Available online at www.CivileJournal.org

Civil Engineering Journal

(E-ISSN: 2476-3055; ISSN: 2676-6957)

Vol. 11, No. 11, November, 2025

Review Article

Agile Project Management for Sustainable Construction: A Systematic and Thematic Literature Review

Ahmad M. Zamil [1*], Mohammad Alhusban [2]

[1] *Marketing Department, College of Business Administration, Prince Sattam bin Abdulaziz University, Al-Kharj 16278, Saudi Arabia.*

[2] *Department of Civil Engineering, Middle East University, Amman 11831, Jordan.*

Received 08 September 2025; Revised 18 October 2025; Accepted 23 October 2025; Published 01 November 2025

Abstract

This study aims to explore the implementation of Agile Project Management (APM) in Sustainable Construction Projects (SCPs) to identify thematic trends, challenges, and enablers shaping agile adoption in the construction industry. The objective of this review is to determine how agile principles improve collaboration, adaptability, and sustainability outcomes. A systematic review of 104 scholarly articles published between 2006 and 2025 was performed using the PRISMA protocol to ensure rigour and transparency. Thematic analysis was conducted with NVivo and ATLAS.ti to code, visualise, and validate evolving patterns across the literature. The analysis revealed five major themes: iterative planning, responsiveness to change, stakeholder collaboration, digital facilitation, and sustainability integration. These results reveal that agile principles significantly contribute to sustainable construction by improving adaptability, decision-making, and communication processes, in spite of barriers such as organisational resistance and policy constraints. The integrative use of NVivo and ATLAS.ti improved depth and methodological reliability through cross-validation of themes. The novelty of this review lies in its dual-software thematic framework and its demonstration of how agile practices can transform sustainability-orientated construction management. It provides methodological and practical insights for researchers and practitioners aiming to embed agility in sustainable development goals.

Keywords: Agile Project Management; Sustainable Construction Project; Thematic Visualization Models; Regional Analysis of Literature; Thematic Contribution to Agile Project Management.

1. Introduction

The increasing international commitment to sustainable development has transformed how construction projects are conceived, evaluated and delivered. In response to increasing environmental pressures, sustainable construction projects (SCPs) have evolved as essential pathways for minimising ecological footprints, optimising material and energy efficiency and improving long-term socio-economic outcomes [1, 2]. These projects are inherently complex, involving multiple stakeholders, dynamic regulatory requirements and evolving sustainability goals. Conventional project management methods- typically linear, plan-driven and hierarchical- have often proven inadequate for managing this complexity, resulting in limited flexibility, stakeholder disengagement and inefficient adaptation to change [3, 4]. Thus, there is a growing shift concerning more adaptive management paradigms that align better with the iterative and uncertain nature of sustainable construction.

Agile project management has evolved as one such paradigm capable of tackling these challenges. Originating in software engineering, APM emphasises flexibility, continuous stakeholder engagement, and iterative value delivery-

* Corresponding author: am.zamil@psau.edu.sa

http://dx.doi.org/10.28991/CEJ-2025-011-11-024

principles that resonate strongly with the sustainability agenda [5, 6]. Over time, agile practices have diffused into non-software sectors, including engineering and construction, providing a promising framework for improving responsiveness, collaboration and innovation in sustainable building environments. Conversely, while interest in APM within construction is quickly increasing, existing evidence remains scattered, with inconsistent definitions, varied methodological rigour and fragmented insights into its effectiveness and contextual adaptation [7, 8].

Even though the existing literature has examined the integration of agile project management (APM) into non-software domains, their focus has largely been fragmented across different themes, including team collaboration, sustainability reporting and cost optimisation [9, 10]. Few studies have systematically analysed how agile frameworks, including Scrum, Kanban and Lean, can be holistically adapted to the sustainability objectives of construction projects. Existing literature [5, 11-13] tends to emphasise either the theoretical underpinnings of agile principles or project efficiency outcomes, with limited exploration of contextual barriers, stakeholder dynamics and technological enablers such as IoT and BIM. Additionally, research in developing nations, especially in Africa and Asia, remains under-represented, leading to a geographic and methodological bias that limits global generalisability [14, 15]. This review, therefore, addresses these shortcomings by conducting a structured thematic review that synthesises the dispersed body of literature to uncover converging insights, adoption barriers and evolving best practices in APM for sustainable construction. By integrating ATLAS.ti and NVivo analyses, the study not only improves methodological rigour and validation but also offers a comprehensive framework to identify conceptual empirical gaps, contributing to a more comprehensive understanding of how agile principles can advance sustainability in the construction sector.

1.1. Theoretical Approach of the Present Study

The theoretical foundation of this review is built on the Agile-Sustainability Integration Framework, which synthesises principles from Agile Project Management (APM) and Sustainable Construction Project (SCP) theories [16, 17]. This framework is underpinned by systems thinking and organisational learning theory, highlighting iterative adaptation, stakeholder collaboration and feedback-driven improvement as catalysts for sustainable performance [18, 19]. It posits that the agility of project processes – manifested through flexibility, continuous iteration, and cross-functional teamwork – improves the environmental, social, and economic dimensions of project sustainability [5, 20]. Likewise, the study integrates Value Management (VM) principles to reinforce alignment between agile practices and lifecycle value optimisation [21, 22]. Together, these theoretical lenses offer a comprehensive structure for understanding how agile methodologies can improve sustainability outcomes by fostering innovation, resilience and responsiveness in complex construction environments.

1.2. Rationale for the Review

Sustainable construction projects (SCPs) are characterised by iterative planning cycles, multidisciplinary collaboration, and stringent ecological performance standards that need adaptive management approaches [23, 24]. These characteristics closely align with agile value delivery. Despite this conceptual alignment, much of the literature on Agile Project Management (APM) in construction remains theoretical or anecdotal, with limited systematic analysis of how agile frameworks are operationalised in practice [23-26]. The lack of a comprehensive synthesis hinders understanding of what drives successful adoption, what barriers persist and how outcomes vary across project contexts and regions.

Furthermore, empirical studies primarily concentrated on isolated case applications in developed economies, leaving significant knowledge gaps regarding adoption in developing regions where sustainability issues are most acute [27, 28]. Likewise, there is limited exploration of how emerging digital tools- e.g., building information modelling (BIM) and internet of things- intersect with agile techniques to improve project sustainability outcomes [29, 30]. Therefore, this review responds to these deficiencies by conducting a rigorous thematic literature analysis that consolidates fragmented evidence, identifies recurring adoption patterns and assesses contextual enablers and constraints. Through the combined use of NVivo and ATLAS.ti for data coding and validation, the study provides both methodological innovation and substantive insights into how agile principles can be leveraged systematically in the construction industry.

1.3. Why Agile in Sustainable Construction Project?

Agile Project Management (APM) is based on principles articulated in the agile manifesto, stressing interactions and individuals over tools and processes, working solutions over comprehensive articulation, client collaboration over contract negotiation, and responding to change over following a plan [31, 32]. These guidelines are not compatible with the dynamic needs of sustainable construction projects, though they might, in fact, be essential for success. Sustainable building projects (SBPs) often deal with sprouting customer needs, sustainability certifications (e.g., Green Star, BREEAM, or LEED), frequent design iterations, and regulatory compliance [33].

Agile presents a framework that is both responsive and adaptive, making it well-suited for these situations. In addition, the social and environmental objectives in SBPS need iterative feedback loops and the involvement of

stakeholders, further justifying the application of agile practices [34, 35]. Likewise, building projects also face unique difficulties, e.g., physical constraints, safety and legal regulations, and protracted supply chain elements not typically found in software development. This difficulty underscores the significance of context-specific adaptations of agile approaches, making it essential to systematically examine how these applications have been implemented in SBPs across diverse circumstances [36].

1.4. Thematic Analysis: A Methodological Significance

Given the complex and interdisciplinary nature of both agile project management (APM) and sustainable building, the thematic analysis offers a strong methodological procedure for distilling patterns over different studies [37, 38]. Thematic analysis enables researchers to identify, analyse and report themes (patterns) within data, making it especially significant in synthesising large volumes of the existing literature. Unlike meta-analysis, which needs quantitative consistency, thematic analysis can accommodate epistemological and methodological diversity often found in construction analysis [39, 40]. In this paper, thematic analysis was employed to categorise and code data across various dimensions, comprising applied agile approaches, addressed sustainability dimensions, roles of stakeholders, difficulties encountered, success metrics, and contextual factors. This procedure enables a nuanced understanding of how agile principles are operationalised in sustainable construction and what impacts they produce.

1.5. Justification for the Use of NVivo and ATLAS.ti

To perform the thematic analysis, two tools for qualitative data analysis – NVivo and ATLAS.ti – were used to ensure analytical vigour, methodological triangulation, and tool-based cross-validation of insights. ATLAS.ti is famous for its powerful network views and semantic linking abilities. It enables researchers to visualise thematic linkages, track code co-occurrences, and create conceptual frameworks using graphical crossing points [41, 42]. This is particularly vital in exploring multifaceted relationships between agile principles, sustainability goals, and project results. [42, 43],

NVivo, on the other hand, excels in managing data and query-based searches. Its auto-coding capabilities, node structuring, and matrix coding queries enable the extraction of structured themes and comparisons across literature sources [44, 45]. It is also exceptionally robust in analysing mixed-method data and enables integration with survey results, secondary sources (e.g., this review), and interview transcripts, which is beneficial while dealing with multidisciplinary literature. Thus, using both tools in tandem, this study leverages the strengths of each. The joint application improves reliability through the cross-verification of themes and offers a deeper understanding through compound analytical lenses [46, 47]. In addition, the methodological comparison of ATLAS.ti and NVivo contributes to construction management by illustrating that digital tools can support literature reviews, an area that has received limited attention to date.

1.6. Scope and Objectives

This review focuses on peer-reviewed published journal articles and conference papers published from 2006 to 2025 that examine the application of agile approaches within the context of sustainable construction. Thus, this review aims to answer the following questions:

i. What agile approaches are being used in sustainable building projects (SBPs), and how are they operationalised?

ii. What are the major patterns and themes emerging from the literature on agile implementation in SCPs?

iii. What enablers and challenges affect the integration of agile in SBPs?

iv. How do NVivo and ATLAS compare in terms of analytical depth and utility for thematic literature reviews in this area?

By providing answers to these questions, this review will contribute to both academic literature and practical guidance for project managers, policymakers, and sustainability consultants engaged in the construction sector. The selected period (2006-2025) captures significant methodological and conceptual shifts in agile project management (APM) and its integration into sustainable construction. Around 2006, agile practices began extending beyond software into engineering and construction contexts, coinciding with the rise of Lean-Agile and Sustainable Project Management paradigms [48, 49]. The subsequent years saw a methodological expansion, with growing use of qualitative tools (e.g., ATLAS.ti and NVivo) and mixed-method reviews for APM research. The endpoint, 2025, represents the most current phase of conceptual development, highlighting digital transformation, sustainability frameworks and AI-driven project analytics in agile-driven construction [50, 51]. Thus, this timeframe effectively encompasses the evolution from foundational agile methodologies to contemporary sustainable and data-integrated practices.

1.7. Review Structure

The remaining parts of the paper are organised as follows: Section 2 delineates the methodology, specifying the selection criteria, data sources, and coding framework. Section 3 summarises the thematic findings obtained from both NVivo and ATLAS.ti analyses. Section 4 presents a discussion of results comprising significant implementation challenges of agile project management in sustainable building projects. Section 5 concludes with suggestions for future research and a reflection on the qualitative data analysis (QDA) tools in construction management research. Building on these identified gaps and conceptual linkages, this review adopts a systematic and thematic approach [52, 53] to assess how agile project management (APM) is applied within the context of sustainable construction projects (SCPs). The study highlights methodological transparency and analytical rigour by integrating both the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol and dual qualitative data analysis tools – NVivo and ATLAS.ti [54-56]. This triangulated technique ensures a comprehensive assessment of the literature, allowing the identification of dominant themes, contextual variations and methodological patterns across multiple studies [57, 58]. In doing so, the review advances both substantive and methodological knowledge by relating the analytical capacities of NVivo and ATLAS.ti in handling interdisciplinary complex data. Therefore, the next section details the systematic review process, outlining the search strategy, inclusion criteria, data extraction procedures, and coding framework that strengthen the thematic synthesis of APM implementation in sustainable construction projects.

2. Review Methodology

Agile project management (APM) and sustainable construction projects (SCP) are strategic techniques for improving construction projects' efficiency and quality. APM centres on improving project value via optimising resources, ensuring efficiency, benefits, and operability. However, SCP is a comprehensive approach that incorporates sustainability-orientated activities at all construction project phases, seeking to improve projects' quality and client satisfaction. APM and SCP can drive construction practices' sustainability and high-quality projects, even though their integration poses exclusive challenges that require alignment with implementation strategies.

Thus, APM and SCP are increasingly employed in construction to increase cost-effectiveness, optimisation of resources, life cycle thinking, engaging stakeholders, creativity and innovation, risk management, and regulatory compliance for overall construction sustainability. Therefore, this review employed a model design since integrating the various aspects of APM and SCP is challenging due to the APM and SCP phases concerning sustainable construction (see Figure 1).

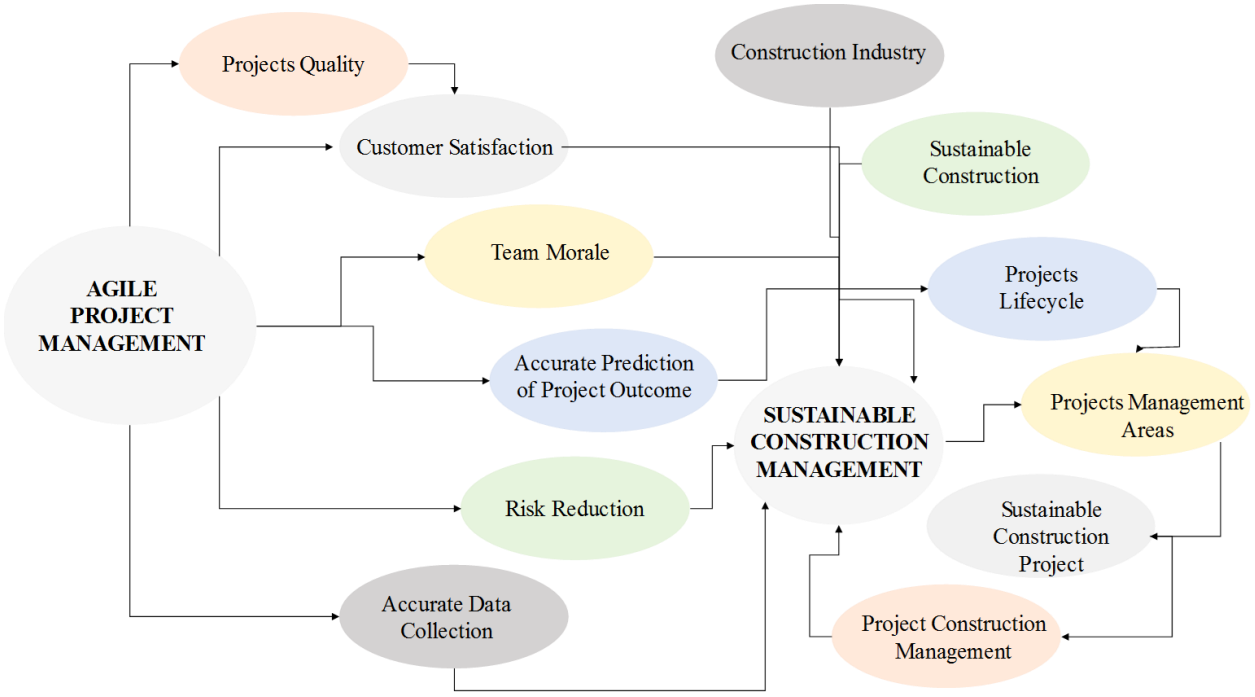

Figure 1. Theoretical Structure for Agile Project Management and Sustainable Construction Project

The initial review method has been embraced by preceding studies [59-61]. The guiding research question for this review is: How does the implementation of Agile Project Management facilitate Sustainable Construction Projects? Databases including Web of Science, ScienceDirect, Scopus, PubMed, ERIC, JSTOR, and IEEE were explored on 20/04/2025 using Figure 1 to articulate search terms and literature scrutiny as exemplified in Figure 1. The search was restricted to articles published in English and accessible from 2006 to 2025 (Table 1).

Table 1. Search terms employed to query the databases

S/no.	Terms Classification	Terms used for searching
1	APM and SCP, Quality Improvement	Communication and Collaboration, Flexibility and iterative planning, stakeholder involvement, feedback loops, continuous enhancement, and integration of sustainable quality metrics.
2	APM and SCP, Customer Satisfaction.	Quality of artistry, timely delivery, stakeholder involvement, responsiveness to change, value for money.
3	APM and SCP boost team morale.	Transparent communication, collaborative culture, empowered teams, adaptability and flexibility, and continuous feedback.
4	APM and SCP predict project outcome with accuracy.	Team collaboration, stakeholder engagement, resource efficiency, adaptability to change, risk management, and resource efficiency.
5	APM and SCP reduce risk in an agile environment.	Stakeholder collaboration, iterative planning, continuous feedback, transparent communication, and cross-functional teams.
6	APM and SCP, accurate data collection	stakeholder involvement, collaboration efficiency, resource optimisation, iterative planning, feedback loops, and environmental compliance.

Agile Project Management (APM) and Sustainable Construction Projects (SCPs) are two management principles that operate synergistically to improve project outcomes in the building industry. APM establishes a culture of excellence by improving all the participants in continuous enhancement processes [62, 63]. This improves quality standards, reduces defects, and improves customer satisfaction. VM emphasises maximising and identifying the value of a project through cost analysis, time, and quality compromises [64, 65]. It encourages innovative thinking to realise the best possible outcome within budget limitations. When joined, APM and SCP create a potent project management approach [66, 67]. APM ensures that projects are implemented with high quality, though SCP improves the resource allocation to achieve the best value for the investment. This collaborative effort leads to more cost-effective, efficient, and successful building projects, as indicated by Figure 1. APM offers the foundation for consistency and quality, whereas SCP ensures that the project offers maximum value to the client [68, 69].

The Boolean positional operators ('AND00, OR00, SAME00, WITH00, 'ADJ00) were employed to search the literature concerning Agile Project Management (APM) and Sustainable Construction Projects (SCP) in the construction industry to categorise and appropriately select the relevant literature [59-61]. Choosing a paper requires authentication of APM and SCP. Studies on different APM and SCP approaches and their application in construction were considered appropriate if the APM and SCP approaches were depicted. About 99,800 potential papers were recognised, plummeting to 4,087 based on accessibility and suitability. Lastly, one hundred and four (104) articles were selected for this review based on the criteria abridged in Figure 2.

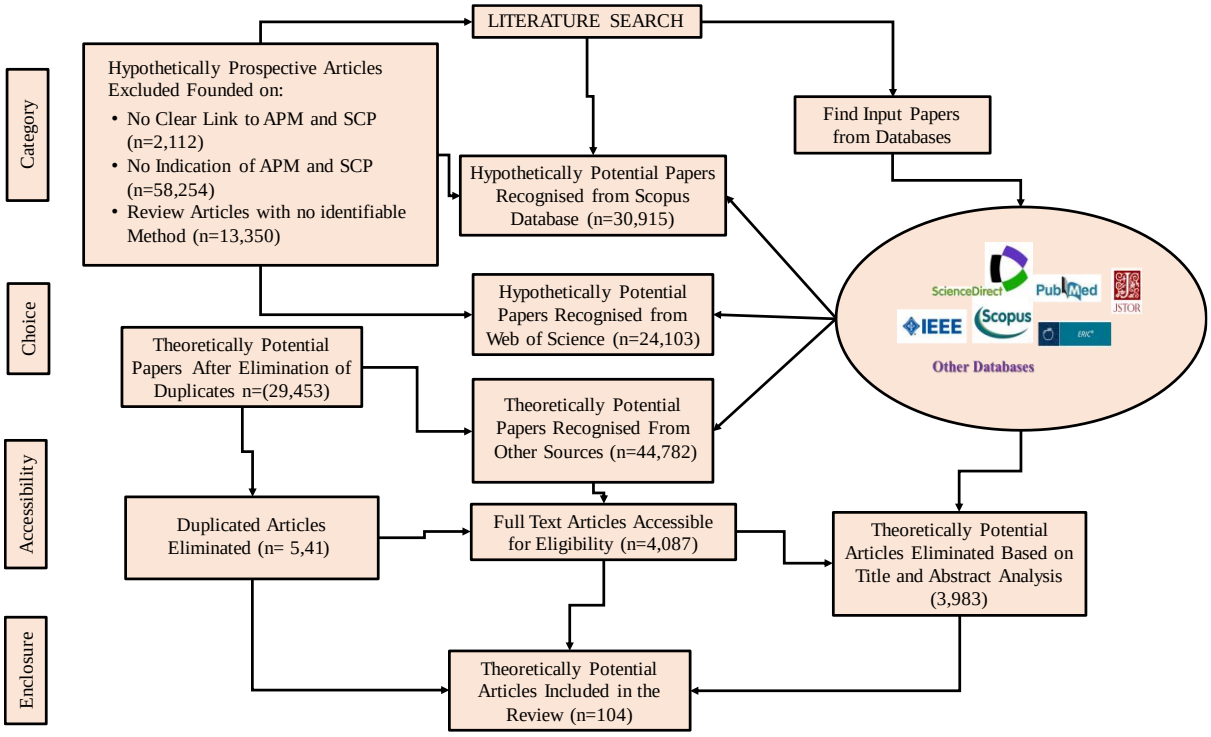

Figure 2. PRISMA chart showing literature assortment and addition process

Figure 2 shows a literature search process, indicating stages of identifying and choosing suitable relevant manuscripts, starting with a comprehensive search and reducing the pool of potential papers via different criteria.

This procedure ensures a rigorous and systematic literature review approach, resulting in a comprehensive and focused analysis.

3. Thematic Literature Analysis Using ATLAS.ti and NVivo

This review used an integrative qualitative data analysis method using NVivo (v14) and ATLAS (v23) to assess ad synthesis themes from one hundred and four peer-reviewed articles on Agile project management (APM) and sustainable construction projects (SCP). The dual-scale qualitative data platform method was employed to leverage the robustness of each software in analysing large-scale qualitative data, guaranteeing comprehensive thematic extraction, pattern visualisation, and code comparison.

The literature was initially identified systematically using PRISMA guidelines, choosing articles from databases including Scopus, WoS, ScienceDirect, and other sources such as IEEE, DOAJ, etc. (Figure 2), covering from 2006 to 2025. The final set of 104 papers was incorporated in ATLAS.ti for preliminary open coding. The ATLAS.ti was employed for its robust network visualisation and co-occurrence mapping abilities. Each paper was coded line-by-line to produce initial codes linked to agile approaches, sustainability objectives, adoption challenges, stakeholder engagement, and project results. Subsequently, the codes were grouped into wider categories via axial coding, showing connections between agile principles (including flexibility, iterative development, and collaboration) and sustainability supports (economic, social, and environmental).

The coded results were exported and further analysed using NVivo for theme refinement and triangulation. The matrix coding queries for NVivo, the cluster analysis function, and the word frequency queries were utilised to compare, validate, and refine evolving themes across the literature. The cross-validation aided detection of recurring patterns, evolving concepts, and frequency distributions of codes in different contexts. Hence, the integrative method improved the methodological firmness of the thematic analysis, ensuring thematic saturation, reliability, and a stronger interpretation of how APM is adopted in sustainable building. Likewise, it enabled the detection of nuanced gaps and upcoming research directions in the APM-SCP interface.

4. Results

4.1. Visual Representation of Keyword Frequencies

Figures 3-a and 3-b present comparative word cloud visualisations produced by ATLAS.ti and NVivo, respectively, to illustrate keyword frequencies obtained from literature focused on Agile Project Management (APM) in Sustainable Construction Projects (SCP) [70, 71]. These depictions serve as qualitative analytical tools for detecting dominant themes, research priorities, and contracts. In Figure 3-a, the NVivo-produced word cloud highlights 'agile', 'project', 'management', and 'construction' as the most common terms, indicating a central focus on project implementation frameworks. The layout using NVivo tends to cluster connected keywords spatially, improving conceptual clustering (such as 'implementation', 'lean', 'framework', and 'sustainability') [72, 73]. This grouped density around core concepts indicates NVivo's robustness in revealing thematic emphasis and keyword relationships.

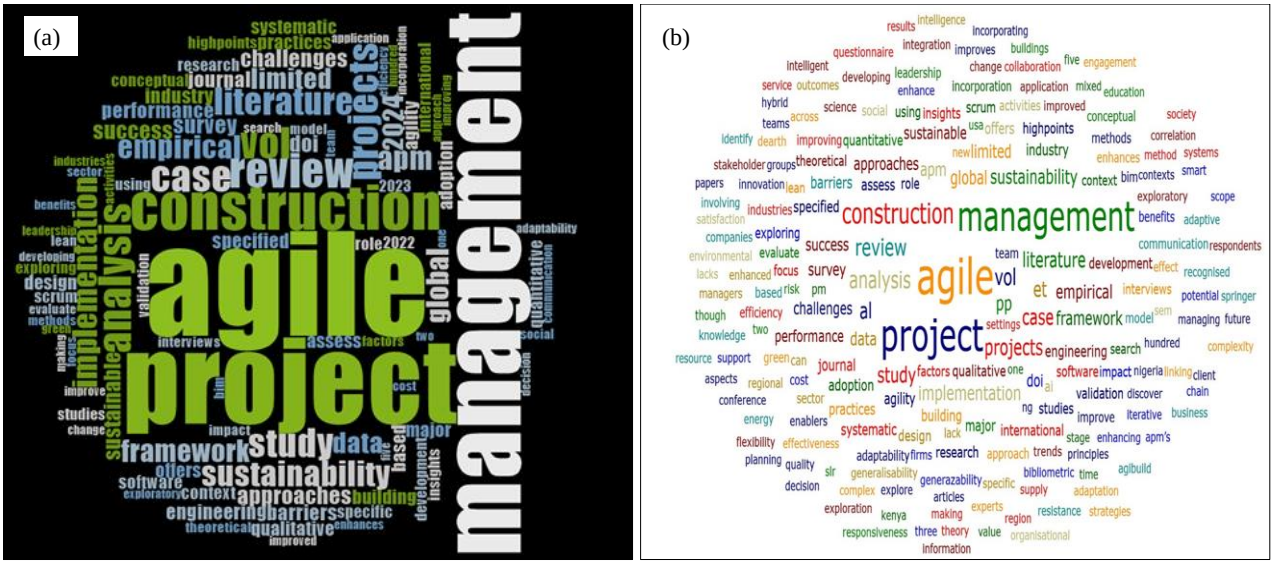

Figure 3. Visual representation of keyword frequencies in Agile Project Management and Sustainable Construction (a) NVivo and (b) ATLAS.ti. Word clouds

The bold colour contrast and large fonts visually accentuate term significance, making it easier to recognise the hierarchical significance. Additionally, NVivo's capacity to integrate frequency metrics in spatially weighted outlines illustrates its robustness in exploratory thematic mapping [74, 75]. Conversely, Figure 3-b – produced by ATLAS.ti – shows a more colour-diverse and dispersed word cloud. Keywords including 'management', 'agile', 'construction', and 'project' still dominate, though the spatial layout is more decentralised. This outline offers a wider surface-level view of the theoretical terrain without strong clustering, making it effective for picturing keyword diversity rather than thematic depth. The colour coding in ATLAS.ti is more visually appealing and varied and lacks the immediate semantic clustering NVivo offers. However, ATLAS.ti's integration of terms such as 'collaboration', 'green', 'adaptability' and 'complexity' indicates its sensitivity to nuanced concepts relevant in sustainable construction frameworks [76, 77].

Overall, NVivo appears more vigorous for detecting primary constructs and their theoretical groupings, while ATLAS.ti provides better visibility of term variety and peripheral themes [46, 47]. Scholars seeking thematic constructs and saturation centrality may prefer NVivo, while those aiming to map broader theoretical scope might opt for ATLAS.ti. Thus, integrating both tools can yield a more comprehensive qualitative insight. The word clouds showed that 'management', 'project', 'agile' and 'construction' dominate the literature, highlighting an intense research concentration on agile principles application in sustainable construction frameworks [46, 47].

The importance of terms such as 'framework', 'implementation' and 'sustainability' indicates an emphasis on effective integration and application. Moreover, words including 'lean', 'efficiency' and 'collaboration' imply a focus on team dynamics and resource optimisation. These insights underscore an increasing trend concerning adaptive, efficient project implementation methods in green construction [78-80], guiding upcoming research to assess stakeholder involvement, long-term sustainability, and policy framework outcomes in agile-based building schemes.

4.2. Thematic Visualization Models: ATLAS.it Conceptual Network vs. NVivo's Radial Structure

Figures 4-a and 4-b show models created using ATLAS.ti and NVivo, respectively, providing different analytical depictions of literature concerning Agile Project Management (APM) and Sustainable Construction Projects (SCPs). These tools are prominent in qualitative research but serve atypical interpretive and analytical purposes, especially in how they facilitate the synthesis, comparison, and organisation of multifaceted data [46, 81]. Figure 4-a, produced using NVivo, offers a radial thematic model typified by centralised core nodes surrounded by satellite sub-nodes. Each hub signifies a primary outward connection to specific subthemes and references derived from the literature. The strength of this model lies in its accessibility and clarity; it enables direct thematic breakdown and allows quick detection of the diversity and number of sources coded under each theme. In contrast, NVivo's model is relatively descriptive and linear [46, 82]. However, it failed to emphasise interconnections between themes or the depth of conceptual interdependencies, which can limit explanatory richness in multifaceted reviews.

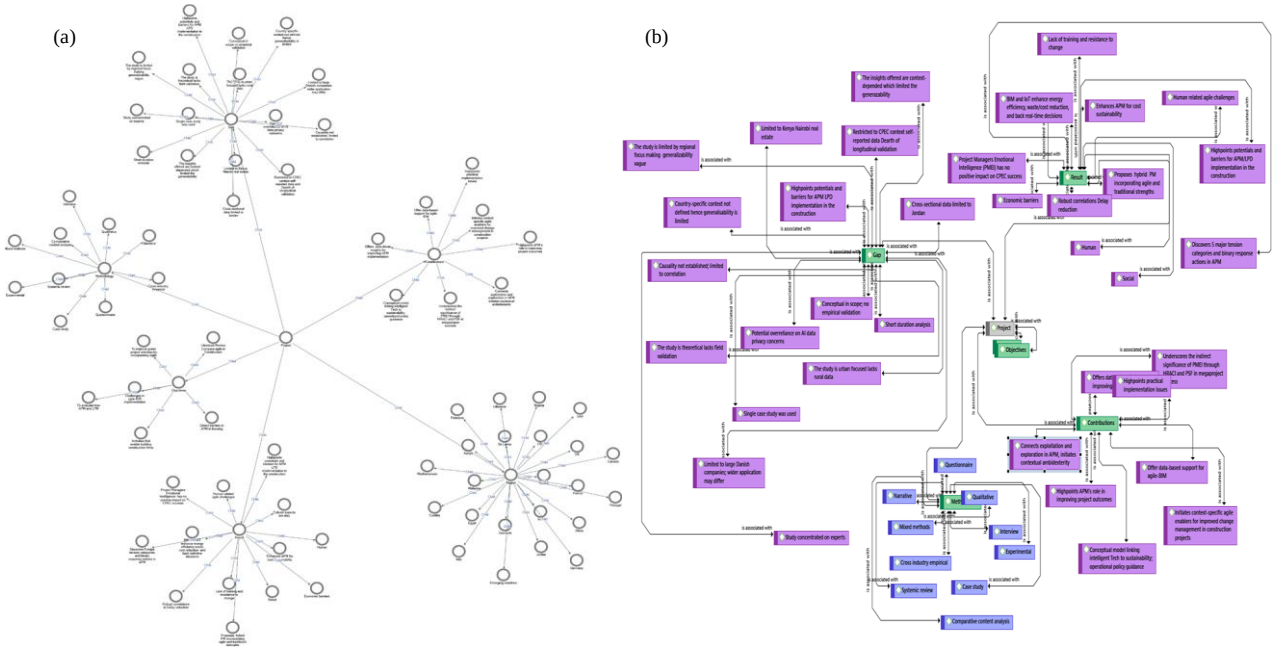

Figure 4. ATLAS.it's Conceptual Network vs. NVivo's Radial Structure

Figure 4-b, created with ATLAS.ti, indicates a highly interlinked theoretical network. This model incorporates themes including 'Contributions', 'Project Objectives', 'Methodological Gaps', and 'Limitations' using a web of layered and directed link nodes. Unlike NVivo, ATLAS.ti highlights rational logic, indicating how, for instance, empirical limitations impact methodological selections or how thematic contributions intersect with recognised gaps [42, 83]. The

utilisation of colour coding, directional arrows, and accompanying phrases (e.g., 'is linked with') makes it especially effective for theoretical mapping and theory building. This model emulates the structure of argumentative writings, allowing researchers to visualise cause-effect pathways, thematic intersections, and research knowledge gaps [84, 85].

Thus, NVivo's Figure 4(a) is best for structured literature synthesis and thematic coding, while ATLAS.ti's Figure 4(b) excels in complex theoretical integration and exploration. The NVivo model provides coding transparency and simplicity, whereas the ATLAS.ti model. The model supports depth, critical assessments, and the evolution of nuanced conceptual insights, particularly valuable in multidisciplinary settings, e.g., APM in sustainable construction projects [86].

4.3. Representation of Study Objectives NVivo and ATLAS.ti Models Compared

Figures 5-a and 5-b present a comparative picture of study objectives on Agile Project Management (APM) in the construction research, using ATLAS.ti and NVivo, respectively. Each tool provides a unique conceptual and structural representation of qualitative insights, mirroring diverse analytical capabilities and interpretive strengths [71, 87]. Figure 5-a is produced using NVivo and follows a node-based radial structure. The central node called 'Objectives' links to six child nodes, each representing a different objective obtained from the literature. These comprised 'To improve green project activities by integrating Agile,' 'Detect Barriers to APM', 'Activities that Enable Building Construction Companies' and 'To assess how LPM (lean project management) and APM operate.

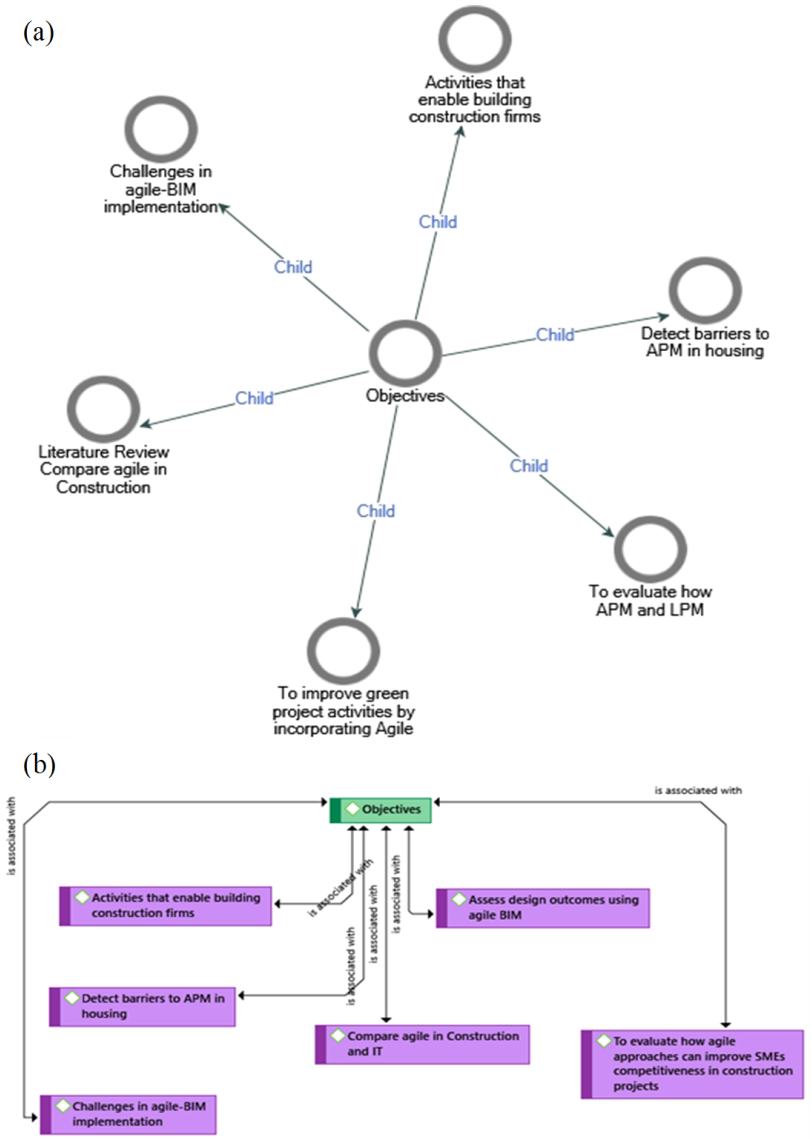

Figure 5. Representation of study Objectives (a) NVivo Model and (b) ATLAS.ti Model

The straightforwardness of NVivo's model makes it especially effective for presenting objectives in a sparkling, hierarchical form, ideal for thematic coding and content arrangement [88, 89]. The connections are labelled as 'Child', reinforcing the parent-theme structure. However, NVivo does not indicate cross-linkages or interdependencies among objectives. It also lacks depth in illustrating how these objectives can conceptually affect or overlap with one another, which can limit the interpretive richness in complex systematic reviews or theory-driven research.

Figure 5-b, produced by ATLAS.ti, offers a more consistent and relational map of the same set of objectives. Although maintaining the central objective node, it maps various layers of connections via bidirectional arrows called 'is associated with' [90, 91]. The ATLAS.ti chart not only incorporates objectives analogous to NVivo (e.g., 'Activities that enable building companies' and 'Detect barriers to APM in housing') but also extends the theoretical reach by introducing nuanced nodes, including 'To assess design outcomes via agile BIM' and 'Assess how agile methods can enhance SMEs' competitiveness'.

This widens the academic value and scope by illustrating how objectives relate to each other over distinct domains, e.g., IT, SME development, sustainability, and design enhancement. The ATLAS.ti model supports deeper reflection by allowing researchers to imagine how one objective may inform another, hence fostering a systems-thinking viewpoint [92, 93]. Therefore, NVivo is more suitable for a clear, grouped representation of study objectives and initial thematic design [94, 95], while ATLAS is not. It is robust for elaborating interlinked relationships, providing a more integrated, multidimensional viewpoint. For studies requiring a robust conceptual framework or the generation of hypotheses, ATLAS.ti presents a more advanced option [42, 96]; NVivo likewise is beneficial for structured thematic clarity and code-based analysis. Both figures' depictions are complementary, offering a comprehensive understanding of how objectives are conceptually aligned and structured within Agile and Sustainable Construction analysis.

4.4. Regional Analysis of Literature in the Context of Agile Project Management in Sustainable Construction

Figures 6-a and 6-b present visual comparisons of the regional dispersion of literature sources used in the thematic analysis of agile project management (APM) in sustainable construction projects (SCP), utilising ATLAS.ti and NVivo, respectively. These charts offer insights into the geographical concentration of research contributions, which is important for understanding the contextual applicability, diversity, and generalisability of results in the literature. Figure 6-a, created by NVivo, depicts a node-based hierarchical model. The central node called 'Region' twigs out to 25 child nodes, each indicating a country or regional concentration, e.g., Canada, Nigeria, Malaysia, Global, the UK, and developing nations. The format provides a structured and clear overview of the geographical dispersion, making it easier to quantify the number of studies per region. Conversely, though it highlights the presence of literature from both developing and developed nations, it does not clearly depict relationships among regional contexts or thematic overlaps between them [97, 98]. NVivo's outline here is suitable for preliminary regional grouping and coding, though it lacked the dynamic depiction of thematic interactions between regions.

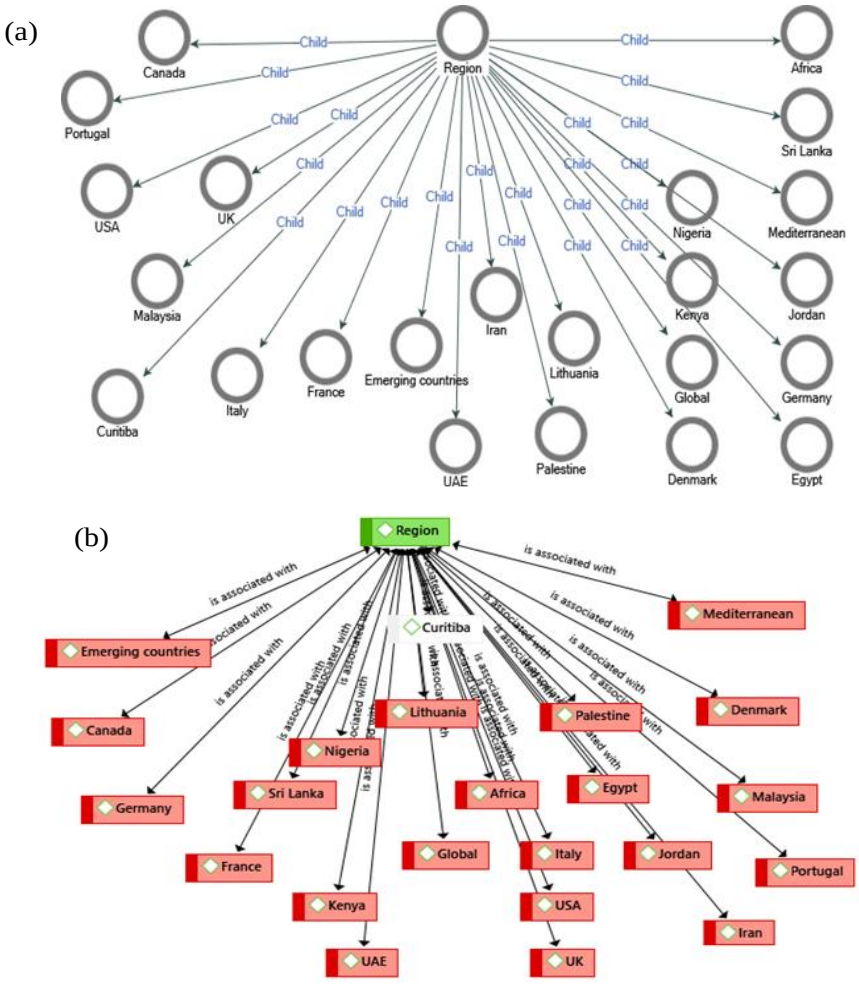

Figure 6. Regional Literature Sources (a) NVivo and (b) ATLAS.ti

However, Figure 6-b, created by ATLAS.ti, builds a relational network around the 'region' node. This model not only enumerates regional literature sources but also highlights interrelationships through labelled arrows, including 'is associated with' [81, 99]. The ATLAS.ti model is more theoretically dense, indicating how different regions are linked contextually; for instance, how 'developing nations', 'Sri Lanka', 'Africa' and 'Nigeria' can share practices or challenges in APM application.

Likewise, it highlights thematic groups, suggesting, for example, that research from Nigeria and Kenya tends to concentrate on local innovations and barriers, whereas studies from the USA and the UK contribute more theoretical frameworks and project methods. This increases the depth of comparative regional analysis, revealing not just where studies originate but how they inform the broader discourse.

Relating this to the literature 'exploring the implementation of APM in SCPs, both tools contribute unique value. NVivo supports quantitative content arrangement and a macro-level geographic synopsis [100, 101], whereas ATLAS.ti allows qualitative relational analysis to discover regional dynamics, contextual relevance, and knowledge gaps [42, 81]. The joint application of these tools enables researchers to capture more comprehensive insights into regional diversity in APM implementation – important for modelling context-specific policy, capacity-building, and framework approaches in both the global south and the global north. Therefore, the regional mapping in Figure 6 highlights the geographical thematic depth and breadth of existing research and validates the need for a hybrid software approach to assess global patterns of APM in sustainable construction comprehensively.

4.5. Methodological Styles for Agile Project Management Application in Sustainable Construction

Figures 7-a and 7-b depict the theoretical arrangement of methodologies for analysing qualitative data using software, particularly ATLAS.ti and NVivo, respectively [46, 102]. These charts are critical to the proposed thematic analysis of the literature on the assessment of APM in SCP. Figure 7-a NVivo visually depicts 'Methodology' as a significant node with different 'Child' nodes splitting out, comprising Case Study, Cross-industry Empirical, Comparative Content Analysis, Interview, Experimental, Narrative, Mixed Methods, Qualitative, Systematic Review, and Questionnai re. This hierarchical depiction illustrates NVivo's ability to classify and arrange different research methodologies recognised in the literature [46, 102].

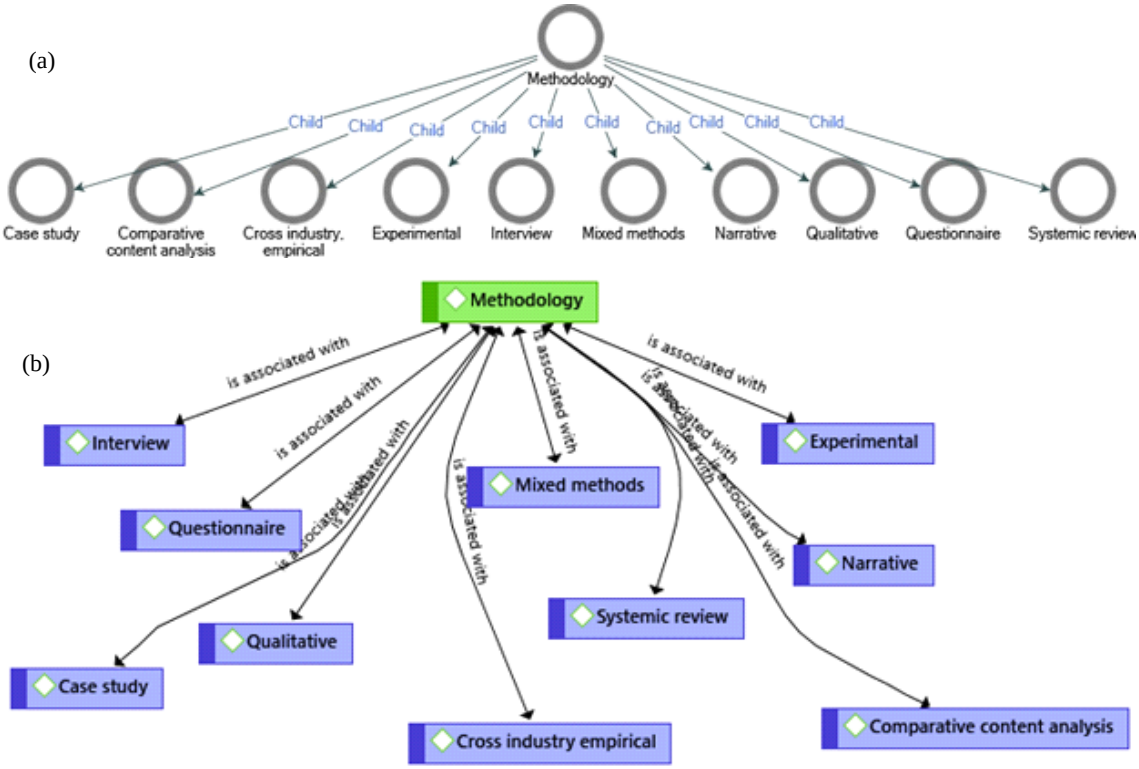

Figure 7. Methodological Styles for APM Implementation in Sustainable Construction

For narrative and systematic reviews on agile in sustainable construction, this enables researchers to code and classify articles based on the preliminary methodology used, enabling a comparative analysis of results across various research designs. For instance, studies using the 'case study' method on a particular sustainable construction project adopting agile can be simply differentiated from those using a 'questionnaire' to survey industry experts. Figure 7-a, created by ATLAS.ti, presents a comparable mapping, where 'Methodology' 'is associated with' different research methods,

including questionnaire, interview, case study, qualitative, systematic review, mixed methods, narrative, experimental and comparative content analysis [103, 104].

The 'is associated with' links underscore how ATLAS.ti enables the establishment of correlations among concepts. In the context of assessing APM applications in SCP, this feature could be priceless for thematic analysis [81]. Researchers might code segments of text from literature with particular methodologies and assess how challenges, insights, or best practices related to agile applications vary or converge across these methodological techniques [105, 106].

For example, themes evolving from 'systematic reviews' can underscore overarching trends, whereas those from case studies or qualitative studies might offer rich, in-depth narratives of real-world agile implementation in sustainable construction. Both ATLAS.ti and NVivo, as depicted in these charts, provide robust tools for coding [46, 58], arranging, and analysing contextual data from a large body of literature, ensuring a comprehensive and rigorous thematic review that could effectively identify best practices, challenges, and benefits.

5. Thematic Analysis of Agile Project Management Implementation in Sustainable Construction

Figures 8-a and 8-b depict the thematic results of a literature analysis using ATLAS.ti and NVivo, respectively, which are highly relevant to assessing the APM application in SCPs [107, 108]. These charts showcase the significant relationships and themes derived from the literature, providing insights into the challenges, benefits, and proposed solutions for incorporating agile into sustainable construction.

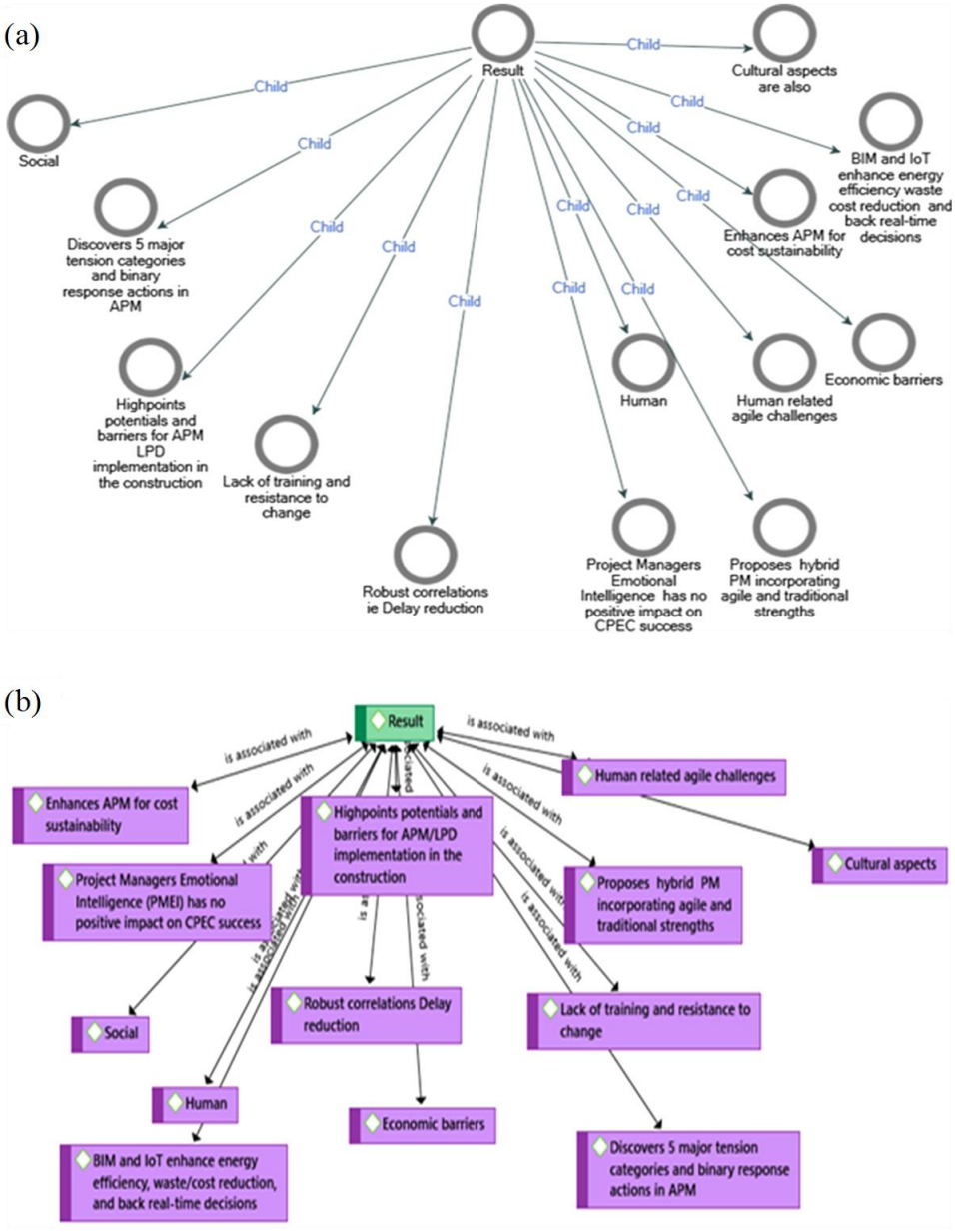

Figure 8. Thematic Map and Network Diagram of Literature results (a) NVivo and (b) ATLAS.ti

5.1. Thematic Insights and Clusters from the Literature

Figure 8-a shows a hierarchical tree map from NVivo that visually classifies the 'Result' of the literature review into various major themes. These comprise 'Social Aspects,' 'Cultural Aspects,' 'Economic Barriers,' 'Human,' and specific results associated with 'IoT and BIM,' improving energy efficiency, reducing cost/waste, and supporting real-time decisions. Other important themes are 'Highpoints Barriers and Potentials of APM LPD Application in Construction,' 'Death of Training and Resistance to Change,' and robust relationships, i.e., 'Reduction in Delays.' The appearance of 'Discoverers Five-Major Tension Clusters and Double Response Actions in APM' and 'Project Emotional Intelligence Has No Positive Effect on CPEC Success' likewise points to more nuanced results. Moreover, the theme 'Proposes Hybrid PM Integrating Agile and Conventional Strengths' advocates a pragmatic method to bridging the gap between prevailing and innovative approaches [46, 47].

These thematic results highlight that the integration of agile project management (APM) in sustainable construction projects (SCPs) transcends procedural improvements, mirroring a systematic transformation of organisational culture, technological adaptation and stakeholder collaboration [109]. The identification of cultural and social aspects as dominant clusters reveals that sustainability-orientated agility depends largely on human and institutional behaviour instead of frameworks or tools alone [110, 111]. Training deficiencies and economic barriers, for example, expose the gap between theoretical understanding of agile principles and their practical operationalisation in construction settings, especially in developing economies [17, 112]. The inclusion of BIM and IoT within the results points to a paradigm shift toward digital sustainability, where smart technologies amplify agile responsiveness, improve monitoring precision and reduce waste generation.

In addition, the recurring theme of hybrid methodologies – blending agile with traditional project management – indicates that structure and flexibility must coexist to meet sustainability and compliance objectives [113, 114]. This resounds with earlier studies stressing that pure agile systems often falter in complex infrastructure settings. The results also align with the "iterative sustainability model", wherein feedback loops and adaptive learning improve social and environmental performance throughout project life cycles. Hence, this review shows that successful APM adoption in SCPs needs an ecosystem of supportive leadership, continuous learning and digital facilitation rather than isolated technical interventions.

The findings from the thematic analysis reveal that Agile Project Management (APM) in Sustainable Construction Projects (SCPs) represents a multidimensional framework that extends beyond process optimisation. The evolving themes – iterative planning, stakeholder collaboration, responsiveness to change, sustainability integration and digital facilitation- together highpoint that agility is an enabler of sustainability rather than an isolated project management philosophy. This study's results confirm that integrating agile practices facilitates adaptability to dynamic regulator, environmental and stakeholder demands- core principles within sustainable construction discourse.

A critical interpretation of the results underscores that cultural and social aspects play pivotal roles in agile implementation outcomes. Organisational culture and leadership commitment determine whether agile principles translate into tangible sustainability gains. The emphasis on "lack of training" and "resistance to change" shows the persistence of traditional project mindsets that hinder agile adoption, particularly in developing nations where hierarchical structures and policy stringency prevail. This aligns with the existing literature, e.g., Zakrzewska et al. [115], Kunda et al. [116] and Mageed [117], who observed that cultural inertia often undermines agile performance in non-software sectors.

Technological enablers, including building information modelling (BIM) and the Internet of Things (IoT), evolved as major accelerators of agile-based sustainability. Their integration fosters real-time monitoring, improves feedback loops and supports data-driven decision-making – key aspects of the "smart sustainability" paradigm. These results corroborate studies by Abdelalim et al. [118] and Dahanayake & Sumanarathna [119], which identified the synergy between digital tools and agile frameworks as critical for improving environmental efficiency and waste reduction.

Another crucial insight is the prominence of hybrid methodologies that combine structured control of traditional project management with the flexibility of agile frameworks. Such incorporation appears necessary in complex sustainable projects where compliance, stakeholder alignment and documentation remain critical. This supports the concept of "contextual ambidexterity" [120], where organisations balance exploration (innovation) with exploitation (efficiency) to achieve sustainable outcomes.

Overall, the discussion reinforces that APM adoption in SCPs is not a uniform process but a context-sensitive evolution needing leadership adaptability, cultural transformation and digital integration. The thematic intersections

identified through ATLAS.ti and NVivo substantiate that the success of agile approaches in sustainable construction relies on continuous learning, alignment and collaboration between sustainability goals and agile principles; thus, APM acts as both a methodological and strategic tool for achieving resilience, environmental performance and inclusivity in the construction sector.

These themes directly inform the increasing insights of agile applications in SCPs. For example, the 'Cultural' and 'Social' aspects clusters suggest that the organisational and human aspects are essential determinants of agile implementation success. 'Economic barriers' underscore 'economic barriers', whereas 'lack of training and resistance to change' signals major human challenges. The 'strong correlations', i.e., 'reduction of delay', highlight a concrete advantage of agile, aligning with efficiency objectives of sustainable construction projects. The addition of 'IoT and BIM' highlights the technological synergy that could facilitate agile activities in realising sustainable outcomes, including waste reduction and energy efficiency [103, 121].

5.2. Implications and Interrelationships for Agile in Sustainable Construction Projects

Figure 8-b shows a grid chart created by ATLAS.ti, which further clarifies the interrelationships among the thematic 'Results' and their relationships. The 'Results' node is connected centrally to all the identified themes, indicating how they contribute to the general understanding of agile application in sustainable construction projects [122, 123]. For instance, 'Highpoints barriers and potentials for LPD/APM application in the construction' is linked with several factors: 'Dearth of training and resistance to change', 'Human-linked agile barriers', and 'Financial barriers'. This explicitly shows that the challenges in implementing agile in construction projects, especially for sustainability, are complex and interconnected.

The relationship between 'IoT and BIM' improves the reduction of waste/cost and energy efficiency and supports real-time decisions with wider 'Results', underscoring how technological innovations could enable agile implementation and contribute to sustainable results [119, 124]. The explicit mention of 'proposes hybrid PM integrating traditional and agile strengths' is exceptionally substantial for sustainable construction, where the structured nature of old-style project management often coexists with the need for the flexibility of agile to tackle emerging sustainability needs and client feedback. This advocates that an unalloyed agile method cannot always be optimal or possible, and an integrated methodology might be more effective. The result is that 'Project Manager's Emotional Intelligence (PMEI)' has no positive effect on CPEC success' is a fantastic insight, possibly advocating that while emotional intelligence is generally cherished [125], its direct benefit on particular project success metrics in specific contexts can be less overshadowed or pronounced by other factors.

Thus, the insights from both Figures 8-a and 8-b highlight that the successful application of APM in SCPs is not merely a technical undertaking but instead a complex interplay of human factors, economic aspects and organisational culture, and technological incorporation. The thematic analyses, as depicted by Figures 8-a and 8-b, offer a rich basis for discussing benefits (e.g., improved efficiency via IoT/BIM, reduction of delays) [126, 127], challenges (e.g., human-related agile challenges, economic barriers, resistance to change) and potential solutions (e.g., hybrid PM techniques, tackling cultural aspects) in this area.

5.3. Thematic Contribution to Agile Project Management in Sustainable Construction Projects

Figures 9-a and 9-b depict the thematic contributions obtained from the analysed literature concerning the exploration of agile project management (APM) implementation in sustainable construction projects (SCPs), visualised via ATLAS.ti and NVivo [70, 71], respectively. These diagrams underscore the significant insights and advancements provided by prevailing literature, indicating how the field is progressing in understanding the incorporation of agile approaches in the field of sustainable construction. Figure 9-a-NVivo depicts 'Contributions' as a pivotal node splitting out to various 'Child' nodes, each representing a different contribution from the literature. These comprised:

- Provides data-driven insights for enhancing APM application [128, 129].
- Highlights the indirect significance of PMEI via PSF and HRACI in megaproject success [125].
- Provides data-based backing for agile-BIM [37, 130].
- Initiates context-based agile enablers for increased change management in building projects [131, 132].
- Highlights practical implementation problems and APM's role in increasing project outcomes [115, 133].
- Links exploration and exploitation in APM and initiates contextual ambidexterity [120, 134].
- Theoretical model connecting Sustainability to intelligent Tech, Operational policy guidance [16, 115].

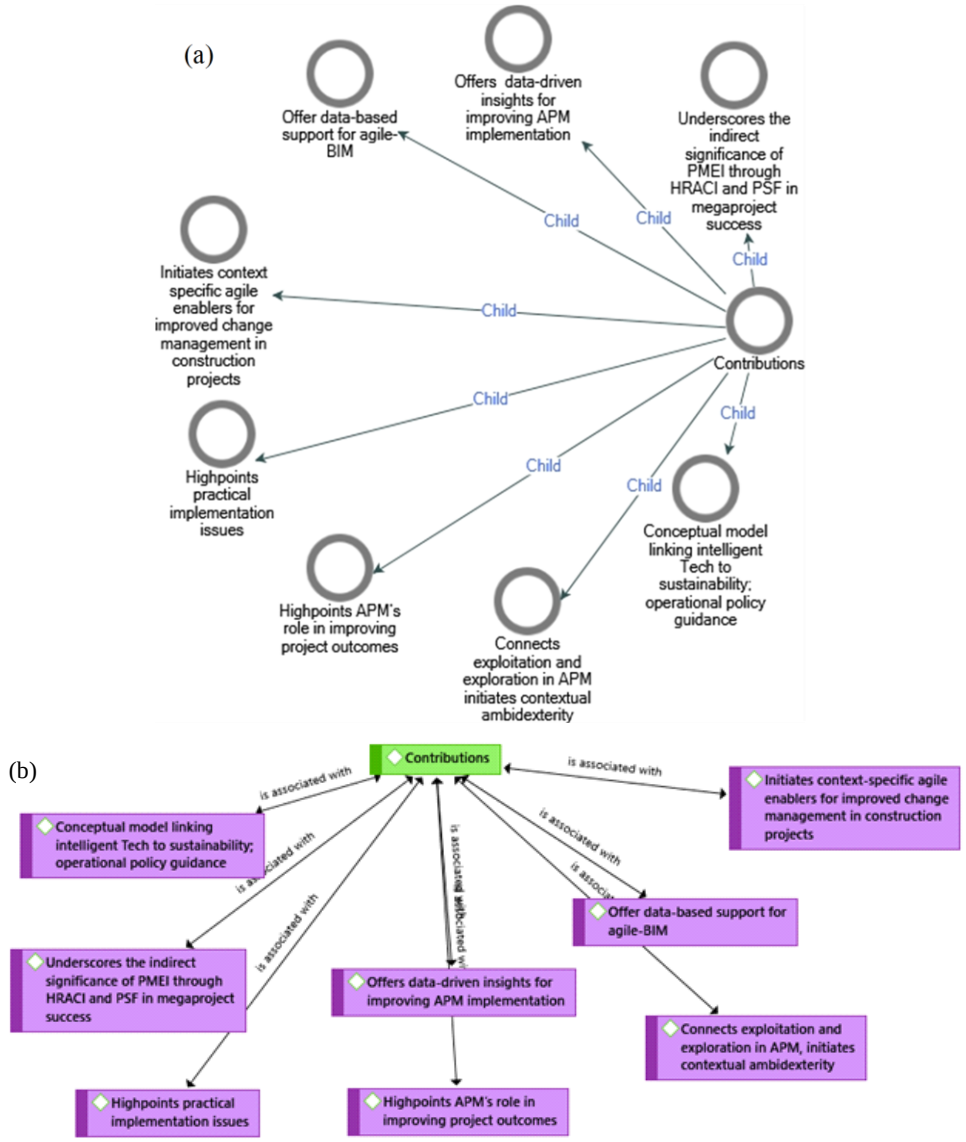

Figure 9. Thematic Contribution to Agile Project Management in Sustainable Construction Projects

The diverse range of contributions illustrates that the literature is not only detecting the challenges and benefits but also suggesting solutions and conceptual/theoretical frameworks. For example, the emphasis on agile-BIM and data-driven insights support shows a move concerning data-based and technologically improved agile applications [129, 135]. The concentration on 'context-specific agile enablers' suggests a recognition that agile implementation cannot be a one-size-fit-all approach, especially in a specific environment of sustainable construction projects [136, 137]. The underscoring of 'practical application problems' also shows a pragmatic approach in the literature, acknowledging real-world intricacies.

5.3.1. Comparative Analysis of Major Themes in Agile Project Management for Sustainable Building Projects

The present thematic review synthesises 104 studies to show that agile principles – when adapted to construction contexts – advance sustainable construction by enabling iterative planning, richer stakeholder collaboration and rapid responsiveness to change, purposeful sustainability incorporation and targeted digital facilitation. These conclusions align with earlier work that links lean/agile hybrids to improved delivery and stakeholder outcomes, while adding stronger methodological rigour through dual QDA (ATLAS.ti + NVivo) triangulation and PRISMA-based selection that enhances reproducibility.

Compared with the literature, this review confirms established results (e.g., hybrid agile-traditional models are often essential in construction; IoT/BIM are enablers) while refining them: the dual-tool coding reveals subtle regional and thematic clusters (e.g., cultural vs economic barriers) that many single-case empirical papers do not capture. Where the review diverges, it tempers universal claims – for instance, project manager emotional intelligence reveals context-dependent effects rather than uniformly positive impacts on megaproject metrics.

Practically, the comparison shows that the most defensible pathway is tailored hybridisation (select agile practices matched to site/regulatory realities) combined with investments in digital integration and targeted capacity building. Methodologically, the field requires longitudinal, multi-stakeholder, mixed-method and experimental studies to test causal links between agile adoption and sustainability KPIs; the present study's triangulated thematic maps supply a prioritised agenda and validated theme list for those empirical tests (see Table 2).

Table 2. Comparative analysis of Major Themes in Agile Project Management for Sustainable Building Projects

SN	Theme	Short Findings	Representative prior Study (from the literature)
1	Iterative Planning	Hybrid/ tailored iterative approaches improve adaptability on-site but require method tailoring for physical constraints.	Papadakis & Tsironis [138]
2	Stakeholder Collaboration	Agile increases stakeholder engagement and job – satisfaction in cross-functional teams; benefits scale with stakeholder inclusion.	Huck-Fries et al. [139]
3	Responsiveness to Change	Empirical agile studies show faster issue resolution and iteration, through evidence in construction is sparser that in software	Dybå & Dingsøyr [140]
4	Sustainability Integration	Critical success factors link agile adoption to lifestyle and resource-efficiency gains when sustainability metrics are embedded early.	Kineber [141]
5	Digital Facilitation (IoT/BIM)	IoT-BIM integration enables real-time decisions that lessen waste/energy use and operationalisation of agile feedback loops.	Abdelalim et al. [124] and Dahanayake & Sumanarathna [119]

Figure 10 (radar chart) visually summarises the five key themes identified in this review. It compares their relative importance based on the thematic analysis performed using NVivo and ATLAS.ti. The chart reveals high prominence of stakeholder collaboration, sustainability integration and digital facilitation (IoT/BIM), indicating the agile implementation in sustainable construction is most effective when it improves cooperation, embeds sustainability objectives, and leverages digital technologies. Iterative planning and responsiveness to change also rank strongly, reflecting agile adaptability to evolving sustainability and project requirements. Overall, the figure reinforces the study's conclusion that agile principles- especially collaboration, digital integration and continuous iteration- collectively advance sustainability performance and project resilience in the construction industry.

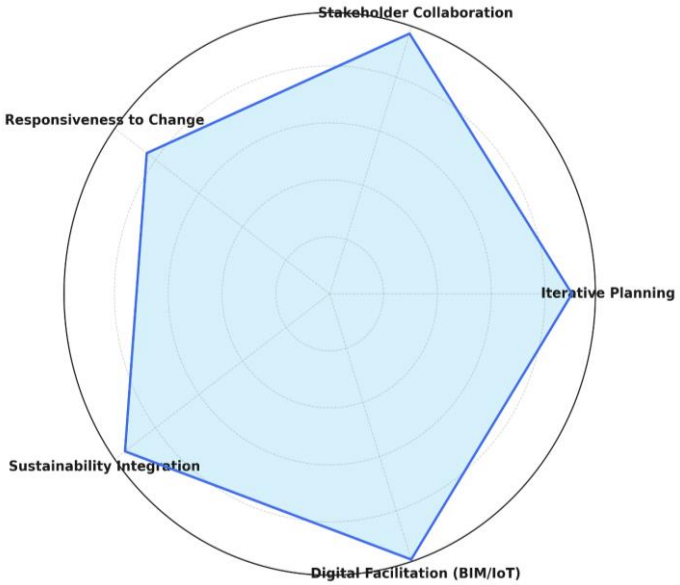

Figure 10. Comparative analysis of Major Themes in Agile Project Management for Sustainable Building Projects

The industry practitioners can operationalise the study's insights by embedding agile principles – iterative planning, stakeholder collaboration, digital facilitation (BIM/IoT) and sustainability integration – into project workflows [142, 143]. This involves forming multidisciplinary teams, using real-time digital monitoring tools and adopting hybrid management frameworks that balance flexibility with regulatory compliance [5, 144]. The reviewed literature shows measurable outcomes such as enriched energy efficiency, reduced construction waste, shorter delivery cycles and improved stakeholder satisfaction [5, 145]. Studies also report gains in project adaptability and decision accuracy through BIM-IoT integration, which enables continuous feedback and performance tracking [11, 124]. Jointly, these outcomes confirm that agile frameworks can enhance both sustainability performance and operational efficiency in the construction sector.

5.4. Strategic Implications and Linkages for Sustainable Construction Projects

Figure 9-b – ATLAS. It further clarifies the interconnections among these contributions, indicating how various aspects are 'associated with' each other, creating a richer needlepoint of knowledge [86, 146]. The pivotal

'Contributions' node is connected to all the identified themes, strengthening their collective effect in the field. For instance, 'offers data-driven insights for increasing APM application' is explicitly linked with 'Highpoint role in boosting project outcomes', indicating a clear causal connection that research is establishing. The theoretical model connecting intelligent technology to policy guidance and sustainability is a significant contribution [47, 147], signifying that the literature is not just descriptive but also prescriptive, providing frameworks for upcoming development.

The relationship between 'Underscores the undeviating importance of HRACI from PMEI and PSF in mega project success' and the wider contributions underscores more nuanced insights into leadership qualities in complex projects [125, 148]. Additionally, 'Connects exploration and exploitation in APM, initiates contextual ambidexterity' is a conceptual contribution that offers a framework for how agile teams can pursue efficiency simultaneously (exploitation) and innovation (exploration)—a critical balance for sustainable construction projects that need both innovative and optimised solutions for increased change management in building projects. It is especially valuable since it directly addresses a known challenge in the building industry. The interlinked contributions, as depicted by both software tools, jointly advance the understanding of how APM can be implemented effectively to improve sustainability in construction projects by providing insights, conceptual frameworks, and detecting essential success factors.

5.5. Unveiling Research Gaps in Agile Implementation in Sustainable Construction Projects

Figures 11-a- and 10-b critically underscore the 'Gap' in the accessible literature in relation to Agile Project Implementation (APM) in Sustainable Construction Projects (SCPs) as classified and depicted by ATLAS.ti and NVivo, respectively. These charts are important for identifying areas where upcoming research is needed to offer more robust and comprehensive insights on the subject. Figure 10-a-NVivo arranges the identified 'Gap' into many 'Child' nodes, indicating specific limitations of the literature. These comprised:

- Restricted to the CPEC context, self-reported data and lacked longitudinal validation, suggesting a dearth of long-term analyses and dependence on subjective data.
- Limited to specific nations' real estate and limited to large European firms' suggesting an organisational and geographical bias, which limits the generalisability of results.
- The existence of a 'single case study was used' indicates a lack of wider empirical proof.
- Methodological shortcomings are likewise apparent, e.g., 'Conceptual in scope nor empirical validation.
- The studies are theoretical and lack field validation, and causality is not established and is limited to correlation; all show a need for more rigorous, empirical-based research.
- Studies focused on experts suggest a narrow perspective, potentially overlooking insights from other stakeholders.
- There are concerns about 'potential overreliance on data privacy and country-specific AI context not being clear, hence limiting generalisability.
- Underscore the challenges related to contextual application and data, significant given the rise of AI in project management.
- Studies in urban settings lacked rural data, indicating a geographic data bias.

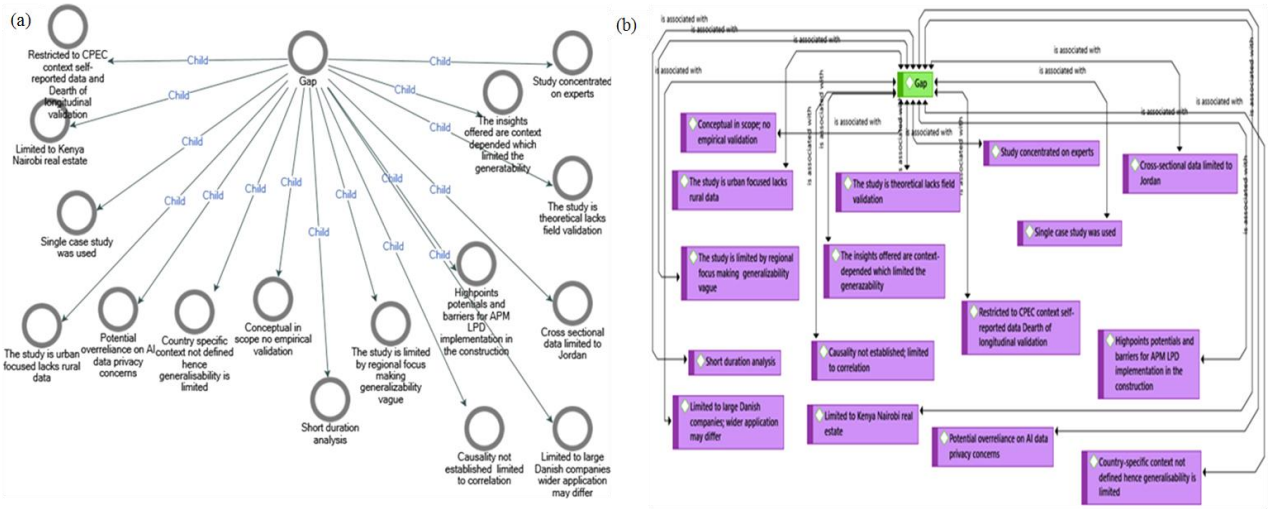

Figure 11. Research Knowledge Gaps (a) NVivo and (b) ATLAST.ti

5.6. Future Research Areas and Interconnected Limitations

Figure 11-b, ATLAS.ti, further explicates the interactions between the identified gaps, indicating how different limitations are 'associated with' one another, producing a complex web of research deficiencies. For example, 'The insights offered are context-dependent, which limited generalisation' is associated with numerous specific limitations such as 'Limited to a particular country's real estate' and 'A single case study was used', unswervingly linking the contracted scope of studies to their applicability. The relationship between 'Conceptual scope, no empirical validation' and 'The study is conceptual and lacks real-world testing.' The link between 'Causality not established, restricted to correlation' and the general 'Gap' signifies a critical need for research that can illustrate direct cause-and-effect associations between agile applications and sustainable construction outcomes instead of mere correlations.

The overall message conveyed by these figures is an explicit call for more diverse, empirically validated, and robust research. Upcoming studies on APM in SCP must aim to:

- Performed longitudinal analyses to collect data from a broader range of geographical contexts, e.g., rural areas and developing regions
- Integrate multiple case studies or bigger sample sizes and establish causal relationships via experimental or quasi-experimental designs.
- Engage a broader spectrum of stakeholders beyond just construction experts and explicitly define the contextual application of their results, particularly regarding AI integration.

Thus, addressing the aforementioned gaps will considerably increase insights and effective implementation of Agile for enhancing true SCPs.

6. Conclusion

This review systematically examined the implementation of agile project management (APM) within the sustainable construction projects (SCPs) using a rigorous thematic literature analysis of 104 peer-reviewed articles. The adoption of the PRISMA framework ensured methodological transparency and replicability in choosing and analysing studies. This structured approach facilitated the extraction of major themes reflecting the intersection of agility, sustainability and construction management. To improve analytical robustness, ATLAS.ti and NVivo were jointly applied for data coding and pattern identification, allowing triangulated insights and validation of results. Thematic analysis showed five dominant themes – iterative planning, stakeholder collaboration, change responsiveness, sustainability incorporation and digital facilitation – highlighting how agile methods transform construction practices by increasing adaptability, especially decision-making and sustainability-orientated project delivery. Overall, the results show that APM principles considerably improve sustainability outcomes by embedding innovation, flexibility and stakeholder engagement throughout project lifecycles. Conversely, persistent barriers, including skill gaps, cultural resistance and limited institutional support, continue to hinder effective integration. The integration of NVivo and ATLAS.ti with PRISMA established a replicable methodological framework for future reviews, strengthening qualitative synthesis in construction management research. Essentially, this review advances theoretical and practical understanding of APM's potential to operationalise sustainability goals in construction. Upcoming research must expand empirical validation via longitudinal, multi-contextual case studies and mixed-method approaches to establish causal links between agile practices and sustainable performance outcomes. By addressing these gaps, practitioners and scholars can enhance the adoption of agile frameworks that align with global sustainability agendas and improve resilience in the construction industry.

7. Declarations

7.1. Author Contributions

Conceptualization, A.M.Z. and M.A.; methodology, A.M.Z. and M.A; software, A.M.Z. and M.A validation, A.M.Z. and M.A; formal analysis, A.M.Z.; investigation, A.M.Z. and M.A; resources, A.M.Z. and M.A; data curation, A.M.Z. and M.A; writing—original draft preparation, A.M.Z. and M.A; writing—review and editing, A.M.Z. and M.A; visualization, A.M.Z. and M.A; supervision, A.M.Z. and M.A; project administration, A.M.Z. and M.A; funding acquisition, A.M.Z. All authors have read and agreed to the published version of the manuscript.

7.2. Data Availability Statement

Data sharing is not applicable to this article.

7.3. Funding

The authors extend their appreciation to Prince Sattam bin Abdulaziz University for funding this research work through the project number (PSAU/2024/01/31350).

7.4. Conflicts of Interest

The authors declare no conflict of interest.

8. References

[1] Ibrahım, U. M., & Labaran, Y. H. (2024). Cultivating Holistic Approaches To Sustainable Construction: Insights From the Real-World Projects. ArtGRID - Journal of Architecture Engineering and Fine Arts, 6(1), 121–150. doi:10.57165/artgrid.1382482.

[2] Mad Kaidi, H., Hassan, F. P., Mohammad, H., Ismail, N. A. A., & Hafreez Kamil, M. D. (2025). Enhancing Sustainable Development Practices in The Malaysian Construction Industry: Sustainable Built Environment, Sustainable Project Management, and Sustainable Construction. Built Environment Journal, 22(1), 105–123. doi:10.24191/bej.v22i1.905.

[3] Mikkelsen, M. F., Venable, J., & Aaltonen, K. (2021). Researching navigation of project complexity using action design research. International Journal of Managing Projects in Business, 14(1), 108–130. doi:10.1108/IJMPB-02-2020-0040.

[4] Verwijs, C., & Russo, D. (2023). A Theory of Scrum Team Effectiveness. ACM Transactions on Software Engineering and Methodology, 32(3), 1–51. doi:10.1145/3571849.

[5] Dugbartey, A. N., & Kehinde, O. (2025). Optimizing project delivery through agile methodologies: Balancing speed, collaboration and stakeholder engagement. World Journal of Advanced Research and Reviews, 25(1), 1237–1257. doi:10.30574/wjarr.2025.25.1.0193.

[6] Lee, H., & Seymour, M. (2023). Managing the Magic behind the Movies. ACAMP: The Applicability of Agile Project Management to the Visual Effects Industry, 5-8 December, 2023, Wellington, New Zealand.

[7] Mazzetto, S. (2024). Interdisciplinary Perspectives on Agent-Based Modeling in the Architecture, Engineering, and Construction Industry: A Comprehensive Review. Buildings, 14(11), 3480. doi:10.3390/buildings14113480.

[8] Arar, A. J., Poirier, E., & Staub-French, S. (2025). A research and development framework for integrated project delivery. Construction Management and Economics, 43(2), 85–112. doi:10.1080/01446193.2024.2390529.

[9] Žužek, T., Gosar, Ž., Kušar, J., & Berlec, T. (2020). Adopting Agile Project Management Practices in Non-Software SMEs: A Case Study of a Slovenian Medium-Sized Manufacturing Company. Sustainability, 12(21), 9245. doi:10.3390/su12219245.

[10] Rana, M. (2025). Integrating Agile Project Management and Lean Industrial Practices a Review for Enhancing Strategic Competitiveness in Manufacturing Enterprises. ASRC Procedia: Global Perspectives in Science and Scholarship, 1(1), 895–924. doi:10.63125/0yjss288.

[11] Van Tran, T., Van Vu Tran, H., & Nguyen, T. A. (2024). A Review of Challenges and Opportunities in BIM Adoption for Construction Project Management. Engineering Journal, 28(8), 79–98. doi:10.4186/ej.2024.28.8.79.

[12] Nahod, M. M. (2025). Unlocking Circularity in Construction via Agile Methods and BIM. Sustainability (Switzerland), 17(16), 7497. doi:10.3390/su17167497.

[13] Prakash, A., Maddulety, K., & Bhoola, V. (2024). Agile Project Management: An Empirical Exploration of Adoption Factors and Implementation Strategies Across Industries. IEEE Engineering Management Review. doi:10.1109/EMR.2024.3487291.

[14] Shamim, M. M. R. (2025). Maintenance Optimization in Smart Manufacturing Facilities: a Systematic Review of Lean, TPM, and Digitally-Driven Reliability Models in Industrial Engineering. American Journal of Interdisciplinary Studies, 6(1), 144–173. doi:10.63125/xwvaq502.

[15] Borges, D., Pinto, I., Santos, O., Moura, I., Ferreira, I. R., Macedo, A. P., & Taveira, A. (2025). On–Off Childhood? A Rapid Review of the Impact of Technology on Children's Health. Healthcare (Switzerland), 13(14), 1769. doi:10.3390/healthcare13141769.

[16] Ali, A., & Sameh, H. (2024). Developing a theoretical framework for enhancing green project approaches via Agile methodology. Scientific Reports, 14(1), 27786. doi:10.1038/s41598-024-78613-x.

[17] Elseknidy, M., Kineber, A. F., Oke, A. E., Elshaboury, N., Abunada, Z., Zamil, A., Alhusban, M., & Ilori, S. A. (2024). Identifying the agile project management implementation barriers for sustainable residential buildings. International Journal of Engineering Business Management, 16, 18479790241299630. doi:10.1177/18479790241299634.

[18] Chuah, C., Homer, S. T., & Loo, W. H. (2025). Mapping regenerative business: a conceptual framework building upon systems thinking in Southeast Asia. Asian Journal of Business Ethics, 1–29. doi:10.1007/s13520-025-00244-w.

[19] Xu, P. (2025). Institutionalizing Design Thinking in Public Sector Innovation: Comparative Insights from Singapore's Innovation Lab within a Global Context. doi:10.2139/ssrn.5371190.

[20] Gomes Silva, F. J., Kirytopoulos, K., Pinto Ferreira, L., Sá, J. C., Santos, G., & Cancela Nogueira, M. C. (2022). The three pillars of sustainability and agile project management: How do they influence each other. Corporate Social Responsibility and Environmental Management, 29(5), 1495–1512. doi:10.1002/csr.2287.

[21] Rodrigues Coelho, F. I., Bizarrias, F. S., Rabechini, R., Martens, C. D. P., & Martens, M. L. (2025). Strategic Alignment and Value Optimization: Unveiling the Critical Role of Project Portfolio Management for a Flexible Environment. Global Journal of Flexible Systems Management, 26(1), 209–224. doi:10.1007/s40171-024-00434-8.

[22] Tettey, D. J., Sunday, O. E., & Azumah, N. C. (2025). Agile Hybrid Methodologies for Complex Project Execution: Balancing Flexibility, Control, and Stakeholder Value Maximization. International Journal of Research Publication and Reviews, 6(3), 6190-6204.

[23] Toochukwu, A. C. (2025). Sustainable Construction Practices: Balancing Cost Efficiency, Environmental Impact, and Stakeholder Collaboration. International Research Journal of Modernization in Engineering Technology and Science, 7(1), 4118–4140. doi:10.56726/irjmets66703.

[24] El Hafiane, A., En-nadi, A., & Ramadany, M. (2025). Towards Sustainable Construction: Systematic Review of Lean and Circular Economy Integration. Sustainability (Switzerland), 17(15), 6735. doi:10.3390/su17156735.

[25] Jiang, X., Zhou, H., Li, M., Lu, K., Lyu, S., Omrani, S., & Skitmore, M. (2024). Sustainable construction projects management in the AEC industry: analysis and visualization. International Journal of Construction Management, 24(4), 384–399. doi:10.1080/15623599.2023.2257477.

[26] Yu, T., Shi, Q., Zuo, J., & Chen, R. (2018). Critical factors for implementing sustainable construction practice in HOPSCA projects: A case study in China. Sustainable Cities and Society, 37, 93–103. doi:10.1016/j.scs.2017.11.008.

[27] Zanello, G., Fu, X., Mohnen, P., & Ventresca, M. (2016). the Creation and Diffusion of Innovation in Developing Countries: a Systematic Literature Review. Journal of Economic Surveys, 30(5), 884–912. doi:10.1111/joes.12126.

[28] Olawumi, T. O., & Chan, D. W. M. (2022). Developing project evaluation models for smart sustainable practices implementation in construction projects: a comparative study between Nigeria and Hong Kong. Engineering, Construction and Architectural Management, 29(3), 1522–1552. doi:10.1108/ECAM-11-2020-0906.

[29] Chen, Y., Wang, X., Liu, Z., Cui, J., Osmani, M., & Demian, P. (2023). Exploring Building Information Modeling (BIM) and Internet of Things (IoT) Integration for Sustainable Building. Buildings, 13(2), 288. doi:10.3390/buildings13020288.

[30] Malagnino, A., Montanaro, T., Lazoi, M., Sergi, I., Corallo, A., & Patrono, L. (2021). Building Information Modeling and Internet of Things integration for smart and sustainable environments: A review. Journal of Cleaner Production, 312, 127716. doi:10.1016/j.jclepro.2021.127716.

[31] Issagaliyev, A. (2023). Investigation of the challenges of agile project management at Infineon Technologies. Master Thesis, Technische Hochschule Ingolstadt, Ingolstadt, Germany.

[32] Kalluri, R. (2022). A Human Factors Study of Risk Management of Complex Agile Scrum Projects in Large Enterprises. International Journal of Business & Management Studies, 3(8), 38–44. doi:10.56734/ijbms.v3n8a6.

[33] Karamoozian, M., & Zhang, H. (2025). Obstacles to green building accreditation during operating phases: identifying Challenges and solutions for sustainable development. Journal of Asian Architecture and Building Engineering, 24(1), 350–366. doi:10.1080/13467581.2023.2280697.

[34] Raja, P. (2025). Agile Project Management Tools for Successful Information Technology Projects. Master Thesis, University of Liberec, Liberec, Czech .

[35] Olufuwa, E. A. (2025). Leadership in agile teams and its impact on team performance. Master Thesis, Vilniaus Universitetas, Vilnius, Lithuania.

[36] Kunaka, C. (2010). Logistics in Lagging Regions. The World Bank, Washington, United States. doi:10.1596/978-0-8213-8649-1.

[37] Ng, P. L., Maqsood, T., Khalfan, M., & Rahmani, F. (2023). AgiBuild: A Scaled Agile Framework for Building Adaptation Projects †. Buildings, 13(12), 3019. doi:10.3390/buildings13123019.

[38] Dong, H., Dacre, N., Baxter, D., & Ceylan, S. (2024). What is Agile Project Management? Developing a New Definition Following a Systematic Literature Review. Project Management Journal, 55(6), 668–688. doi:10.1177/87569728241254095.

[39] Leary, H., & Walker, A. (2018). Meta-Analysis and Meta-Synthesis Methodologies: Rigorously Piecing Together Research. TechTrends, 62(5), 525–534. doi:10.1007/s11528-018-0312-7.

[40] Clarke, N. J., Willis, M. E. H., Barnes, J. S., Caddick, N., Cromby, J., McDermott, H., & Wiltshire, G. (2015). Analytical Pluralism in Qualitative Research: A Meta-Study. Qualitative Research in Psychology, 12(2), 182–201. doi:10.1080/14780887.2014.948980.

[41] Gupta, A. (2023). Discovering Themes in ATLAS.ti. Qualitative Methods and Data Analysis Using ATLAS.ti. Springer Texts in Social Sciences, Springer, Cham, Switzerland. doi:10.1007/978-3-031-49650-9_7.

[42] Ronzani, C. M., Da Costa, P. R., Da Silva, L. F., Pigola, A., & De Paiva, E. M. (2020). Qualitative methods of analysis: an example of Atlas.TITM Software usage. Revista Gestão & Tecnologia, 20(4), 284–311. doi:10.20397/2177-6652/2020.v20i4.1994.

[43] Konopásek, Z. (2007). Making thinking visible with Atlas.ti: Computer assisted qualitative analysis as textual practices. Historical Social Research, 32(SUPPL. 19), 276–298.

[44] Franzosi, R., Doyle, S., McClelland, L. E., Putnam Rankin, C., & Vicari, S. (2013). Quantitative narrative analysis software options compared: PC-ACE and CAQDAS (ATLAS.ti, MAXqda, and NVivo). Quality and Quantity, 47(6), 3219–3247. doi:10.1007/s11135-012-9714-3.

[45] Bifulco, F., Tregua, M., Amitrano, C. C., & D'Auria, A. (2016). ICT and sustainability in smart cities management. International Journal of Public Sector Management, 29(2), 132–147. doi:10.1108/IJPSM-07-2015-0132.

[46] Woods, M., Paulus, T., Atkins, D. P., & Macklin, R. (2016). Advancing Qualitative Research Using Qualitative Data Analysis Software (QDAS)? Reviewing Potential Versus Practice in Published Studies using ATLAS.ti and NVivo, 1994–2013. Social Science Computer Review, 34(5), 597–617. doi:10.1177/0894439315596311.

[47] Paulus, T., Woods, M., Atkins, D. P., & Macklin, R. (2017). The discourse of QDAS: reporting practices of ATLAS.ti and NVivo users with implications for best practices. International Journal of Social Research Methodology, 20(1), 35–47. doi:10.1080/13645579.2015.1102454.

[48] Moyano-Fuentes, J., & Sacristán-Díaz, M. (2012). Learning on lean: A review of thinking and research. International Journal of Operations & Production Management, 32(5), 551–582. doi:10.1108/01443571211226498.

[49] Núñez-Merino, M., Maqueira-Marín, J. M., Moyano-Fuentes, J., & Martínez-Jurado, P. J. (2020). Information and digital technologies of Industry 4.0 and Lean supply chain management: a systematic literature review. International Journal of Production Research, 58(16), 5034–5061. doi:10.1080/00207543.2020.1743896.

[50] Aradhyula, G. (2025). The security-first agile playbook: Embedding DevSecOps into program management practices. World Journal of Advanced Engineering Technology and Sciences, 16(3), 15–31. doi:10.30574/wjaets.2025.16.3.1313.

[51] Alorbany, A., Sheta, M., Hagag, A., Elshaarawy, M., Elharty, Y., & Fares, A. (2025). AI-Driven Electronic Health Records System for Enhancing Patient Data Management and Diagnostic Support in Egypt. arXiv Preprint, arXiv:2502.05603. doi:10.48550/arXiv.2502.05603.

[52] Bruce, J., & Mollison, J. (2004). Reviewing the literature: Adopting a systematic approach. Journal of Family Planning and Reproductive Health Care, 30(1), 13–16. doi:10.1783/147118904322701901.

[53] Balzani, A., & Hanlon, A. (2020). Factors that influence farmers' views on farm animal welfare: A semi-systematic review and thematic analysis. Animals, 10(9), 1–25. doi:10.3390/ani10091524.

[54] Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2009). Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ, 339, 2535. doi:10.1136/bmj.b2535.

[55] Moher, D., Liberati, A., Tetzlaff, J., & Altman, D. G. (2010). Preferred reporting items for systematic reviews and meta-analyses: The PRISMA statement. International Journal of Surgery, 8(5), 336–341. doi:10.1016/j.ijsu.2010.02.007.

[56] Mortelmans, D. (2025). Doing Qualitative Data Analysis with NVivo. Springer Nature, Cham, Switzerland. doi:10.1007/978-3-031-66014-6.

[57] Schlunegger, M. C., Zumstein-Shaha, M., & Palm, R. (2024). Methodologic and Data-Analysis Triangulation in Case Studies: A Scoping Review. Western Journal of Nursing Research, 46(8), 611–622. doi:10.1177/01939459241263011.

[58] Sankar, J. G., Darwish, D., & Valan, P. (2025). Evaluating Qualitative Data Analysis Tools. Evolving Designs, Applications, Technological Advances, and the Future of Qualitative Research, IGI Global, Hershey, United States. doi:10.4018/979-8-3373-4432-4.ch005.

[59] Evans, D. (2025). What is Value Management?: Explained? The Knowledge Academy Ltd. Available online: https://www.theknowledgeacademy.com/blog/what-is-value-management/ (accessed on November 2025).

[60] Wali, S. U., Alias, N., & Harun, S. B. (2020). Quality reassessment using water quality indices and hydrochemistry of groundwater from the Basement Complex section of Kaduna Basin, NW Nigeria. SN Applied Sciences, 2(10), 1742. doi:10.1007/s42452-020-03536-x.

[61] Wali, S. U., Alias, N., & Harun, S. B. (2021). Reevaluating the hydrochemistry of groundwater in basement complex aquifers of Kaduna Basin, NW Nigeria using multivariate statistical analysis. Environmental Earth Sciences, 80(5), 208. doi:10.1007/s12665-021-09421-z.

[62] Valmohammadi, C., & Roshanzamir, S. (2015). The guidelines of improvement: Relations among organizational culture, TQM and performance. International Journal of Production Economics, 164, 167–178. doi:10.1016/j.ijpe.2014.12.028.

[63] Ikhsannudin, M., & Pakpahan, P. L. (2021). Empowerment as A Quality Improvement Human Resources Through The Implementation of Total Quality Management. Nidhomul Haq: Jurnal Manajemen Pendidikan Islam, 6(1), 41–60. doi:10.31538/ndh.v6i1.1190.

[64] Sadis, A. M., Usman, K. S., & Mohammed, M. (2024). Evaluating the Implementation Efforts of Sustainable Value Management Strategies in Northern Nigeria. BIMA Journal Of Science And Technology Gombe, 8(2A), 74-82. doi:10.56892/bima.v8i2.661.

[65] Oke, A. E., & Aigbavboa, C. O. (2017). Sustainable Value Management for Construction Projects. Springer International Publishing, Cham, Switzerland. doi:10.1007/978-3-319-54151-8.

[66] Vijayabanu, C., Karthikeyan, S., & Vijay Surya, P. (2022). Total quality management practices and its impact on Indian construction projects. Organization, Technology and Management in Construction, 14(1), 2697–2709. doi:10.2478/otmcj-2022-0013.

[67] Oke, A. E., Stephen, S. S., & Aigbavboa, C. O. (2022). Value Management in South Africa. Value Management Implementation in Construction, 177–184, Emerald Publishing Limited, Leeds, United Kingdom. doi:10.1108/978-1-80262-407-620221015.

[68] Male, S., Kelly, J., Gronqvist, M., & Graham, D. (2007). Managing value as a management style for projects. International Journal of Project Management, 25(2), 107–114. doi:10.1016/j.ijproman.2006.09.001.

[69] Parumasur, S. B. (2013). The Importance of Teamwork, Continuous Top Management Support and Training in Bringing About TQM. Journal of Economics and Behavioral Studies, 5(9), 639–651. doi:10.22610/jebs.v5i9.437.

[70] Thipe, M. E. (2023). Minimizing Aberrations in Planned Power Plant Outage Projects. Master Thesis, University of Johannesburg, Johannesburg, South Africa.

[71] Payne, S., & Needham, C. (2024). The Purpose of Outsourcing for Automotive Manufacturing Managers. Open Journal of Business and Management, 12(5), 3284–3325. doi:10.4236/ojbm.2024.125165.

[72] Lobo Mesquita, L., Lizarelli, F. L., Duarte, S., & Oprime, P. C. (2022). Exploring relationships for integrating lean, environmental sustainability and industry 4.0. International Journal of Lean Six Sigma, 13(4), 863–896. doi:10.1108/IJLSS-09-2020-0145.

[73] Wijethilake, C., Upadhaya, B., & Lama, T. (2023). The role of organisational culture in organisational change towards sustainability: evidence from the garment manufacturing industry. Production Planning & Control, 34(3), 275–294. doi:10.1080/09537287.2021.1913524.

[74] Morse, W. C., Lowery, D. R., & Steury, T. (2014). Exploring Saturation of Themes and Spatial Locations in Qualitative Public Participation Geographic Information Systems Research. Society & Natural Resources, 27(5), 557–571. doi:10.1080/08941920.2014.888791.

[75] Rose, J., Low-Choy, S., Katz, I., & Homel, R. (2023). Enriching thematic analysis with clustering techniques: applying mixed analysis to interviews about big data linkage. Handbook of Mixed Methods Research in Business and Management, 310–327, Edward Elgar Publishing, Cheltenham, United Kingdom.. doi:10.4337/9781800887954.00029.

[76] Siddiquei, T. M. (2025). Exploring Challenges and Opportunities in Aligning Construction Projects with SDGs in Bangladesh. SSRN Electronic Journal, 1-121. doi:10.2139/ssrn.5092035.

[77] Morake, O., Meng, Q., Sampene, A. K., & Kyere, F. (2024). Influencing Factors and Promotion Strategies for the Adoption or Resistance of Prefabricated Buildings by Construction Companies in Botswana. Buildings, 14(11), 3556. doi:10.3390/buildings14113556.

[78] Borah, G. (2024). Emerging Trends in Smart Green Building Technologies. Heat Transfer Enhancement Techniques, 391–415, John Wiley & Sons, Hoboken, United States. doi:10.1002/9781394270996.ch18.

[79] Nwaogbe, G., Urhoghide, O., Ekpenyong, E., & Emmanuel, A. (2025). Green construction practices: Aligning environmental sustainability with project efficiency. International Journal of Science and Research Archive, 14(1), 189-201. doi:10.30574/ijsra.2025.14.1.0023.

[80] Heidari, M., Thangavel, S., Naamani, E. A., & Khashehchi, M. (2024). Emerging trends in smart green building technologies. Sustainable Technologies for Energy Efficient Buildings, CRC Press, Boca Raton, United States. doi:10.1201/9781003496656-15.

[81] Gupta, A. (2023). Qualitative Methods and Data Analysis Using ATLAS.ti. Springer Texts in Social Sciences, Springer International Publishing, Cham, Switzerland. doi:10.1007/978-3-031-49650-9.

[82] Alam, M. K. (2021). A systematic qualitative case study: questions, data collection, NVivo analysis and saturation. Qualitative Research in Organizations and Management: An International Journal, 16(1), 1–31. doi:10.1108/QROM-09-2019-1825.

[83] Vila-Henninger, L. A. (2019). Turning Talk into "Rationales": Using the Extended Case Method for the Coding and Analysis of Semi-Structured Interview Data in ATLAS.ti. BMS Bulletin of Sociological Methodology/ Bulletin de Methodologie Sociologique, 143(1), 28–52. doi:10.1177/0759106319852887.

[84] Paulus, T. M., & Lester, J. N. (2016). ATLAS.ti for conversation and discourse analysis studies. International Journal of Social Research Methodology, 19(4), 405–428. doi:10.1080/13645579.2015.1021949.

[85] Kimmel, M. (2012). Optimizing the analysis of metaphor in discourse. Review of Cognitive Linguistics, 10(1), 1–48. doi:10.1075/rcl.10.1.01kim.

[86] Aziz, N. D., Noor, N. N. M., Samsul, W., Hamdan, Z. W., & Hashim, H. The Influence of Empowerment Attribute on Leadership Competencies to the Intention of BIM Adoption in Malaysian Facilities Management Industry: NCT Technique Via ATLAS.ti Software. International Journal of Academic Research in Business and Social Sciences, 13(11), 2576-2588. doi:10.6007/IJARBSS/v13-i11/19733.

[87] de Matos Pinto, R. T. A. (2021). Improvement of Project Lines Coordination: A Case Study of Automotive R&D Innovation Master Thesis, Universidade do Minho, Braga, Portugal.

[88] Michael, P., Luke, D., & Robinson, O. (2025). An encounter with death: a comparative thematic and content analysis of naturalistic DMT experiences and the near-death experience. Frontiers in Psychology, 16. doi:10.3389/fpsyg.2025.1532937.

[89] González Canché, M. S. (2022). Mapping, Organizing, and Visualizing Interdependent Events (MOVIE): A rigorous analytic framework and cost-free software application designed to model temporal and dynamic complex realist structures in social research settings. Methodological Innovations, 15(3), 263–288. doi:10.1177/20597991221119012.

[90] Friese, S. (2022). Qualitative Data Analysis with ATLAS.ti. Sage Publications, Thousand Oaks, United States. doi:10.4135/9781529799590.

[91] Botts, N., Thoms, B., Noamani, A., & Horan, T. A. (2010). Cloud Computing Architectures for the Underserved: Public Health Cyberinfrastructures through a Network of HealthATMs. 43rd Hawaii International Conference on System Sciences, 1–10. doi:10.1109/hicss.2010.107.

[92] Sonnier, E., & Grit, A. (2022). A narrative for circular economy in Cities: Conditions for a Mission-Oriented innovative system. City and Environment Interactions, 16, 100084. doi:10.1016/j.cacint.2022.100084.

[93] Eidin, E., Bielik, T., Touitou, I., Bowers, J., McIntyre, C., Damelin, D., & Krajcik, J. (2024). Thinking in Terms of Change over Time: Opportunities and Challenges of Using System Dynamics Models. Journal of Science Education and Technology, 33(1), 1–28. doi:10.1007/s10956-023-10047-y.

[94] Maher, C., Hadfield, M., Hutchings, M., & de Eyto, A. (2018). Ensuring Rigor in Qualitative Data Analysis: A Design Research Approach to Coding Combining NVivo With Traditional Material Methods. International Journal of Qualitative Methods, 17(1), 1609406918786362. doi:10.1177/1609406918786362.

[95] Nowell, L. S., Norris, J. M., White, D. E., & Moules, N. J. (2017). Thematic Analysis: Striving to Meet the Trustworthiness Criteria. International Journal of Qualitative Methods, 16(1), 1609406917733847. doi:10.1177/1609406917733847.

[96] Rambaree, K. (2013). Three methods of qualitative data analysis using ATLAS.ti: 'A Posse Ad Esse'. In ATLAS.ti User Conference 2013, 12-14 September, 2013, Berlin, Germany.

[97] Burgis-Kasthala, S., Bain-Donohue, S., Tailby, E., Stonestreet, K., & Moore, M. (2024). Developing interconnectedness is critical in retaining rural general practitioners: A qualitative thematic analysis of recently recruited general practitioners to South East New South Wales, Australia. PLOS Global Public Health, 4(3), 2860. doi:10.1371/journal.pgph.0002860.

[98] Smyth, R. (2006). Exploring Congruence between Habermasian Philosophy, Mixed-Method Research, and Managing Data Using NVivo. International Journal of Qualitative Methods , 5(2), 131–145. doi:10.1177/160940690600500204.

[99] Hidalgo, C., Ther, F., Saavedra, G., & Díaz, A. (2015). Affordance of landscapes and economic socio-spatial networks in the quinchao archipelago, Chile: A contribution to landscape research and island studies. Island Studies Journal, 10(1), 49–70. doi:10.24043/isj.320.

[100] Windle, A., Javanparast, S., Freeman, T., & Baum, F. (2023). Factors that influence evidence-informed meso-level regional primary health care planning: a qualitative examination and conceptual framework. Health Research Policy and Systems, 21(1), 99. doi:10.1186/s12961-023-01049-8.

[101] Zeng, H., & Yang, L. (2022). The Innovation and Development Path of Cultural and Creative Industries in Anhui Province, China: Nvivo12-Based Policy Text Analysis. Computational Intelligence and Neuroscience, 6202746. doi:10.1155/2022/6202746.

[102] Niedbalski, J., & Ślęzak, I. (2017). Computer Assisted Qualitative Data Analysis Software. Using the NVivo and Atlas.ti in the Research Projects Based on the Methodology of Grounded Theory. Computer Supported Qualitative Research. Studies in Systems, Decision and Control. Springer, Cham, Switzerland. doi:10.1007/978-3-319-43271-7_8.

[103] Smit, B. (2021). Introduction to ATLAS.ti for Mixed Analysis. The Routledge Reviewer's Guide to Mixed Methods Analysis. Routledge, Milton Park, United kingdom. doi:10.4324/9780203729434-28.

[104] Choe, Y., Lee, J., & Lee, G. (2022). Exploring Values via the Innovative Application of Social Media with Parks Amid COVID-19: A Qualitative Content Analysis of Text and Images Using ATLAS.ti. Sustainability (Switzerland), 14(20), 13026. doi:10.3390/su142013026.

[105] Huck-Fries, V., Nothaft, F., Wiesche, M., & Krcmar, H. (2023). Job satisfaction in agile information systems development: A stakeholder perspective. Information and Software Technology, 163, 107289. doi:10.1016/j.infsof.2023.107289.

[106] Gall, M., & Pigni, F. (2022). Taking DevOps mainstream: a critical review and conceptual framework. European Journal of Information Systems, 31(5), 548–567. doi:10.1080/0960085X.2021.1997100.

[107] Ahmad Ibrahim, S. R., Yahaya, J., & Sallehudin, H. (2022). Green Software Process Factors: A Qualitative Study. Sustainability (Switzerland), 14(18), 11180. doi:10.3390/su141811180.

[108] Mamatlepa, M. C., & Mazenda, A. (2024). Building project management tools and techniques capacity to drive Information and Communications Technology projects in the Department of Social Development, South Africa. Information Development, 02666669241264740. doi:10.1177/02666669241264740.

[109] Huzooree, G., & Yadav, M. (2025). Sustainable project management and organizational resilience. In Enhancing Resilience in Business Continuity Management. IGI Global Scientific Publishing. doi:10.4018/979-8-3693-8809-9.ch005.

[110] Rubio-Andrés, M., & Abril, C. (2024). Sustainability oriented innovation and organizational values: a cluster analysis. Journal of Technology Transfer, 49(1), 1–18. doi:10.1007/s10961-022-09979-1.

[111] DiBella, J., Forrest, N., Burch, S., Rao-Williams, J., Ninomiya, S. M., Hermelingmeier, V., & Chisholm, K. (2023). Exploring the potential of SMEs to build individual, organizational, and community resilience through sustainability-oriented business practices. Business Strategy and the Environment, 32(1), 721–735. doi:10.1002/bse.3171.

[112] Ribeiro, F. L., & Fernandes, M. T. (2010). Exploring agile methods in construction small and medium enterprises: A case study. Journal of Enterprise Information Management, 23(2), 161–180. doi:10.1108/17410391011019750.

[113] Özener, O. Ö., & Büyüktopcu, E. (2025). Agile-hybrid delivery approaches for complex design and engineering projects: an integrated case study. Smart and Sustainable Built Environment, 1–34. doi:10.1108/SASBE-04-2024-0125.

[114] Bindal, A. (2024). Balancing Tradition and Innovation: Hybrid Project Management in Banking and Finance. Tec Empresarial, 6(2), 162–177.

[115] Zakrzewska, M., Piwowar-Sulej, K., Jarosz, S., Sagan, A., & Sołtysik, M. (2022). The linkage between Agile project management and sustainable development: A theoretical and empirical view. Sustainable Development, 30(5), 855–869. doi:10.1002/sd.2285.

[116] Kunda, D., Mulenga, M., Sinyinda, M., & Chama, V. (2018). Challenges of Agile development and implementation in a developing country: A Zambia case study. Journal of Computer Science, 14(5), 585–600. doi:10.3844/jcssp.2018.585.600.

[117] A Mageed, I. (2025). Issues and Challenges in Transforming Management Practices through Agility. Systemic Analytics, 3(2), 91–111. doi:10.31181/sa32202546.

[118] Abdelalim, A. M., Shawky, K., Alnaser, A. A., Shibeika, A., & Sherif, A. (2024). Developing Standard BIM Execution Plans for Complex Construction Projects. Applied Sciences (Switzerland), 14(15), 6614. doi:10.3390/app14156614.

[119] Dahanayake, K. C., & Sumanarathna, N. (2022). IoT-BIM-based digital transformation in facilities management: a conceptual model. Journal of Facilities Management, 20(3), 437–451. doi:10.1108/JFM-10-2020-0076.

[120] Binci, D., Cerruti, C., Masili, G., & Paternoster, C. (2023). Ambidexterity and Agile project management: an empirical framework. TQM Journal, 35(5), 1275–1309. doi:10.1108/TQM-01-2022-0011.

[121] Mortelmans, D. (2019). Analyzing Qualitative Data Using NVivo. The Palgrave Handbook of Methods for Media Policy Research. Palgrave Macmillan, Cham, Switzerland. doi:10.1007/978-3-030-16065-4_25.

[122] Sary, C. K., Adda, H. W., & Rossanti, N. P. E. (2024). Navigating change: agile leadership implementation in local government of Palu City. Manajemen Dan Bisnis, 23(2), 351. doi:10.24123/mabis.v23i2.797.

[123] Granzotto Llagostera, E., Khaled, R., & Sinervo, K. (2025). Tracing Research Through Design with Ponte: bridging game development repositories and qualitative research tools. Proceedings of the 20th International Conference on the Foundations of Digital Games, 1–10. doi:10.1145/3723498.3723821.

[124] Abdelalim, A. M., Essawy, A., Alnaser, A. A., Shibeika, A., & Sherif, A. (2024). Digital Trio: Integration of BIM–EIR–IoT for Facilities Management of Mega Construction Projects. Sustainability (Switzerland), 16(15), 6348. doi:10.3390/su16156348.

[125] Haider, S. A., Tehseen, S., Koay, K. Y., Poulova, P., & Afsar, B. (2024). Impact of project managers emotional intelligence on megaprojects success through mediating role of human related agile challenges: Project management as a moderator. Acta Psychologica, 247, 104305. doi:10.1016/j.actpsy.2024.104305.

[126] Ehab, A., Mahdi, M. A., & El-Helloty, A. (2024). BIM Maintenance System with IoT Integration: Enhancing Building Performance and Facility Management. Civil Engineering Journal, 10(6), 1953–1973. doi:10.28991/CEJ-2024-010-06-015.

[127] Liu, H., Su, H., & Li, H. (2024). Study on Digital Twin Technologies for Watershed Information Modeling (WIM): A Systematic Literature Review and Bibliometric Analysis. Archives of Computational Methods in Engineering, 31(1), 263–289. doi:10.1007/s11831-023-09977-y.

[128] Harish, V., & Mansurali, A. (2024). Data-Driven Excellence: Unravelling the Potential of Analytics in Project Management. In Using Strategy Analytics for Business Value Creation and Competitive Advantage, IGI Global, Hershey, United States. doi:10.4018/979-8-3693-2823-1.ch017.

[129] Rahaman, M. A., Rozony, F. Z., Mazumder, M. S. A., & Haque, M. N. (2024). Big Data-Driven Decision Making in Project Management: a Comparative Analysis. Academic Journal on Science, Technology, Engineering & Mathematics Education, 4(3), 44–62. doi:10.69593/ajsteme.v4i03.88.

[130] Kineber, A. F., Oke, A. E., Elshaboury, N., Abunada, Z., Elseknidy, M., Zamil, A., Alhusban, M., & Ilori, S. A. (2024). Agile project management for sustainable residential construction: A study of critical success factors. Frontiers in Built Environment, 10, 1442184. doi:10.3389/fbuil.2024.1442184.

[131] Karim, N. (2025). Embedding Agile Management Practices in Traditional Project Management. Master Thesis, University of Vaasa, Vaasa, Finland.

[132] Eboh, M. F. (2024). Effective customer engagement strategies for agile project management. Master Thesis, Vilniaus Universitetas, Vilnius, Lithuania.

[133] Badran, S. S., & Abdallah, A. B. (2025). Lean vs agile project management in construction: impacts on project performance outcomes. Engineering, Construction and Architectural Management, 32(5), 2844–2869. doi:10.1108/ECAM-05-2023-0470.

[134] Virag, P., Bernroider, E. W. N., & Remus, U. (2024). Agile Project Management Styles and Control Ambidexterity in Agile Information Systems Development Projects: An Exploratory Case Study. Journal of the Association for Information Systems, 25(5), 1274–1302. doi:10.17705/1jais.00880.

[135] Huang, Y., Shi, Q., Zuo, J., Pena-Mora, F., & Chen, J. (2021). Research Status and Challenges of Data-Driven Construction Project Management in the Big Data Context. Advances in Civil Engineering, 6674980. doi:10.1155/2021/6674980.

[136] Saini, M., Arif, M., & Kulonda, D. J. (2018). Critical factors for transferring and sharing tacit knowledge within lean and agile construction processes. Construction Innovation, 18(1), 64–89. doi:10.1108/CI-06-2016-0036.

[137] Dutta, P. K. (2025). Implementing agile healthcare frame works in the context of low income countries: Proposed Framework and Review. arXiv Preprint, arXiv:2502.10403. doi:10.48550/arXiv.2502.10403.

[138] Papadakis, E., & Tsironis, L. (2018). Hybrid methods and practices associated with agile methods, method tailoring and delivery of projects in a non-software context. Procedia Computer Science, 138, 739–746. doi:10.1016/j.procs.2018.10.097.

[139] Huck-Fries, V., Spitzer, R., Thatcher, J., & Krcmar, H. (2025). (No) Need to Apply Agile?: A Review of the Literature and Agenda for Future Research on Job Satisfaction in Agile Information Systems Development. Business and Information Systems Engineering, 67(1), 55–81. doi:10.1007/s12599-024-00916-0.

[140] Dybå, T., & Dingsøyr, T. (2008). Empirical studies of agile software development: A systematic review. Information and Software Technology, 50(9–10), 833–859. doi:10.1016/j.infsof.2008.01.006.

[141] Kineber, A. F. (2024). Identifying the Internet of Things (IoT) implementation benefits for sustainable construction project. HBRC Journal, 20(1), 700–766. doi:10.1080/16874048.2024.2369462.

[142] Marbach, P., Rosser, L., Osvalds, G., & Lempia, D. (2015). Principles for Agile Development. INCOSE International Symposium, 25(1), 524–537. doi:10.1002/j.2334-5837.2015.00079.x.

[143] Stewart, J. C., DeCusatis, C. S., Kidder, K., Massi, J. R., & Anne, K. M. (2009). Evaluating agile principles in active and cooperative learning. Proceedings of Student-Faculty Research Day, 8 May, 2009, New York, United States.

[144] Joseph Chukwunweike, & Opeyemi E. Aro. (2024). Implementing agile management practices in the era of digital transformation. World Journal of Advanced Research and Reviews, 24(1), 2223–2242. doi:10.30574/wjarr.2024.24.1.3253.

[145] Shehu, A. A., Usman, N., & Muhammad, I. Y. (2024). Agile principles ' implementation : Enhancing efficiency of construction project time performance in the construction industry in Nigeria. International Journal of Advanced Engineering and Technology, 8(2), 13-18.

[146] Rambaree, K., Sundström, A., Wang, Z., & Wright, S. A. I. (2021). Qualitative stakeholder analysis for a Swedish regional biogas development: A thematic network approach. Sustainability (Switzerland), 13(14), 8003. doi:10.3390/su13148003.

[147] Enwereji, P. C., & Uwizeyimana, D. (2022). Smart City Readiness in South African Municipalities: A Qualitative Study. HOLISTICA – Journal of Business and Public Administration, 13(1), 93–109. doi:10.2478/hjbpa-2022-0006.

[148] Bellarmino, R. (2024). The Role of Power Skills and Organizational Culture in Achieving Project Success. Ph.D. Thesis, Politecnico di Torino, Turin, Italy.