). These labels are ranked using log-likelihood ratio (LLR), which ensures that the most representative terms to characterize each cluster's thematic focus. However, automatic label extraction may generate broad or non-informative terms. Thus, a manual review was needed to remove unspecific clusters by analysing the content of articles in each cluster ([Zhong et al., 2019](#)). As shown in [Figure 3](#), cluster #0 "employability skills" was removed because it broadly includes terms like "employability skills", "civil engineering", "construction industry", "built environment" and "construction education". Although Cluster #0 was removed, it is worth noting that it contained "BIM", which addresses the industry's demand for high-quality projects ([Russell et al., 2014](#)). The present-day industry requires graduates not only to learn construction elements but also to possess innovative digital skills for construction effectively. The remaining clusters reflect the research themes of employability research in the construction industry, which need to be discussed.

Cluster #1 centres on "early career", which means the initial phase of professional development, typically characterized by less than 10 working years ([Rastogi and Singla, 2023](#)). The transition from university to the workplace is vital, as it involves navigating early career decisions and managing the interaction between educational and employment paths ([Okay-Somerville and Scholarios, 2017](#)). "Choice", "job search", "satisfaction" and "student perceptions" explore the factors influencing early career choices.

Cluster #2 titled "career decision-making self-efficacy", focused on the capacity to handle tasks and challenges in difficult situations ([Wen et al., 2020](#)). This cluster includes key aspects like "emotional intelligence", "proactive personality" and "adaptability" that affect career choices. For example, emotional intelligence helps manage stress and environmental needs, enhancing self-efficacy by boosting confidence and resilience in professional decision-making ([Wen et al., 2020](#)). A "proactive personality" characterizes individuals who identify chances and persist in their career goals ([Chen et al., 2020](#)). "Adaptability" improves self-efficacy by equipping individuals to cope with uncertainties.

Cluster #3, initiated in 2014 and labelled "soft skills", is crucial for the future workforce in the construction industry ([Low et al., 2021](#)). Employees with a high level of soft skills can quickly adapt to new technologies and processes, thus enhancing their "career success" ([Van Heerden et al., 2023](#)).

Cluster #4 indicates graduates' proactive involvement in seeking career paths. "Extracurricular activity", which includes volunteering, sports and community-based activities, encourages students to invest resources in self-development, potentially giving them a competitive edge in the labour market ([Jackson and Tomlinson, 2020](#)). Additionally, "self-perceived employability", "adapt abilities scale" and "career control" highlight the exploration of individual attributes and perceptions that directly influence their engagement with the labour market.

Cluster #5 labelled "STEM education", includes keywords like "professional development", "hands-on activities", "conceptions" and "engagement". It is demanding in higher education to produce graduates with advanced skills ([Finch et al., 2016](#)). Numerous initiatives aim to enhance interest in STEM fields through both formal and informal learning opportunities. Five key domains identified for promoting STEM are: interest and engagement; competence and reasoning; career knowledge and acquisition; attitude and behaviour and content knowledge ([DeCoito and Myszkal, 2018](#)).



Cluster #6 is “education mode”, which includes keywords such as “colleagues and universities curriculum optimisation”, “employment guidance” and “practice courses”. Higher education institutions are tasked with refining curricula to meet industry demands (O’Connor, 2022; Posillico *et al.*, 2022). As mentioned earlier, there is a recognized need for these institutions to provide employment guidance to help students navigate early career choices.

3.3 Keyword burst analysis

A citation burst analysis identifies keywords frequently cited over a period, helping to map out co-occurrences and trends in knowledge (Chen and Liu, 2020). This analysis predicts emerging research topics and trends (Wang *et al.*, 2020). Figure 4 presents the top 25 keywords with the strongest citation bursts. The five leading keywords are “soft skills” (2014–2016), “professional development (2014–2018)”, employment guidance (2016–2017), “civil engineering (2017–2019), and design (2018–2021)”, with “soft skills” having the highest burst strength at 1.14. As highlighted previously, construction graduates need a combination of hard and soft skills to effectively apply their knowledge and enter industries (Mahasneh and Thabet 2015). The emerging research frontiers in Figure 4 include (1) Adaptability: Research on how graduates

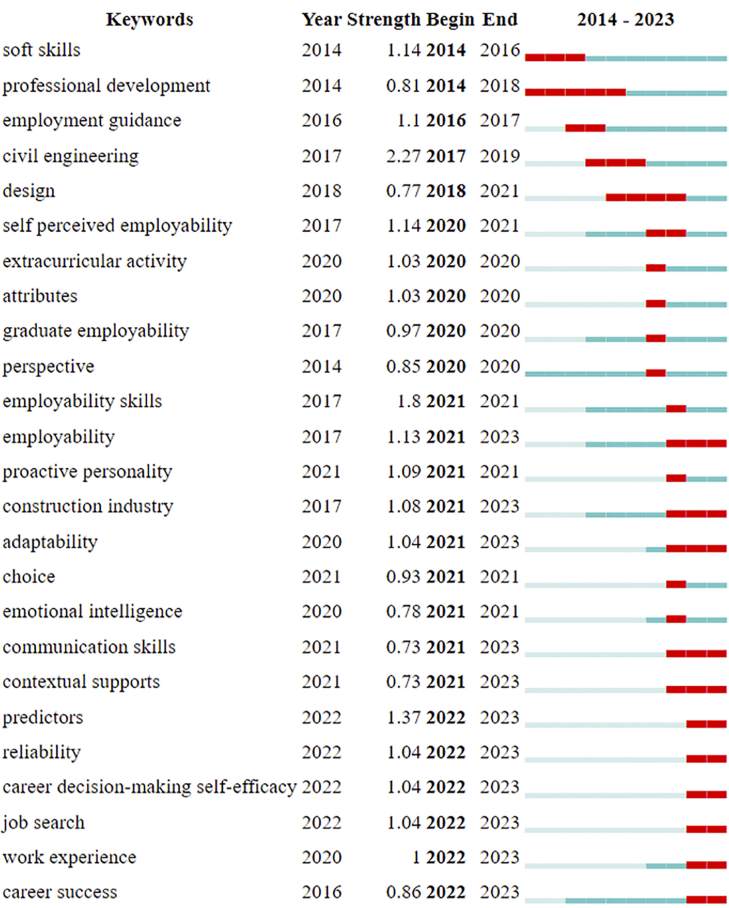


Figure 4. Top 25 keywords with the strongest citation bursts. Source: Authors’ own work

adapt to changing working conditions. (2) Communication skills: Research on how graduates enhance their communication skills and the impact of these skills on their career success and (3) contextual supports: research on how support systems and educational approaches within the construction industry contribute to the employability and performance of graduates.

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4. Content analysis

A detailed content analysis for the top ten papers was conducted, which were chosen based on citations given by the entire academic community. Through open coding, 28 coding items in Table 1 were extracted and refined, which were further consolidated into seven groups based on their relevance. To ensure the group robustness, one additional paper (*No.11* in Table 1) was analysed, confirming that no new group concept emerged. The final seven groups, i.e. profession; personal capital; soft skills; career proactivity and adaptability; personality; emotional intelligence and work ethics, provide structured insights into graduate employability strategies in the construction sector.

Profession refers to professional knowledge and industry knowledge specific to occupations. Graduates are expected to apply this knowledge in their occupations (Jackson, 2017). However, obtaining a degree or vocational qualification is not the only requirement for today's graduates. The built environment comprises disciplines like quantity surveying, architecture, property management, construction management and technology (Zaheer et al., 2021). Graduates in these fields are expected to interpret clients' requirements, transform drawings and define projects (Obi et al., 2020). Moreover, recent expansion in scope and size of construction projects necessitates BIM, AI, programming, construction equipment and new technologies (Arditi and Polat, 2010). Students must be well-educated to meet these challenges. BIM's rising prominence has led to its inclusion in education, giving students with BIM knowledge a market advantage (Zhang et al., 2018).

Personal capital includes essential elements for professional growth, such as work experience, extracurricular activities and professional networks. Due to the high cost of on-the-job training, industries seek graduates with skills beyond those gained in the traditional classrooms (Aliu and Aigbavboa, 2023a, b). Extracurricular activities, including conferences, workshops and field trips, enhance job applicants' understanding of their work preferences and improve the job search process (Kanar and Bouckennooghe, 2021). In the built environment, these activities are crucial for developing soft skills and general skills, like adaptability, open-mindedness and cultural awareness and staying informed about industry trends (Aliu and Aigbavboa, 2023a, b). Work experience, whether full-time, part-time or an internship, demonstrates practical skills and qualities like passion and cultural fit, which employers value (Anderson and Tomlinson, 2021). Additionally, professional networks provide access to opportunities, mentorship and insights, greatly enhancing employability.

Soft skills are essential for the future construction workforce (Low et al., 2021), as the competitive labour market pushes employers to seek candidates with a full range of skills (Suhaili et al., 2015). Employees must use their soft skills effectively to interact and manage work processes (Low et al., 2021). These skills are vital for construction professionals, helping them navigate project challenges (Van Heerden et al., 2023). Research shows that hard skills contribute only 15% to career success, while soft skills account for 85% (Van Heerden et al., 2023). Despite their significance, "soft skills" lacks a precise definition. In this study, soft skills include teamwork, social sensitivity, managing relationships, time management, creativity and practicality, communication, critical thinking, decision-making, problem-solving, analysis and networking. Similarly, Low et al. (2021) identify leadership, communication, negotiation and problem-solving as the four key skills for project managers. However, the remaining gap in soft skills poses a significant challenge for workforce development and industry success.

Proactive individuals have the potential to achieve their professional objectives and succeed in their careers (Park et al., 2022). It also enhances graduates' engagement in the labour market, improving future employability (Jackson and Tomlinson, 2020). Career

Table 1. Top ten most cited publications

Ref	Publication	Coding item	No	Reference
1	Developing pre-professional identity in undergraduates through work-integrated learning	• Attributes and capabilities: communication, self-awareness, self-management, and collaboration • Technical and transferable skills: knowledge, behaviours, qualities and values, career management, awareness, reflection, confidence, resilience and networks • Other core elements: self-esteem, positive attitude, reflective ability, self-awareness, critical learning, engagement, and enthusiasm	128	Jackson (2017)
2	Position, possession or process? Understanding objective and subjective employability during university-to-work transitions	• Profession: teamwork and problem-solving • Social background: access to prestigious educational credentials • Proactive career behaviours	60	Okay-Somerville and Scholarios (2017)
3	Investigating the relationship between career planning, proactivity and employability perceptions among higher education students in uncertain labour market conditions	• Transferable skills • Career adaptability • Proactivity • Personal capital: extracurricular activities and work experience	52	Jackson and Tomlinson (2020)
4	A dynamic capabilities view of employability Exploring the drivers of competitive advantage for university graduates	• Career planning • Intelligence resources: critical thinking skills, decision-making and problem-solving skills • Personality resources: emotional stability, openness, extraversion, agreeableness and conscientiousness • Meta-skill resources: listening, communication, teamwork, adaptability, social sensitivity, managing relationships, time management, goal-orientation, and task completion • Job-specific resources: knowledge, skills and passion	35	Finch et al. (2016)
5	Career adaptability research: A literature review with scientific knowledge mapping in Web of Science	• Proactive personality • Career adaptability: planful attitudes, self and environmental exploration, and adaptive decisions	34	Chen et al. (2020)
6	Enhancing Building Information Modelling competency among civil engineering and management students with team-based learning	• Technical skills: BIM. • Soft skills: collaboration, communication, teamwork, and leadership	32	Zhang et al. (2018)
7	Connecting science instruction and teachers' self-efficacy and beliefs in STEM education	• 21st century skills: critical thinking, problem solving, creativity, collaboration, self-directed learning, and practical use of science	21	DeCoito and Myszkal (2018)

(continued)

Table 1. Continued

Ref	Publication	Coding item	No	Reference
8	Future-ready project and facility management graduates in Singapore for industry 4.0 Transforming mindsets and competencies	• Knowledge of new technologies • Soft skills: communicating, negotiating, problem solving, resilience, adaptability, curiosity, insight, empathy, emotional sensing, entrepreneurial thinking, pursuing conviction, and vision	20	Low et al. (2021)
9	Key generic skills for employability of built environment graduates	• Academic degrees and theoretical knowledge • Generic skills: leadership skills, critical thinking and analytical skills, problem-solving skills and entrepreneurship skills	18	Aliu and Aigbavboa (2023)
10	Employers' perception of employability skills among built-environment graduates	• Academic degree • Non-academic skills: technical and leadership skills, management and academic skills, work ethics and business skills, organisational and ethical skills	16	Aliu and Aigbavboa (2020)
11	The relationship between emotional intelligence and entrepreneurial self-efficacy of Chinese vocational college students	• Emotional intelligence • Self-efficacy	16	Wen et al. (2020)

Source(s): Authors' own work

proactivity includes elements like career curiosity, exploration, planning, self-esteem, positive attitude, confidence, personal development and enthusiasm. These qualities indicate an active and forward-looking approach towards self-discovery for graduates' career development. For example, career curiosity motivates individuals to explore various career options and set future goals ([Chen et al., 2020](#)). Confidence involves belief in one's problem-solving abilities and self-efficacy ([Chen et al., 2020](#)). Career planning involves critically evaluating potential outcomes to set and achieve objectives ([Park et al., 2022](#)). Proactive career engagement can help graduates navigate labour market challenges and enhance their marketability ([Jackson and Tomlinson, 2020](#)).

Adaptability is the ability to adjust thoughts and behaviours for changing circumstances ([Low et al., 2021](#)). It overlaps with proactivity but focuses on four key resources: concern about the future; control to be persistent; curiosity to explore the environment and confidence to overcome challenges ([Nota et al., 2013](#)). Adaptability also includes the ability to work independently and collaboratively ([Aliu and Aigbavboa, 2023a, b](#)). Up to date, construction graduates face pressures from the dynamic nature of the industry ([Aliu and Aigbavboa, 2023a, b](#)), making the transition from university to the labour market challenging ([Monteiro et al., 2019](#)). Graduates must be adaptable to diverse conditions ([Khalid and Ahmad, 2021](#)). Embracing adaptability, rather than resisting inevitable change, ensures a smooth and prompt adjustment to evolving circumstances, holding the potential to obtain career opportunities and improve work-related outcomes ([Low et al., 2021](#)).

The personality model includes emotional stability, extraversion, agreeableness, openness to experience and conscientiousness ([Finch et al., 2016](#)). Emotional stability is an individual's ability to remain balanced during emotional fluctuations, such as anxiety or low self-esteem, allowing them to stay calm amid uncertainties ([Neneh, 2020](#)). Extraversion includes traits like being outgoing, talkative and ambitious, which help extroverts gain recognition and status in

the workplace (Fynn, 2020; Neneh, 2020). Agreeable individuals are courteous, trustworthy and flexible, while those high in openness are adept at identifying new opportunities (Neneh, 2020; Wilmot and Ones, 2022). Conscientious individuals demonstrate strong organisational skills and attention to detail in their work (Neneh, 2020). In the construction industry, the human element remains crucial in the production process, despite the rise of automation (Augustine Senanu Komla *et al.*, 2022). It is vital to organise individuals effectively, foster positive relationships and ensure productive interactions (Augustine Senanu Komla *et al.*, 2022).

Emotional intelligence is particularly important in this complex and dynamic environment. It includes attributes such as emotional sensing, self-awareness, empathy, self-motivation and relationship management (Potgieter, 2013). It also correlates with the individuals' capacity to comprehend, regulate and express emotions, enabling them to adapt to their environment and maintain mental well-being, ultimately positively impacting job performance (Wen *et al.*, 2020). Similarly, Augustine Senanu Komla *et al.* (2022) prove that emotional intelligence could work as a stress buffer, as individuals with higher emotional intelligence demonstrate more adaptive responses. Therefore, high emotional intelligence is crucial in the workplace, and many industries now incorporate training to enhance it (Saini and Soni, 2016).

Work ethics should have been focused due to the potential exposure to issues like corruption, collusive tendering and bribery (Van Heerden *et al.*, 2023). Ethical behaviour, defined as "good" or "right" conduct, involves proper analysis of situations and adherence to rational decision-making criteria. Ethical challenges in the construction industry include collusion, conflicts of interest, breaches of confidentiality, bribery, negligence, fraud, dishonesty and unfair practices (Ho, 2011). A strong work ethic is vital for employability, demonstrating reliability, dedication and commitment. Employers seek individuals with a solid work ethic to maintain a trustworthy and ethical work environment. Today, many engineering professions have developed their ethical framework. For instance, the Australian Institute of Building (AIB) has formulated codes of ethics to define the roles and responsibilities. However, codes alone are insufficient and must be complemented with ongoing training (Vee and Skitmore, 2003).

5. Directions for future research

By examining keyword cluster analysis, burst analysis and seven skills groups through content analysis, several research gaps require further discussion:

- (1) *Emphasis on soft skill improvement.* The content analysis highlights a significant shortage of soft skills in the construction industry, with employers often dissatisfied with graduates in this area (Mahasneh and Thabet 2015). Its significance has also been captured by burst analysis of "emotional intelligence" and "communication skills", indicating the growing recognition of soft skill. Strengthening these skills can better prepare graduates for the industry, reduce unemployment pressure and enhance job market performance (Teng *et al.*, 2019).
- (2) *Development of profession of digital skills.* As Industry 4.0 continues to evolve, the profession of digital skills is crucial for identifying the competencies required in the modern workforce and ensuring individuals remain competitive in the job market (Newman *et al.*, 2021). For instance, designers need specialized digital skills, like BIM and IoT, to create drawings that influence material usage and dismantling complexity. This emphasis is also reflected in the "profession" group in the content analysis.
- (3) *Skills required for the lifelong career development.* Through cluster analysis, most current research focuses on early-career stages (Borg and Scott-Young, 2022; Borg *et al.*, 2023). However, graduate employability studies should extend beyond entry-level employment to encompass lifelong career development. Future research should

emphasize this broader scope for continuous skill development, career progression and adaptability in the evolving construction industry (Froehle *et al.*, 2022).

- (4) *Exploration of curriculum from an educational perspective.* There is a need for universities, employers, students and government to address skills deficits for construction graduates. Higher education faces challenges in nurturing graduates with the skills and competencies demanded by the dynamic construction industry (Aliu *et al.*, 2023). This aligns with the emerging research frontier of “contextual supports” identified in the keyword burst analysis, highlighting the need for industry-aligned curricula.

6. Conclusions, policy implications and limitations

6.1 Conclusions

Graduate employability refers to a variety of qualities and competencies which are imperative to be improved due to the dynamic and uncertain nature of the construction sector. Previous research over the years has focused on employability skills and pedagogical approaches across various construction disciplines (Aliu and Aigbavboa, 2023a, b). However, there is a lack of a thorough examination of the employability skills demanded within the current construction sector. This study addressed this gap by undertaking a systematic review via *Citespace* on graduate employability skills crucial in the context of the construction sector.

About 94 publications were finally selected for analysis to explore the keywords and research trends. Firstly, keyword co-occurrence analysis, including network, cluster and burst, was analysed to identify research hotspots over time. The most frequently keyword was “adaptability”, “higher education”, “self-perceived employability”, “work experiences” and “competences” excluding the general keywords. In the cluster analysis, six clusters (excluding cluster #0), in descending order of size, were determined: cluster #1 “early career”, cluster #2 “career decision-making self-efficacy”, cluster #3 “soft skills”, cluster #4 “labour market”, cluster #5 “STEM education” and cluster #6 “education mode”. The top three keywords with the strongest citation bursts were “soft skills”, “professional development” and “employment guidance”. Then, the employability skills in the construction industry were categorised into seven groups through an in-depth content analysis: profession; personal capital; soft skills; career proactivity and adaptability; personality; emotional intelligence and work ethics.

6.2 Policy implications

From an academic standpoint, this research advances the knowledge on employability skills by identifying seven skills groups and offering guidance on cultivating graduates’ employability for adapting to a changing environment. From a practical perspective, the findings of this study provide actionable educational strategies for educators, researchers and policymakers.

- (1) For educators: they can enhance employability by integrating real-world case studies and problem-solving exercises into curricula, helping students build professional expertise and adaptability. Workshops focusing on soft skills, emotional intelligence and work ethics should be organised to prepare students for workplace challenges. Additionally, mentorship programmes pairing students with industry professionals can provide valuable insights and foster the development of personal capital.
- (2) For researchers: They can contribute by conducting longitudinal studies to track graduates’ career development, identifying critical skills required at different career stages. Cross-disciplinary collaborations between STEM and disciplines like computer science can also promote innovative approaches to digital skill development.
- (3) For policymakers: It is important to expand work-integrated learning opportunities, such as internships and apprenticeships, to provide students with hands-on experience.

6.3 Limitations

Despite the implications, this study has certain limitations. For instance, this study relies solely on the *Web of Science* as the data source, whereas future research could supplement this with additional databases like *Google Scholar* and *Scopus*. Furthermore, combining the time zone chart and co-citation clustering view of employability skills could help identify more specific research pathways and pinpoint literature requiring intensive reading, enabling further research and deeper analysis.

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