

ORGANISATIONAL CULTURE AND ORGANISATIONAL EFFICIENCY IN THE ROMANIAN CONSTRUCTION SECTOR: A THEORETICAL AND BIBLIOMETRIC ANALYSIS IN THE CONTEXT OF INDUSTRY 5.0

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Abstract: *This paper examines the relationship between organisational culture and organisational efficiency in the construction sector, an industry traditionally characterised by structural fragmentation, operational complexity and resistance to organisational change. The main objective of the study is to analyse the conceptual evolution of this relationship, from traditional management approaches focused on hierarchy and control to the contemporary Industry 5.0 paradigm, which emphasises sustainability, resilience, digital transformation and human-centred development. The study uses a bibliometric methodology based on VOSviewer software to analyse and visualise scientific publications indexed in international databases such as Web of Science and Scopus. This approach enabled the identification of dominant thematic clusters, intellectual structures, co-occurrence networks and emerging research directions in the specialist literature. The findings indicate a shift from conventional efficiency models based mainly on productivity and operational control towards integrated approaches that emphasise organisational adaptability, innovation, occupational safety and technological integration. The study also highlights the relevance of the Competing Values Framework (CVF) for balancing competing organisational priorities such as cost, quality, time, safety and productivity in construction projects. Particular attention is given to the Romanian construction sector, where organisational efficiency is increasingly influenced by digitalisation pressures, labour shortages, hierarchical managerial traditions and the need to align local organisational practices with Industry 5.0 requirements. The paper argues that organisational culture should be understood not merely as a contextual organisational element, but as an organisational mechanism that can influence innovation adoption, organisational resilience and long-term performance. The study contributes to the literature by integrating bibliometric analysis with organisational culture theory and by contextualising international management paradigms within the realities of the Romanian construction industry. The conclusions provide theoretical perspectives and practical implications for managers seeking to support digital transformation and sustainable organisational development in construction companies.*

Keywords: *organisational culture; organisational efficiency; construction sector; Industry 5.0; bibliometric analysis; Competing Values Framework (CVF); Romania*

JEL Classification: *L74; M14*

1. Introduction

Globally, the construction industry is one of the fundamental pillars of economic development. It generates more than 10% of global GDP and remains a central area of concern in international research on productivity and performance (Barbosa et al., 2017). The sector is also one of the largest employers and consumers of resources, with strong links to manufacturing, logistics, transport, architecture, engineering and raw material extraction. Beyond its economic contribution, construction plays a key role in urban development, infrastructure modernisation and the implementation of sustainability objectives.

Despite this strategic importance, the construction sector has historically been associated with relatively low productivity, fragmented operational structures and resistance to organisational and technological change. In this context, organisational culture is increasingly recognised as a factor that can influence organisational efficiency, project coordination, communication processes, employee behaviour and innovation adoption. Although efficiency is often associated with technical resources, technological capabilities or managerial control mechanisms, the literature suggests that shared values, behavioural norms, leadership styles and communication patterns also shape productivity, occupational safety and project outcomes. The relationship between organisational culture and organisational efficiency in construction is therefore multi-layered and closely connected to the capacity of organisations to adapt to technological and economic transformation. This paper proposes a theoretical and conceptual analysis of the influence of organisational culture on organisational efficiency and project performance in the construction sector. It connects general management paradigms with the sector-specific characteristics of construction, with particular attention to the Romanian context and to the implications of Industry 5.0. The transition from traditional to digital organisational cultures in the construction sector indicates that Industry 5.0 repositions the human factor at the centre of technological transformation. Digital transformation should not be understood as the mere acquisition of advanced technologies, but as a socio-technical process that reshapes organisational routines, decision-making mechanisms, leadership practices and employee capabilities (Matt, Hess and Benlian, 2015; Vial, 2019; Verhoef et al., 2021). From this perspective, efficiency is no longer assessed exclusively through conventional KPIs, but also through an organisation's ability to learn, adapt and integrate innovation into everyday project practices. In construction, this transition is particularly relevant because technologies such as BIM, collaborative platforms, AI-assisted planning and digital twins can generate value only when they are supported by organisational cultures that facilitate coordination, trust, learning and human-technology collaboration (Tripathi and Jha, 2018; Sacks et al., 2018).

Table 1: Evolution of the Organisational Culture Paradigm

Dimension	Traditional Paradigm	Agile/Digital Paradigm
Role of Culture	Control mechanism: emphasis on hierarchy, rigid procedures and compliance.	Catalyst for innovation: agility, learning and openness to change.
Leadership	Transactional leadership based on rewards and sanctions for achieving short-term goals.	Transformational and digital leadership focused on vision, change management and employee engagement.
Communication	Top-down communication, unidirectional information flows and departmental silos.	Collaborative and transparent communication through integrated platforms such as Common Data Environments.
Relationship with Technology	Technology is perceived as a potential threat to established routines or as an additional operational burden.	Organisational culture supports the integration of AI technologies and Industry 5.0 principles as mechanisms for enhancing human capabilities, collaboration and adaptability.
Key Values	Stability and predictability through established working methods.	Resilience and adaptability through the capacity to navigate uncertainty and integrate digital feedback.

Source: Author

The originality of the research derives from the tension between the structural rigidity of construction processes and the organisational flexibility required by contemporary efficiency models. The study identifies organisational culture as an instrument for supporting long-term organisational adaptability and performance. Research gaps were identified through density and network fragmentation analysis in the co-occurrence map. The analysis suggests a fragmented relationship between organisational culture and the systems used to define efficiency. The distance between the “Organisational Culture” clusters and the “Construction sector” cluster indicates that relatively few studies directly integrate culture, efficiency and advanced digital transformation in construction. Moreover, much of the literature focuses on technical barriers, while less attention is given to the cultural and leadership mechanisms through which organisations absorb change over time. The theoretical and conceptual analysis developed in this paper examines the mechanisms through which organisational culture can influence organisational efficiency in the construction sector, with particular attention to Romania. The Romanian case is relevant not only as a national example, but also as a sector-specific configuration in which traditional managerial practices, labour market constraints, uneven digital maturity and growing European integration pressures interact with global transformations associated with Industry 5.0. The Romanian construction sector illustrates a sectoral setting shaped by multiple organisational and institutional pressures. According to FIEC (2025), construction accounted for 7.5% of GDP formation in Romania in 2024, while total investment in

construction reached approximately EUR 48 billion. The same report indicates a contraction in overall construction activity, with a substantial decline in residential construction and a more moderate increase in civil engineering works, largely associated with state-led infrastructure projects. These dynamics suggest that organisational efficiency in the Romanian construction sector cannot be analysed only through the lens of output growth. It must also be connected to firms' capacity to manage volatility, resource constraints, project fragmentation and changing investment priorities.

Romania also faces structural challenges that directly affect organisational efficiency. The European Commission (2025) identifies persistent skills shortages, outdated and inadequate infrastructure, weak digital capacity, labour market participation problems and administrative unpredictability as factors limiting productivity and competitiveness. These challenges are especially relevant for construction organisations, where project continuity, safety compliance, site coordination and technological adoption depend heavily on the interaction between formal management systems and informal organisational practices. From a cultural perspective, studies inspired by Hofstede's cultural dimensions framework indicate that Romanian organisational environments tend to display relatively high power distance, hierarchical decision-making structures and moderate resistance to organisational change (Hofstede, 2010; Văduva et al., 2025). These characteristics may influence leadership practices, communication flows, employee participation, safety behaviour and innovation adoption. However, Romanian organisational culture should not be interpreted deterministically. Significant differences exist between companies depending on organisational maturity, ownership structure, exposure to international markets, managerial professionalisation and participation in European-funded infrastructure projects. The transition towards Industry 5.0 in the Romanian construction sector should therefore be understood not only as a technological process, but also as a cultural and managerial transformation. The integration of BIM, AI-assisted planning tools, collaborative digital platforms and data-driven performance systems requires organisational cultures capable of balancing hierarchy with participation, operational control with learning and productivity pressures with safety and employee well-being. In this respect, the Romanian case provides a useful setting for examining the connection between general management paradigms and sector-specific organisational realities.

2. Organisational culture and efficiency in the construction sector

From a theoretical and sector-specific perspective, organisational culture has been analysed through several research traditions. Classical management theories emphasised efficiency, hierarchy, administrative coordination and managerial control (Taylor, 1911; Fayol, 1949; Drucker, 1954; Mintzberg, 1979). Later organisational culture research shifted attention towards values, symbols, assumptions, meanings and behavioural patterns within organisations. The literature on organisational culture and efficiency is extensive and well established. It reflects sustained academic interest in the ways in which culture shapes organisational behaviour, coordination and performance. In the construction sector, this literature is theoretically diverse and can be organised around several analytical directions. Earlier approaches, including Pettigrew's (1979) work on symbolism, ritual and meaning in organisational life, helped establish organisational

culture as a legitimate analytical concept. More recent approaches connect culture with innovation, sustainability, safety and digital transformation. Schein (2010) defines organisational culture as shared assumptions developed through external adaptation and internal integration, later transmitted to new members as appropriate ways to perceive, think and act. This highlights the learned and transmitted nature of organisational culture. Bogale and Debela (2024) also emphasise its multidimensional influence on employee behaviour, workplace interaction, management practices and organisational outcomes. Complementary definitions further clarify the concept. Hofstede (2001) describes organisational culture as collective programming of the mind, while Denison (1990) links it to values, beliefs and management practices. Deal and Kennedy (1982) define culture as “the way things are done” in an organisation, whereas Pettigrew (1979) and Louis (1983) emphasise symbols, rituals and shared meanings. Taken together, these perspectives define organisational culture as a system of shared assumptions and practices that shape coordination and performance. The term “organisational culture” also has a longer intellectual history. Jay (1967) described organisations as social entities with customs, taboos and distinctive behavioural patterns, including authoritarian, democratic, liberal and paternalistic forms. This early use of the concept is relevant because it shows that organisational culture has long been understood as a social and managerial phenomenon rather than merely a symbolic one.

In the construction sector, organisational culture has specific characteristics because work is frequently project-based, temporary and distributed across multiple organisations. Construction organisations operate through temporary coalitions involving contractors, subcontractors, designers, consultants and clients. This increases the relevance of shared meanings, communication routines, trust and coordination across organisational boundaries (Dainty, Green and Bagilhole, 2007; Kagioglou, Cooper and Aouad, 2001).

Within this sector, organisational culture is closely connected to safety, productivity, quality and project performance. This is especially relevant because construction projects involve high operational risks, changing site conditions and multiple stakeholder groups. Choudhry, Fang and Mohamed (2007) define safety culture through shared values, assumptions and behavioural norms that influence workers’ compliance with safety practices, while Mohamed (2002) emphasises the role of safety climate in shaping site behaviour. Broader safety research also confirms that shared values, climate perceptions and behavioural routines influence risk management and safety performance in high-risk environments (Cox and Cheyne, 2000; Zhou, Fang and Wang, 2008).

The literature also indicates that organisational culture contributes to organisational efficiency through coordination, leadership, learning and performance management. Dainty, Green and Bagilhole (2007) emphasise the role of people and culture in construction processes, while Kagioglou, Cooper and Aouad (2001) propose a conceptual framework for performance management in construction that links organisational processes with project outcomes. From this perspective, organisational culture cannot be separated from the mechanisms through which construction organisations manage time, cost, quality, safety and productivity. Taken together, these definitions indicate that organisational culture in construction is closely linked to project-based work, risk management, occupational safety and the coordination of human resources. Its main dimensions include safety and quality

orientation, collaboration, communication, rules and procedures, hierarchy, teamwork, adaptability, innovation and performance orientation. The literature on organisational culture and efficiency in construction can be grouped into three analytical directions. The first is the Competing Values Framework (CVF), which examines tensions between stability and flexibility, internal cohesion and external competitiveness (Cameron and Quinn, 1999). This model is useful for construction because project-based organisations must combine procedural discipline with adaptive capabilities. The second direction is safety culture research, which links shared assumptions, leadership commitment and communication patterns with safety behaviour and operational performance (Mohamed, 2002; Choudhry, Fang and Mohamed, 2007; Fang, Wu and Wu, 2015; Zahoor et al., 2017). The third direction concerns digital transformation and technological adoption, showing that technology contributes to efficiency only when organisations also develop cultural readiness, managerial commitment and employee acceptance (Ajzen, 1991; Tripathi and Jha, 2018; Sacks et al., 2018; ISO, 2018; Matt, Hess and Benlian, 2015; Vial, 2019).

The analysis of organisational efficiency in the Romanian construction sector requires an integrated approach based on three mutually reinforcing dimensions: organisational structure, safety culture and digital transformation. The first dimension is supported by the CVF, which provides a useful lens for analysing the balance between hierarchical control and flexibility (Cameron and Quinn, 1999). The second dimension is safety culture, which is essential in a field marked by high operational risks and where employee behaviour, communication and leadership commitment influence both safety outcomes and project continuity (Mohamed, 2002; Choudhry, Fang and Mohamed, 2007; Liang, Lin and Zhang, 2023). The third dimension is digital transformation, which requires the integration of BIM, data-driven decision-making and collaborative technologies into organisational routines (Sacks et al., 2018; Tripathi and Jha, 2018).

Within this framework, the long-term performance of construction companies in Romania depends partly on management's ability to align these three dimensions. Excessively rigid structures may limit digital transformation, while accelerated digitalisation without safety culture, employee involvement and clear coordination mechanisms may create new organisational vulnerabilities. Organisational efficiency therefore emerges from the alignment between structural control, safety-oriented values and digital adaptability.

International and national studies highlight the relationship between culture and performance. Cameron and Quinn (1999) show that organisational cultures differ according to their emphasis on hierarchy, market orientation, clan cohesion and adhocracy-oriented innovation. In construction, this framework is useful because firms must balance cost, time, quality, safety and innovation under conditions of uncertainty and project fragmentation. Recent studies also show that innovative and sustainability-oriented cultures may support performance in construction firms (Afzal, Lim and Prasad, 2022; Bangbade et al., 2022). This paper examines cultural mechanisms that strengthen organisational efficiency, including leadership by example, communication, feedback, coaching, learning and rewards. These mechanisms matter because culture is reproduced through everyday managerial practices, not formal declarations alone. In construction, leadership influences safety compliance, information sharing, technology adoption and problem-solving (Fang, Wu and Wu, 2015; Xia et al., 2023).

From a research perspective, organisational efficiency can be operationalised through a coherent set of key performance indicators:

- cost, understood as resource optimisation;
- time, understood as the duration of operational cycles;
- quality, understood as compliance and customer satisfaction;
- safety, understood as the reduction of incidents and occupational risks;
- productivity, understood as the output/input ratio.

In the context of Industry 5.0, these indicators should be integrated into a broader socio-technical logic rather than assessed only through automation and technical efficiency. Digital technologies, including artificial intelligence, collaborative robotics and data analysis, can reshape authority structures, decision-making and collaboration. Industry 5.0 therefore requires a balance between technological performance and human capital, promoting a people-oriented culture in which well-being, creativity and social responsibility contribute to efficiency (Alves, Lima and Gaspar, 2023; Rajumesh, 2023; Townsend and Romme, 2024). Organisational performance is thus understood as the interaction between advanced digital systems and an adaptive, inclusive and sustainable organisational culture. Recent literature suggests that implementing Industry 4.0 and Industry 5.0 principles depends not only on technical infrastructure, but also on organisational readiness, digital capabilities, managerial commitment, employee qualification and openness to change (Müller, Kiel and Voigt, 2018; Frank, Dalenogare and Ayala, 2019; Sony and Naik, 2020). In construction, digital technologies contribute to efficiency only when embedded in coherent organisational routines, supported by leadership practices and accepted by project teams.

Table 2: Evolution of Research Paradigms

Dimension	Traditional Research Focus	Emerging Research Directions
Core Technology	Static BIM, mainly used for 3D modelling and clash detection.	Digital twins and Industry 5.0: dynamic models powered by real-time data and IoT sensors.
Operational Objective	Efficiency and cost: waste reduction and productivity optimisation on site.	Sustainability and resilience: low-emission buildings and infrastructure capable of adapting to climate change.
Human Factor	Management and performance: hierarchical control and performance measurement through rigid indicators.	Transformational leadership: focus on organisational culture, AI ethics and employee well-being.
Data Analysis	Statistical analysis: classical methods, such as PLS-SEM, used to validate theoretical models.	AI and machine learning: predictive algorithms for risk management and decision support.
Collaboration	Lean construction: optimising workflows between contractors and subcontractors.	Blockchain and smart contracts: transparency and payment automation in the supply chain.

Source: Author

The transition from the Industry 4.0 technology paradigm to the human-centred model promoted by Industry 5.0 marks a shift from technological efficiency alone towards the integration of sustainability, resilience and employee well-being into the performance equation. Industry 5.0 seeks to reconcile automation with human creativity, so that technology amplifies human potential rather than replacing it. Organisational culture is therefore evolving towards a participatory model oriented towards co-creation, social responsibility and a balance between economic performance and social impact.

3. Bibliometric Analysis Methodology

To strengthen methodological rigour, bibliometric mapping of the specialist literature was carried out to identify the transition from general management paradigms to construction-sector-specific research directions. The chronological analysis (1975–2026) indicates a shift from traditional construction management perspectives towards increasingly digital and human-centred approaches. Research has gradually moved from static BIM-oriented modelling towards dynamic simulations, Digital Twin applications, IoT-based monitoring and machine learning algorithms for risk prevention in construction management. According to the bibliometric analysis, the evolution from classical efficiency models to Industry 5.0 can be structured into three main stages. The consolidation stage (1975–2010) is associated with Total Quality Management (TQM), cost reduction, performance improvement and labour productivity in construction firms (Pheng and Teo, 2004). The digitisation stage (2011–2020) is associated with the Building Information Modelling (BIM) paradigm, in which organisational culture increasingly becomes a facilitator of technology adoption. The visionary stage (2021–2026), reflected in the more recent clusters, introduces new concepts and trends such as:

- Sustainability and Green Culture, where efficiency is measured through reductions in carbon emissions;
- Industry 5.0;
- Digital Twin;
- Cyber-Physical Systems, which promote human-robot collaboration; and
- Dynamic Capabilities, which refer to organisations' capacity to respond to new global trends.

The analytical challenge is to connect these bibliometric trends with a resource-based and dynamic-capabilities perspective on organisational efficiency. From this perspective, digital technologies do not automatically generate competitive advantage. They become valuable only when they are integrated into organisational resources, managerial capabilities, employee skills and adaptive routines (Barney, 1991; Vial, 2019; Warner and Wäger, 2019). In construction, this interpretation is particularly relevant because productivity improvement depends not only on technological modernisation, but also on collaboration, human capital development, process integration and cultural readiness for change (Barbosa et al., 2017; Tripathi and Jha, 2018). Recent research therefore increasingly examines how modern technologies, organisational learning and safety-oriented management practices can reduce operational risks and improve project performance.

3.1. Co-occurrence Analysis and Overlay Visualisation

As shown in Figure 1, the core of the keyword co-occurrence network is defined by the intersection between organisational culture and organisational efficiency, which represent the central terms of the analysis. Organisational culture acts as a bridge between clusters, suggesting that efficiency-related interventions depend not only on formal rules, regulations and standards, but also on organisational norms, values and informal practices. The main thematic clusters are organised around safety culture, implementation, framework, innovation and competitive advantage. This structure indicates that contemporary efficiency research increasingly integrates safety, cultural dynamics and technological change.

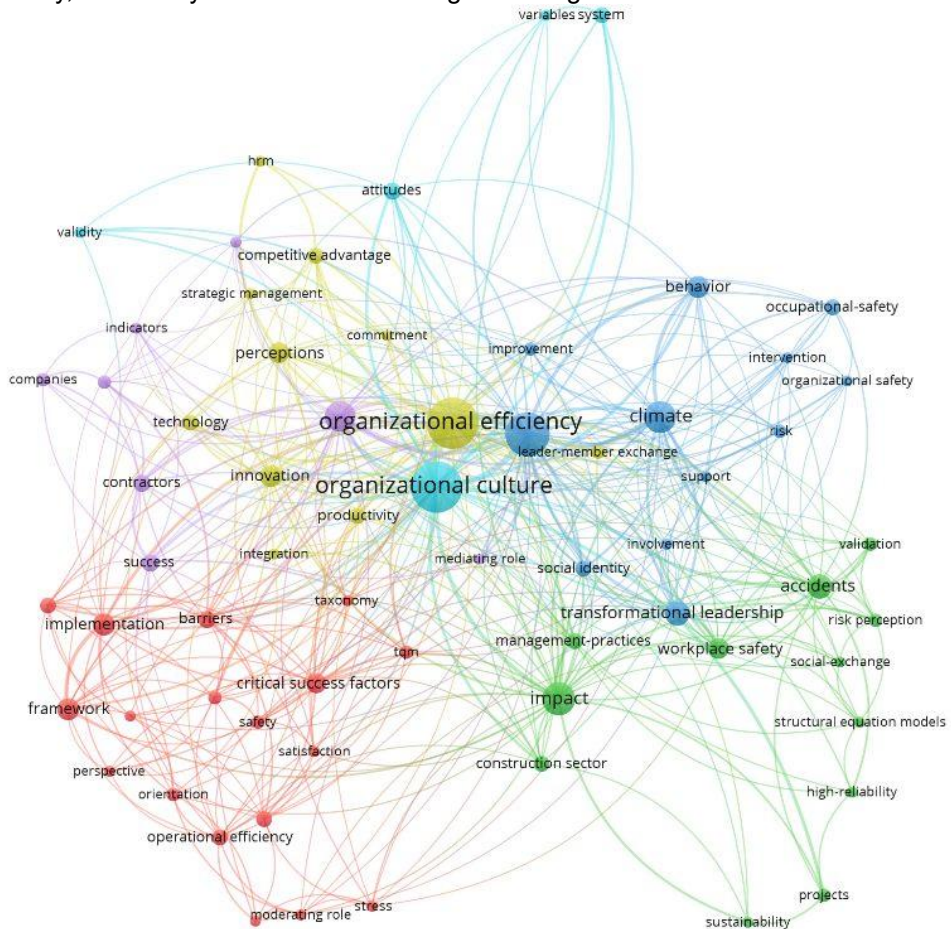


Figure 1: Keyword co-occurrence network of organisational culture, efficiency and construction-related terms

Source: Author's processing in VOSviewer based on the Web of Science and Scopus dataset.

Figure 2 provides the overlay visualisation of the same keyword network. The colour gradient indicates a movement from earlier studies focused on “perceptions” and “attitudes” towards more recent themes such as “digital transformation” and “sustainability” in the latest segment of the analysed dataset.

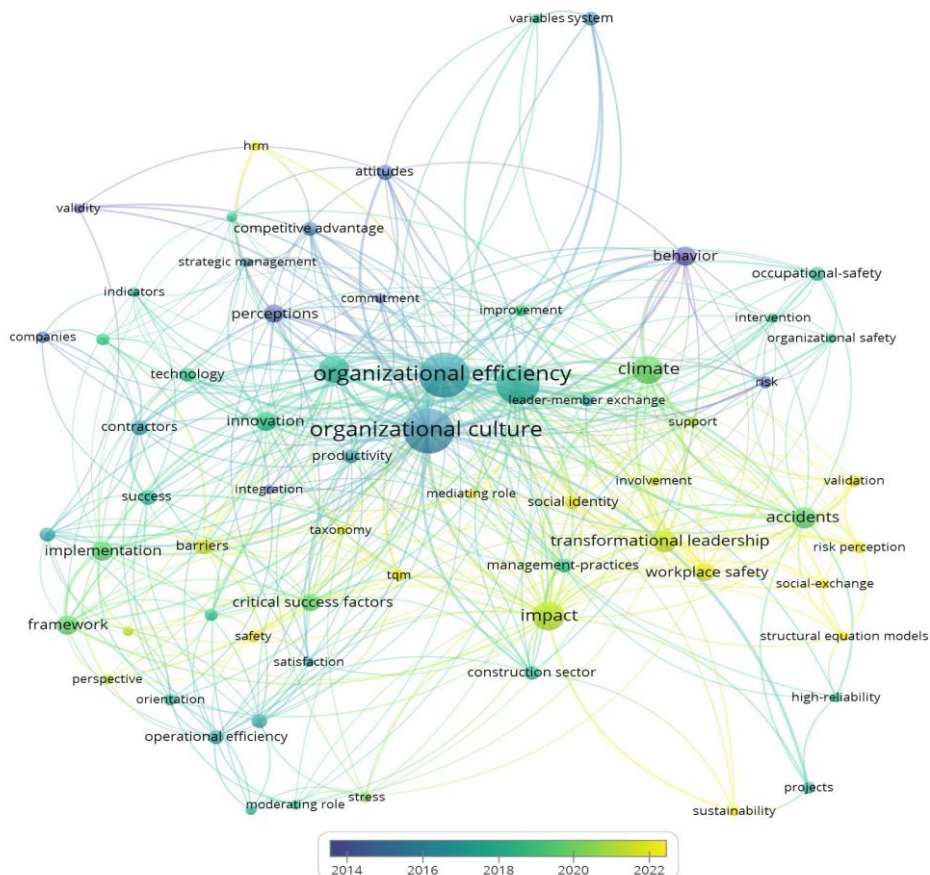


Figure 2: Overlay visualisation of keyword co-occurrence by average publication year

Source: Author's processing in VOSviewer based on the Web of Science and Scopus dataset.

The overlay map also supports the interpretation that workplace safety is no longer treated merely as a technical issue, but as an outcome partly shaped by organisational culture, leadership and shared behavioural routines. Recent research increasingly seeks to identify frameworks that combine transformational leadership, innovation and safety-oriented practices to improve efficiency and reduce accidents.

3.2. Analysis of Citations and Intellectual Structure

Figure 3 presents the citation network and highlights a central conceptual triad: safety climate (Mohamed, 2002), safety culture (Choudhry, Fang and Mohamed, 2007) and human resource management (Lingard and Cooke, 2012). These

contributions support models linking safety climate, employee behaviour and performance in construction. They also frame safety culture as part of organisational culture, emphasising shared responsibility and psychological factors that influence workers' compliance with safety rules.

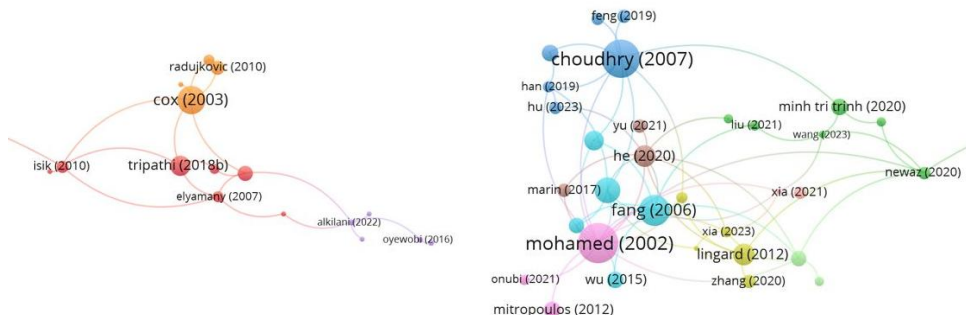


Figure 3: Citation network of key contributions in construction safety and organisational culture

Source: Author's processing in VOSviewer based on the Web of Science and Scopus dataset.

Figure 4 shows the co-authorship network. Authors such as Fang and Lingard appear as relevant nodes because of their contribution to integrating safety culture into construction management and to connecting safety-related research with broader organisational performance debates.

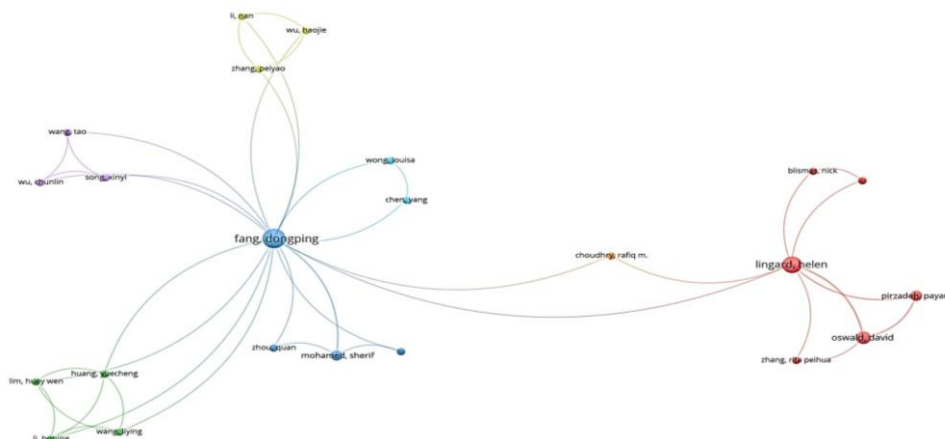


Figure 4: Co-authorship network of authors in the analysed dataset

Source: Author's processing in VOSviewer based on the Web of Science and Scopus dataset.

Figure 5 presents the co-citation structure of the analysed literature. The map highlights the progressive development of research on organisational culture in construction, with a strong focus on safety, performance and project management. Unlike many other economic sectors, construction has a specific profile, characterised by high operational risk, clear hierarchical structures and temporary

projects. These characteristics are directly reflected in the intellectual structure of the literature.



Figure 5: Co-citation network showing the intellectual structure of the analysed literature

Source: Author's processing in VOSviewer based on the Web of Science and Scopus dataset.

3.3. Bibliographic coupling

Figure 6 presents the bibliographic coupling map. Recent research (2020–2026) increasingly focuses on “Industry 5.0” and “Construction 5.0”, marking a new phase of efficiency based on human-technology symbiosis. Studies such as He et al. (2020), Xia et al. (2023) and Patyal and Koilakuntla (2020) use quantitative research methodologies to examine relationships between culture, risk and organisational impact. The network is characterised by dense connections within the main clusters and by bridging links between different schools of thought. This indicates bibliographic continuity, with recent authors building on the foundations established by earlier research.

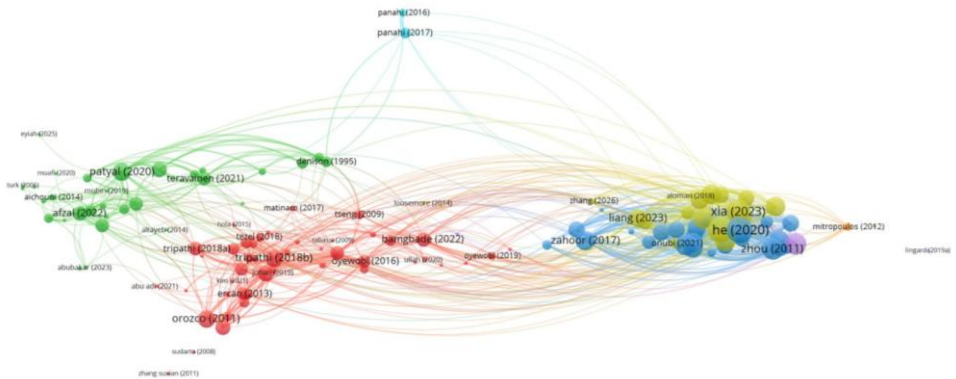


Figure 6: Bibliographic coupling map of recent publications in the analysed dataset
Source: Author's processing in VOSviewer based on the Web of Science and Scopus dataset.

Sustainability and innovation themes are beginning to appear on the periphery of the co-occurrence map, signalling future directions for research expansion. This analysis confirms an increase in recent publications exploring “Construction 5.0” and the impact of key KPIs in digitised environments. Current bibliometric trends show growing interest in connecting organisational culture with Industry 5.0-related themes, including digital transformation, sustainability and performance in construction and related sectors.

Based on the bibliometric maps and the conceptual structure analysed, the theoretical conclusions of the article support the transition from traditional management to integrated management in the Industry 5.0 era.

4. The Relationship Between Culture and Efficiency in the Construction Sector

The construction sector requires a sector-specific analytical approach because its project-based structure shapes both the development and manifestation of organisational culture. Construction projects involve temporary collaboration between main contractors, subcontractors, suppliers, consultants and regulatory authorities. This creates a multi-actor organisational setting in which values, practices and objectives may differ across participating entities. Sectoral efficiency therefore depends partly on the capacity to align these differences within a functional collaborative framework.

The theoretical contribution of this study lies in connecting classical approaches to organisational culture with emerging perspectives that link culture to organisational efficiency, digital transformation, safety and Industry 5.0. The literature has gradually moved from the isolated analysis of employee attitudes towards more integrated models in which organisational culture supports innovation absorption, safety performance and project coordination. In this context, efficiency is not defined exclusively through financial indicators, but through the capacity of organisations to combine operational performance with adaptability, technological learning and safety-oriented behaviour.

The theoretical analysis indicates that the impact of culture on efficiency is mediated by three main dimensions:

- the Competing Values Framework;
- safety-productivity synergy; and
- adaptability and digital transformation.

The Competing Values Framework is useful for balancing the need for stability and hierarchical coordination with the need for flexibility and innovation in complex projects. Safety culture also plays a central role, as robust safety practices can reduce operational losses and support project continuity. Organisational culture further influences the implementation of digital solutions because digital transformation requires changes in routines, capabilities and decision-making processes, not only technology acquisition (Matt, Hess and Benlian, 2015; Vial, 2019; Verhoef et al., 2021). Without adequate managerial commitment, digital skills, employee qualification and organisational readiness, technologies such as BIM, AI-assisted planning tools and integrated project management platforms may remain underused or generate only limited performance gains (Müller, Kiel and Voigt, 2018; Frank, Dalenogare and Ayala, 2019; Tripathi and Jha, 2018).

The bibliometric results indicate a gradual integration of organisational culture into research on change management, innovation and digital transformation. Rather than being treated as a merely descriptive concept, culture is increasingly conceptualised as a dynamic mechanism involved in sustainability, inclusion, technological adoption and organisational adaptability. This transition is supported by research on Industry 4.0 implementation, which shows that technological adoption is shaped by organisational resources, managerial attitudes, workforce capabilities, company size and the ability of firms to align innovation with existing business processes (Müller, Kiel and Voigt, 2018; Frank, Dalenogare and Ayala, 2019). For construction companies, especially small and medium-sized enterprises, digital transformation

may be constrained by limited financial resources, insufficient digital skills and the absence of formalised change-management structures. Similar concerns are reflected in research on lean construction barriers, which shows that organisational culture can either support or constrain continuous improvement and process innovation in construction environments (Romo et al., 2025). The Romanian construction sector makes this relationship especially clear because organisational efficiency is shaped by the simultaneous presence of traditional coordination mechanisms and emerging digital transformation pressures. On the one hand, construction projects require hierarchical control, procedural discipline and clear responsibility structures in order to manage cost, time, quality and occupational safety. On the other hand, contemporary efficiency increasingly depends on collaborative communication, digital coordination, cross-functional learning and the capacity to integrate technological innovation into everyday project routines. This tension can be interpreted through the Competing Values Framework. In the Romanian construction sector, hierarchical culture remains relevant because it provides procedural stability, compliance orientation and managerial control in high-risk environments. However, excessive reliance on hierarchy may reduce flexibility, limit employee participation and slow down innovation adoption. Clan-oriented cultural elements are also relevant because labour shortages and employee retention challenges make trust, mentoring, team cohesion and informal knowledge transfer increasingly significant. Adhocracy-oriented cultural traits support experimentation, BIM adoption, digital collaboration and Industry 5.0 readiness, while market-oriented traits remain necessary for cost discipline, productivity and competitiveness (Cameron and Quinn, 1999; Kagioglou, Cooper and Aouad, 2001). Organisational efficiency in the Romanian construction sector should therefore not be reduced to technical productivity indicators alone. It emerges from the interaction between cultural values, leadership practices, safety routines, digital maturity and project governance mechanisms. In this respect, organisational culture functions as a mediating mechanism between global efficiency paradigms and local sector-specific constraints. A construction company may have access to digital technologies, but their effective use depends on whether employees trust these systems, whether managers encourage learning, whether site teams communicate transparently and whether organisational routines support data-driven decision-making.

At the national level, these arguments are consistent with broader digitalisation challenges identified by the European Commission (2024), including the relatively low share of Romanian SMEs meeting basic digital intensity criteria and the limited level of basic digital skills. Rather than repeating the Romanian sectoral constraints in detail, this section emphasises their theoretical implication: digital transformation in construction requires organisational cultures that support learning, employee involvement, trust in data and adaptive leadership. Within this framework, safety culture remains a central component of organisational efficiency. Construction is characterised by high operational risk, temporary site teams, subcontracting chains and changing work environments. Studies on safety culture in construction show that shared assumptions, communication patterns and leadership commitment influence safety behaviour and operational outcomes (Choudhry, Fang and Mohamed, 2007; Fang, Wu and Wu, 2015; Zahoor et al., 2017). For Romanian construction companies, safety culture should therefore be

treated not only as a compliance requirement, but also as an efficiency-related cultural capability.

5. Characteristics and Organisational Implications of the Romanian Construction Sector

The Romanian construction sector presents several structural, managerial and cultural characteristics that justify a sector-specific discussion of the relationship between organisational culture and organisational efficiency. The sector is economically significant, yet its performance is marked by volatility, uneven development across construction segments and strong dependence on infrastructure investment. According to FIEC (2025), construction represented 7.5% of GDP formation in Romania in 2024, while total investment in construction reached approximately EUR 48 billion. At the same time, the volume of construction works decreased overall, with residential construction registering a substantial contraction, while civil engineering works increased more moderately, mainly because of state-led infrastructure projects. These trends indicate that efficiency in the Romanian construction industry cannot be interpreted only in terms of expansion. It should also be understood as the capacity to maintain project performance, resource coordination and organisational adaptability under unstable market conditions. The first characteristic of the Romanian construction sector is its exposure to fragmented project structures. Like construction industries in other European countries, Romanian construction activity is organised around temporary projects involving contractors, subcontractors, suppliers, designers, consultants and public authorities. This fragmentation creates coordination challenges and increases the importance of shared organisational values, clear communication routines and trust-based collaboration. In such an environment, organisational culture becomes a mechanism through which project participants align expectations, interpret responsibilities and coordinate decisions across organisational boundaries. As project environments become more fragmented, cultural alignment becomes increasingly important for reducing delays, misunderstandings and inefficiencies. The second characteristic concerns labour shortages and skills mismatches. The European Commission (2025a) notes that Romania continues to face shortages of both skilled and non-skilled workers, partly associated with people leaving the country to work abroad, low tertiary education attainment and mismatches between education and labour market needs. Romanian firms, particularly small and medium-sized enterprises, continue to identify inadequate skills as a barrier to growth. For construction companies, these shortages directly affect productivity, project continuity, safety performance and knowledge retention. From an organisational culture perspective, labour scarcity increases the importance of employee engagement, mentoring, learning-oriented leadership and retention-oriented managerial practices. The third characteristic concerns uneven digital maturity. Earlier studies on the evolution of the Romanian construction industry also indicate the relevance of macroeconomic fluctuations and GDP-related construction dynamics for understanding sectoral performance (Nițu and Gasparotti, 2020). The European Commission (2024) shows that the share of Romanian SMEs meeting basic digital intensity criteria remains substantially below the EU average, while the level of basic digital skills among the population is also low. These national digitalisation constraints are especially relevant for construction organisations, where the adoption of BIM, integrated project management platforms, Common Data

Environments, AI-assisted planning tools and digital twin technologies requires financial investment, technical competence and cultural readiness for change. In this context, digital transformation should not be interpreted as a purely technical issue. It is also a cultural process involving learning, trust in data, openness to new workflows and the capacity to modify established routines. The fourth characteristic concerns the role of public investment, public procurement and infrastructure development. Civil engineering works in Romania are closely connected to state-led infrastructure projects, including motorways, railways and public facilities (FIEC, 2025). Recent real estate and construction market surveys also indicate that investor confidence, financing conditions and regional market expectations remain relevant contextual factors for understanding construction-related activity in Romania and Central Europe (Deloitte Romania and Reff & Associates | Deloitte Legal, 2025). At the same time, the European Commission (2025a) highlights administrative capacity problems, insufficient competition in public procurement and policy predictability issues as factors affecting the business environment. These conditions influence construction companies by increasing uncertainty, intensifying pressure on delivery capacity and requiring stronger organisational resilience. In such a context, efficiency depends on internal managerial competence as well as on organisations' ability to respond to external institutional constraints.

The relevance of organisational culture becomes clearer when these Romanian sector-specific characteristics are connected to the Competing Values Framework. Hierarchical cultural traits may support compliance, safety discipline and procedural control, which remain necessary in complex construction projects. However, when hierarchy becomes excessively centralised, it may slow down communication, reduce initiative and limit innovation adoption. Clan-oriented cultural traits may support employee retention, mentoring, trust and informal coordination, which are especially relevant in a labour-constrained environment. Adhocracy-oriented traits may facilitate experimentation with BIM, digital platforms and Industry 5.0 technologies, while market-oriented traits support productivity, cost control and competitiveness. Organisational efficiency in the Romanian construction sector therefore depends on the capacity to balance these competing cultural orientations rather than privileging only one of them. The transition towards Industry 5.0 further reinforces this need for balance. In the Romanian construction sector, human-centred digital transformation, resilience and sustainability must be interpreted in relation to existing organisational realities and European performance expectations. Digital transformation is therefore unlikely to succeed through technology acquisition alone. It requires cultural transformation, including leadership practices that support learning, communication mechanisms that reduce site-level fragmentation and organisational values that encourage safety, collaboration and innovation acceptance. The Romanian case therefore functions as an analytical bridge between the general theoretical framework and the specific organisational constraints of a transitional, fragmented and unevenly digitalised construction market. It illustrates a specific form of organisational tension: the need to preserve operational stability while simultaneously developing adaptive capacity. Traditional managerial structures may provide predictability and authority in complex projects, but Industry 5.0 requires more participatory, learning-oriented and digitally enabled organisational cultures. The challenge is not necessarily to abandon hierarchy, but to transform it into a

framework that supports responsibility, mentoring, coordination and innovation rather than rigid control. Consequently, the main conclusion derived from the Romanian sector discussion is that organisational culture mediates the relationship between structural constraints and efficiency outcomes. Sectoral pressures do not automatically determine inefficiency. Their impact depends on how organisations interpret them, how managers communicate change, how employees participate in problem-solving and how firms integrate safety, learning and technological innovation into everyday routines.

For Romanian construction companies, the practical implication is that efficiency strategies should move beyond narrow cost-time control and incorporate integrated cultural capabilities. These include safety culture, digital learning, collaborative leadership, employee retention, transparent communication and KPI systems that connect productivity with quality, safety, sustainability and resilience. In this sense, the Romanian construction sector confirms the broader theoretical argument of the article: organisational culture is not merely a contextual variable, but a mechanism through which efficiency is produced, constrained or transformed.

6. Research Gaps in the Romanian Construction Sector

The analysis of conceptual maps and literature highlights several identifiable gaps in the Romanian construction sector. These gaps limit the sector's capacity to align with global trends in organisational culture, efficiency and Industry 5.0.

■ *Technological and cultural gap*

Although international research increasingly emphasises Industry 4.0, Industry 5.0 and the integration of digital technologies into construction processes, the Romanian construction sector continues to face a combined technological and cultural gap. This gap should not be understood solely as the absence of digital tools. It also concerns limited digital skills, insufficient organisational readiness, fragmented managerial practices and resistance to changes in established routines. Studies on Industry 4.0 adoption show that implementation barriers are frequently organisational and cultural, including limited strategic clarity, insufficient employee involvement, lack of skills, uncertainty regarding the benefits of technological change and difficulties in aligning digital technologies with existing organisational processes (Dikert, Paasivaara and Lassenius, 2016; Müller, Kiel and Voigt, 2018; Frank, Dalenogare and Ayala, 2019; Sony and Naik, 2020). In this respect, digitalisation in Romanian construction requires investment in BIM, integrated data platforms and AI-assisted planning tools, but also a cultural transition towards learning, collaboration and trust in data-driven decision-making.

■ *Underuse of CVF models*

Another relevant gap is the absence of applied studies using established models for diagnosing organisational culture, such as the Competing Values Framework, in the analysis of Romanian construction companies. The lack of a systematic assessment of cultural typologies limits understanding of the relationship between organisational culture and project performance. It also restricts the development of scientifically grounded managerial interventions.

■ *Fragmentation of KPIs*

In local management practice, performance indicators are often treated separately and sometimes antagonistically. Safety and productivity may be

perceived as competing objectives rather than as components of an integrated performance framework. This approach contrasts with the conclusions of international literature, which emphasises the interdependence between risk management, quality of execution and operational efficiency. In this article, “Culture 5.0” is understood as an organisational culture aligned with Industry 5.0 principles, namely human-centred digital transformation, sustainability, resilience, collaboration and responsible innovation.

■ *Absence of a sustainability-oriented 5.0 culture*

Despite European pressure for green transition and the circular economy, the Romanian sector still shows a gap between external sustainability requirements and internal organisational values. Organisational culture does not yet sufficiently prioritise environmental responsibility and sustainable innovation. This limits companies' ability to adopt a “Culture 5.0” paradigm focused on the balance between economic performance, technology and social impact.

An additional research gap concerns the limited availability of empirical studies examining the direct relationship between organisational culture and organisational efficiency indicators within Romanian construction companies. International literature provides well-established models for analysing organisational culture, safety culture, digital transformation and performance management. However, the Romanian academic context remains underdeveloped in terms of integrated empirical research combining these dimensions. In particular, there is a lack of quantitative studies applying the CVP, safety culture assessment tools, digital maturity indicators and KPI-based efficiency models to Romanian construction firms.

This gap is especially relevant because the Romanian construction sector presents a combination of conditions that may significantly influence the culture-efficiency relationship: labour shortages, migration of skilled workers, uneven SME digitalisation, project fragmentation, public procurement dependency and hierarchical managerial traditions. Without empirical validation, it is difficult to determine which cultural dimensions most strongly influence productivity, safety behaviour, employee retention, innovation adoption and project performance in Romanian construction organisations.

Future studies should therefore move beyond descriptive sectoral analyses and develop integrated research designs capable of measuring the interaction between organisational culture, safety culture, digital maturity and organisational efficiency. Such studies could combine survey-based organisational culture diagnostics, interviews with managers and site personnel, KPI analysis and case studies of construction companies with different levels of digital maturity. This would allow researchers to identify whether Romanian construction firms are predominantly characterised by hierarchical, clan, market or adhocracy-oriented cultures, and how these cultural profiles affect efficiency outcomes. Another relevant gap concerns the absence of longitudinal studies on Industry 5.0 readiness in Romanian construction. Existing research tends to describe digital transformation as an expected direction, but less attention is paid to the organisational processes through which companies absorb, resist or reinterpret digital technologies. Longitudinal research would be particularly useful for understanding how BIM adoption, AI-assisted planning tools, collaborative platforms and sustainability-oriented practices become embedded in organisational routines over time.

Finally, there is a need for comparative research between Romanian construction companies and firms operating in more digitally mature European markets. Such comparisons would help distinguish between challenges that are general to the construction sector and those that are specific to the Romanian institutional, cultural and managerial environment. This would strengthen future research and provide more precise managerial recommendations for adapting international efficiency models to the Romanian construction sector. These gaps confirm the need for a theoretical and bibliometric synthesis capable of connecting organisational culture, efficiency and Industry 5.0 within the Romanian construction sector.

7. Conclusions and Future Directions

The present study contributes to the literature by examining the relationship between organisational culture and organisational efficiency in the construction sector through a theoretical and bibliometric perspective, with specific contextualisation in the Romanian construction industry. The analysis shows that organisational culture should not be interpreted as a secondary organisational variable, but as an organisational mechanism that can influence productivity, project coordination, occupational safety, digital transformation, innovation adoption and long-term organisational resilience.

The bibliometric analysis indicates a clear shift in the literature. Earlier approaches tended to associate efficiency mainly with hierarchical control, productivity, cost reduction and operational discipline. More recent research increasingly connects efficiency with sustainability, safety culture, digitalisation, organisational adaptability, employee well-being and Industry 5.0 principles. This transition suggests that organisational efficiency in construction can no longer be explained only through technical or financial indicators. It should instead be understood as the result of interaction between technological systems, managerial practices, cultural values and human capabilities.

The study also highlights the relevance of the Competing Values Framework for interpreting the cultural tensions specific to construction organisations. Construction firms must simultaneously ensure stability and flexibility, control and innovation, procedural discipline and collaborative learning. In high-risk project environments, hierarchy remains necessary for safety compliance and operational coordination. However, excessive centralisation may limit communication, reduce initiative and slow down digital adoption. The paper's theoretical contribution lies in showing that organisational efficiency emerges from the capacity to balance these competing cultural orientations rather than privileging only one of them. The Romanian construction sector provides an appropriate context for this analysis. It is economically significant, yet marked by volatility, labour market pressures, uneven digital maturity, public procurement complexity and managerial fragmentation. Recent research on Romanian organisational resilience also supports the relevance of strategic human resource management and organisational culture for long-term adaptability (Georgescu et al., 2024). These characteristics create a sectoral context in which general management paradigms cannot be applied mechanically. International models of organisational culture and efficiency must therefore be adapted to the Romanian context, where hierarchical managerial traditions coexist with growing pressures for digitalisation, sustainability, EU-funded infrastructure development and Industry 5.0 readiness.

The expanded discussion of the Romanian sector demonstrates that the relationship between organisational culture and efficiency is mediated by concrete sector-specific constraints. Labour market pressures increase the importance of employee retention, mentoring and knowledge transfer, while uneven digital maturity makes learning-oriented cultures and adaptive leadership necessary for BIM, AI-assisted planning and integrated project management adoption. Fragmented project structures increase the relevance of communication routines, trust and collaborative coordination, whereas public procurement and infrastructure dependency intensify the need for organisational resilience and managerial predictability. These findings support the argument that organisational culture functions as a mechanism through which Romanian construction firms respond to structural and technological pressures.

From a managerial perspective, the study suggests that Romanian construction companies should move beyond narrow efficiency models based exclusively on cost, time and short-term productivity. A more suitable approach would integrate traditional KPIs with indicators related to safety, quality, digital maturity, employee engagement, sustainability and organisational adaptability. Resistance to change should not be interpreted solely as an individual behavioural problem, but also as a reflection of uncertainty, insufficient communication, skill gaps, weak trust in new systems and limited organisational readiness. Addressing these factors requires cultural transformation in parallel with technological investment. The study has several limitations. Its design is predominantly theoretical and bibliometric and does not include direct empirical validation through surveys, interviews or field-based case studies. The study therefore provides a conceptual interpretation of the relationship between organisational culture and organisational efficiency, rather than causal empirical evidence. Another limitation concerns the limited availability of Romania-specific empirical studies on organisational culture in construction compared with the broader international literature. Future research should focus on empirical testing of the proposed conceptual relationships within Romanian construction companies. Quantitative studies could examine the correlation between CVF cultural profiles and efficiency indicators such as productivity, cost performance, time performance, safety outcomes and employee retention. Qualitative studies could explore how managers and site workers perceive organisational culture, digital transformation and resistance to change. Mixed-methods research would be especially valuable for understanding how formal managerial systems interact with informal site-level practices. Future research directions may also include comparative analyses between Romania and other European construction markets, longitudinal studies on Industry 5.0 implementation and the development of integrated KPI systems capable of measuring not only cost and productivity, but also resilience, safety, sustainability, employee well-being and innovation capacity. Such research would strengthen both the theoretical understanding of organisational culture in construction and the practical capacity of Romanian firms to align with emerging European and global standards.

In conclusion, the article shows that organisational culture represents a key explanatory factor for organisational efficiency in the construction sector. In the Romanian context, this relationship is shaped by the coexistence of hierarchical structures, labour market pressures, uneven digitalisation and the need for adaptive, human-centred and sustainability-oriented management. The transition towards

Industry 5.0 therefore requires not only new technologies, but also organisational cultures capable of transforming structural constraints into sources of learning, coordination and long-term competitiveness.

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