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The Influence of Stakeholder Involvement in the Adoption of Digital Technologies in the UK Construction Industry

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Abstract: This study explored stakeholder involvement practice in digitalisation of the construction industry in the UK, and the influence thereof in the adoption of digital technologies. A qualitative interpretive method was followed using a case study approach to collect data. Thematic analysis of twenty-four semi-structured interviews and sixty survey responses, which were conducted with different digital technologies adoption actors in the construction industry, allowed the identification of six final themes depicting the influence of stakeholder involvement in the adoption of digital technologies. The findings indicate that stakeholder involvement influence is a function of its embeddedness in an organisation digitalisation approach. Stakeholder involvement embeddedness in the approach, or lack thereof, dictates how the stakeholder landscape is planned and managed, and how communication between and with stakeholder groups occurs. This is the foundation of digitalisation value creation among stakeholders. The approach is prone to digitalisation limitations and intrinsic determinants of adoption, both of which can be positively impacted through better stakeholder involvement practices. Stakeholder involvement practices are therefore catalytic to the subsequent behaviour change for digital technologies adoption and the extent to which digital technologies become adopted. This paper contextualises stakeholder involvement in the adoption of digital technologies in the construction industry, highlighting the catalytic influence of stakeholder involvement embeddedness in the complex digitalisation activity system and its interplay with industry-specific practices and other digital technology adoption determinants.

Keywords: stakeholder involvement; digitalisation; digital technologies adoption; construction industry; digital construction

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1. Introduction

The advent of new digital technologies (DTs), such as the internet of things, artificial intelligence and big data, has revolutionised the construction industry [1]. The industry has undertaken digitalisation and digital transformation processes to take advantage of digitalisation opportunities [2]. Digitalisation, defined as "*the use of digital technologies to change and improve existing business processes*" [1], and digital transformation, defined as "*a process that aims to improve an entity by triggering significant changes to its properties through the combination of information, computing, communication and connectivity technologies*" [3], have the potential to enable innovation, improve productivity, and increase quality in the construction industry [4]. However, adoption of these technologies in the industry remains a challenge partly due to poor stakeholder involvement [5].

An essential characteristic of digitalisation projects in the construction industry is the participation of different stakeholders with different roles and interests [6,7], and where stakeholder behaviour and lack of trust throughout projects are detrimental to success [8]. In comparison to other sectors, the construction industry is characterised by complexity, uncertainty, a fragmented supply chain, short-term thinking and a culture that hinders adoption progress [9]. These contextual characteristics and project dynamics exacerbate the already challenging task of managing the stakeholder landscape [7]. This is the essence

of digitalisation project risks, which require adequate mitigation strategies such as good organisational stakeholder involvement practice, adequate stakeholder management strategies, and an understanding of stakeholder attributes and behaviours, as argued by Yang, et al. [10]. Yet, stakeholder involvement remains a major challenge across industries in general, and in construction projects in particular [11].

While the advantages of adopting these technologies in the construction industry are generally known [12], achieving the desired digitalisation and digital transformation benefits remains a challenge due to a variety of intertwined influential technical and socio-technical factors including people, culture, process and construction procedures, technology, goals and infrastructure [13]. Exploring these factors and developing mitigating strategies are essential to improve digitalisation processes and to broaden the scope and benefits of DT adoption [14]. The need to understand the intricacies of these factors, and the drive for better digitalisation outcomes in the construction industry, have generated great research interests over recent years [15]. Despite the breadth of scholarly discourse on the relevance of stakeholder involvement, challenges still persist in practice [7,16].

As numerous initiatives are undertaken to maximise DTs' adoption benefits and improve efficiencies in the UK construction industry [17], further exploration of non-technical factors affecting DT adoption, such as stakeholder involvement in the industry [13], and the development of guides and approaches for good stakeholder management in construction [7,18] are pertinent. This study aimed to assess how stakeholder involvement influenced DT adoption from a socio-technical perspective. The Activity Analysis and Development (ActAD) framework, an extension of Activity Theory (AT) [19], is used as a theoretical framework. It builds on stakeholder theory by contextualising stakeholder management practice to the complex socio-technical activity system of digitalisation. The study contributes to developing insight into the dynamics of stakeholder involvement practice and the implications thereof for better DT adoption outcomes. Notwithstanding stakeholder management guidelines and the impact of industry specific characteristics, this study demonstrates the critical role of the embeddedness of stakeholder involvement into an organisation digitalisation approach in enabling systemic positive changes to impact behaviour change for DT adoption.

2. Background

2.1. Digitalisation and Stakeholders in the Construction Industry

The fourth industrial revolution [20,21] and the drive for digitalisation across industries and sectors is well documented. Globally, organisations have undertaken digitalisation projects, leading to the proliferation of the concept of Industry 4.0 across sectors, including the construction industry, with the advent of Construction 4.0. Examples of these technologies include robotics and process control automation, industrial internet of things, additive manufacturing, augmented and virtual reality, simulation, data and systems integration, big data analytics, cognitive computing and artificial intelligence, mobility and wearables, and cloud-based platforms [17]. Among the many drivers of digitalisation is the availability of different innovative DTs and the promise of productivity improvement, services improvement, improved efficiencies and data security [22]. While great progress has been made in certain industries, slow adoption still characterises the construction industry [23,24]. The slow adoption is attributed to different challenges, including the industry's context and complexities [25]. Among these, stakeholder involvement has been identified as a major hurdle [13]. Stakeholders in digitalisation in the construction industry include not only construction project stakeholders such as financial institutions, regulatory authorities, architects and engineers [26], but also diverse actors such as project leaders and managers, government agencies, DT vendors and suppliers, and construction workers [6]. It is therefore imperative to explore how these stakeholders' involvement influences DTs' adoption in the industry.

The stakeholder concept and stakeholder theory have received great attention in the literature and management practice in different industries [27]. The theoretical constructs

have been widely used beyond their field of origin [28] as their relevance spans disciplines including innovation management [29,30]. Over the years, stakeholder theory's further elucidation has led to the development of various stakeholder concepts [31] that are fundamental to its multi-disciplinary exploratory applicability, including in the construction industry [32] and information systems research [33]. Stakeholder salience and related stakeholder attributes of power, legitimacy and urgency are, for example, at the core of stakeholder identification [34]. Stakeholder engagement has similarly been extensively used across sectors and disciplines for its practicality in navigating the process of creating value in a complex multi-stakeholder landscape [35].

As one navigates through stakeholder concepts, understanding stakeholder principles is imperative for adequate theoretical and practical application. In this regard Pouloudi, Currie and Whitley [33] developed the following five stakeholder principles in the context of information systems: (1) "*The set and number of stakeholders are context and time dependent*", (2) "*Stakeholders may have different roles*", (3) "*Different stakeholders may have different values and perspectives, which may be explicit, implicit, or hidden*", (4) "*Stakeholder roles, perspectives, and alliances may change over time*", (5) "*Stakeholders relations and power matter in the shifts in their roles, perceptions, and alliances*". A key element in applying variations in stakeholder theory concepts to different organisational contexts, as argued by Freeman [36], is "value-creation" for the different stakeholders. These concepts and principles are fundamental to our exploration of the influence of stakeholder involvement, which is described by Ingenbleek and Dentoni [37] as a longitudinal process that extends beyond stakeholder management to effectively address changing stakeholder needs and the changing stakeholder landscape in a project lifecycle.

While different scholars have explored the stakeholder concept in different organisational settings, there is still a lack of consensus on the core meaning of the term stakeholder and its constitutive elements [38]. In this study we explore stakeholder involvement in the context of Freeman's definition: "*a stakeholder in an organisation is any group or individual who can affect or is affected by the achievement of an organisation's objectives*" (p. 46, [39]). For the purpose of this study, the following, more specific definition is therefore used: a stakeholder in organisational digitalisation and digital transformation is any individual actor or group who can affect, or is affected by, the achievement of an organisation's digitalisation or digital transformation objectives. We investigate how stakeholder involvement influences the adoption of digital technologies and how involvement enables improved adoption outcomes and digitalisation benefits for all stakeholders in the specific context of the UK construction industry.

2.2. ActAD Framework: A Socio-Technical Theoretical Framework

Analysis of the research landscape on digitalisation in the construction sector highlights the need for diversified, multi-disciplinary research and the exploration of non-technical issues [9] and human factors [40]. Transdisciplinary research that integrates experiences from the construction industry, and the theoretical grounding from information systems, is essential to the development of a greater understanding of DTs' adoption complexity in the industry [41]. Such an approach is appropriate for the exploration of DTs' disruptive characteristic and their socio-technical nature [21]. This is also essential to understand related multi-dimensional organisational change in its complexity and context [42]. In the current digitalisation era, the use of a socio-technical approach for the achievement of a balance between the people, the technology and the organisation is important [43,44].

As a socio-technical theory, AT and its five key pillars—the collective, artefact-mediated object-oriented activity system as the unit of analysis, the multi-voicedness of activity systems, historicity, contradictions, and expansive transformation in the activity system [45]—provide exploratory capabilities in the investigation of complex activities such as the implementation and adoption of DTs in the construction industry [46,47]. The ActAD framework [48] unpacks an activity system's complexities by detailing work activity ele-

ments, actors' individual and group actions, the resulting collective transformation of a joint object into the activity system's outcome, and the systemic mediating.

The ActAD framework can be extended to explore other digitalisation systemic considerations. Taking advantage of the framework's exploratory capabilities and constructs, such as an industry's mode of operation (historical phases), the contradictions in digitalisation practice, means of coordination and communication, mediating factors, and other elements can generate better understanding of related complexities, since in the construction industry, organisational undertakings are characterised by multiple activity systems with myriad sub-activities. The authors adapted the framework to highlight stakeholder involvement and digitalisation's systemic elements as illustrated in Figure 1 and Table 1 below.

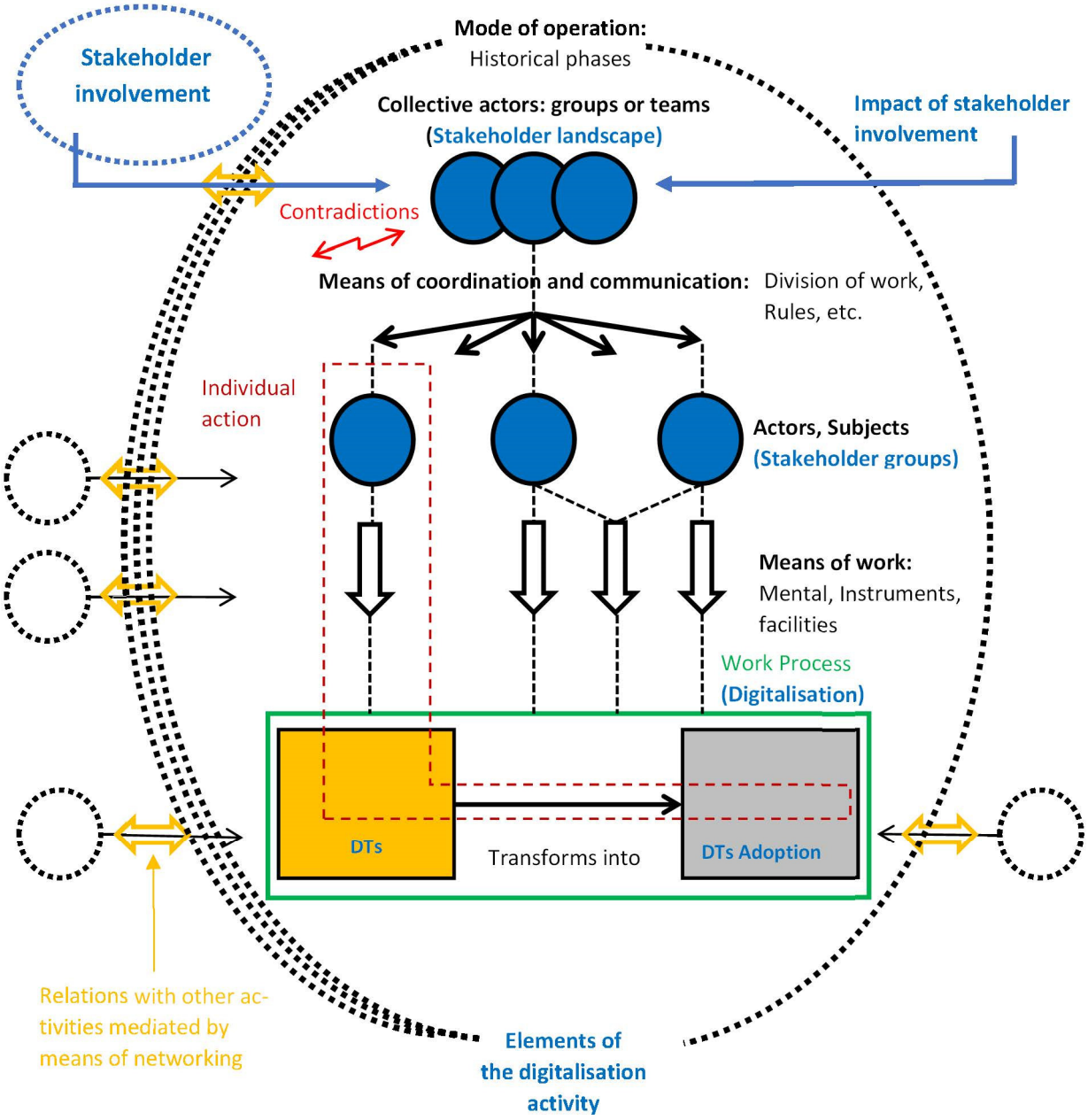

Figure 1. Adaptation of the Activity Analysis and Development (ActAD) framework to the investigation of the influence of stakeholder involvement in the adoption of digital technologies. Adapted from Mursu, Luukkonen, Toivanen and Korpela [19].

Table 1. ActAD framework constructs' adaptation to the exploration of stakeholder involvement in digitalisation.

ActAD Constructs	Constructs' Adaptation to Stakeholder Involvement in Digitalisation
Collective actors: groups or teams	Stakeholder landscape including internal and external stakeholders
Means of coordination and communication	Coordination and communication mechanisms
Actors, subjects	Digitalisation stakeholders (individuals or groups)
Individual actions	Stakeholders (individuals or groups) digitalisation role and actions
Means of work	Tools and means of digitalisation
Work process	Digitalisation process
Object	Digital technologies
Outcome	Digital technologies' adoption
Contradictions	Contradictions in the digitalisation process
Mode of operation: historical phases	Industry digitalisation maturity and culture
Relation with other activities	Digitalisation relations and links with other activities

From an ActAD framework perspective, digitalisation in the construction industry is a joint work process where different stakeholders' individual and collective actions implicitly contribute to DT adoption, which is a joint and desired outcome of the digitalisation activity system. From the collective pool of actors within the stakeholder landscape, some selectively partake, individually or as a group, in subsequent organisational digitalisation processes by means of coordination and communication. The selected stakeholders' joint actions contribute to DT adoption using the means of work (mental, instruments, facilities and tools). Within the digitalisation process there exist modes of operation, or historical phases, and contradictions that characterise the process. Additionally, multiple related sub-activities, such as stakeholder involvement, inherently contribute to the attainment of digitalisation outcomes. Organisational stakeholder involvement practice has implications transcending DT implementation and adoption in the digitalisation activity system.

3. Material and Method

3.1. Research Design and Setting

This study followed an interpretive qualitative approach [49] where the construction industry of the UK was selected as a case study [50]. Commonly used in qualitative and social research, the case study strategy has extensively been applied across disciplines for its deep exploratory abilities of a research unit of analysis within its natural context [51]. This study used a descriptive case study approach [51], where purposeful sampling allowed the selection and identification of relevant individual participants [52] who have been working in different construction organisations and who had digitalisation experience in the UK.

The data was collected through semi-structured interviews and a qualitative survey. Semi-structured interviews were essential in the development of a deep understanding of the research phenomenon's social, cultural and contextual factors and to reach conclusions grounded in the interpretation of these societal realities' contexts and meanings [49]. The qualitative survey gathered diverse responses from participants [53], thereby contributing to deep insight into the research phenomenon using a five-stage process framework [54]: identifying the prerequisites for use of a semi-structured interview, retrieving and utilising the previous knowledge, formulating of the preliminary interview guide, pilot testing, and presenting a complete interview guide. The interview guide and the survey questionnaire were designed using the same questions to allow the collection of detailed information to answer the study's research question: how does stakeholder involvement influence the adoption of digital technologies in the UK construction industry? The group of questions were structured in the following six sections: firstly, exploration of the digital technologies' implementation history, the digitalisation process, the stakeholders and their involvement

process, digital technologies' adoption and, participants' general opinion on the influence of stakeholder involvement and digital technologies' adoption.

We conducted twenty-four interviews and collected sixty survey responses. Using these two techniques, rich and detailed data was collected from eighty-four participants in total. These participants were a mix of digitalisation actors across demographic groups, digitalisation roles, hierarchical positions, and experiences in the construction industry of the UK. They are grouped as follows based on their digitalisation experience in number of years: 1–5 years: thirty-one, 6–10 years: eighteen, 11–15 years: eleven, 16–20 years: sixteen, and more than 20 years: eight. Twenty-three of these interviews were conducted using MS Teams and one was in-person. The interviews were then transcribed for later analysis. The interviews were conducted between February 2023 and November 2023, each lasting between thirty and forty-five minutes. Participants in the interviews included four directors, three programme/digitalisation leads, three BIM/project managers, two associate partners, six architects, three engineers, and three sales and marketing executives. Designed using QuestionPro software (2024 version) [55] and administered through Prolific [56], the survey was conducted between the end of March and the beginning of May 2024. Responses were collected from sixty participants with diversified digitalisation experiences across the construction industry. They included four managers, seven software developers/testers, eleven architects, fifteen engineers, two academics/teachers, thirteen IT department staff, three finance department staff, and five technology providers/salespersons.

3.2. Data Analysis

The collected data were analysed using thematic analysis in a multiple iteration process. The qualitative software NVivo 14 [57] and manual thematic analysis [58] were used complementarily to identify and cluster themes through a five-stage iterative process as illustrated in Figure 2. The themes were coded as follow: the acronym CISI/IF (Construction Industry Stakeholder Involvement Influence factor) followed by two numbers separated by a dot where the first number represents the analysis stage and the second number identifies each subtheme within the respective stage grouping. ActAD constructs were used to extract related quotes from the interview transcripts in the first stage of the analysis (CISI/IF 1). In the second stage, key words and meaning were derived from the extracts and classified in similar grouping meanings (CISI/IF 2). In the third stage and based on the grouping in stage two, eighty-three preliminary subthemes (CISI/IF 3) were identified. These preliminary subthemes were then grouped into eighteen subthemes and further into twelve sub-themes (CISI/IF 4) in stage four. In stage five, these twelve sub-themes were classified into six themes (CISI/IF 5), which were lastly grouped into four themes. Table 2 provides a summary of the final iteration themes and subthemes. Appendix A provides a detailed illustration of part of the themes grouping process. The final four themes were then integrated into a framework highlighting the interrelations between the identified stakeholder involvement influence elements.

Table 2. Summary of the final iteration themes and sub-themes.

STAGE 4 SUB-THEMES	STAGE 5 SUB-THEMES	STAGE 6 FINAL ITERATION THEMES
Digitalisation prerogative **[CISI/IF 4.1]**	**Organisational digitalisation approach [CISI/IF 5.1]**	**STAKEHOLDER INVOLVEMENT EMBEDDEDNESS IN DIGITALISATION APPROACH [CISI/IF 6.1]**
Digitalisation leadership and management **[CISI/IF 4.2]**		
Digitalisation stakeholder landscape, roles, and targeted actions **[CISI/IF 4.3]**	**Stakeholder landscape planning and management [CISI/IF 5.2]**	
Stakeholder groups engagement **[CISI/IF 4.4]**		
Organisation communication strategy and culture **[CISI/IF 4.5]**	**Stakeholder communication framework [CISI/IF 5.3]**	
Stakeholder involvement mechanism and stakeholder engagement tools **[CISI/IF 4.6]**		

Table 2. *Cont.*

STAGE 4 SUB-THEMES	STAGE 5 SUB-THEMES	STAGE 6 FINAL ITERATION THEMES
Digitalisation stakeholder mix/composition limitations **[CISI/IF 4.7]**	**Organisational digitalisation limitations [CISI/IF 5.4]**	**ORGANISATIONAL DIGITALISATION LIMITATIONS [CISI/IF 6.2]**
Digital technologies implementation limitations **[CISI/IF 4.8]**		
Individual, teams and organisation context characteristics **[CISI/IF 4.9]**	**Intrinsic determinants of adoption [CISI/IF 5.5]**	**INTRINSIC DETERMINANTS OF ADOPTION [CISI/IF 6.3]**
Digital technologies implementation scope and mechanisms **[CISI/IF 4.10]**		
Adoption enabling mechanisms **[CISI/IF 4.11]**	**Motivation for behaviour change and digital technology adoption [CISI/IF 5.6]**	**MOTIVATION FOR BEHAVIOUR CHANGE AND DIGITAL TECHNOLOGY ADOPTION [CISI/IF 6.4]**
Perceived technology adoption benefits creation process **[CISI/IF 4.12]**		

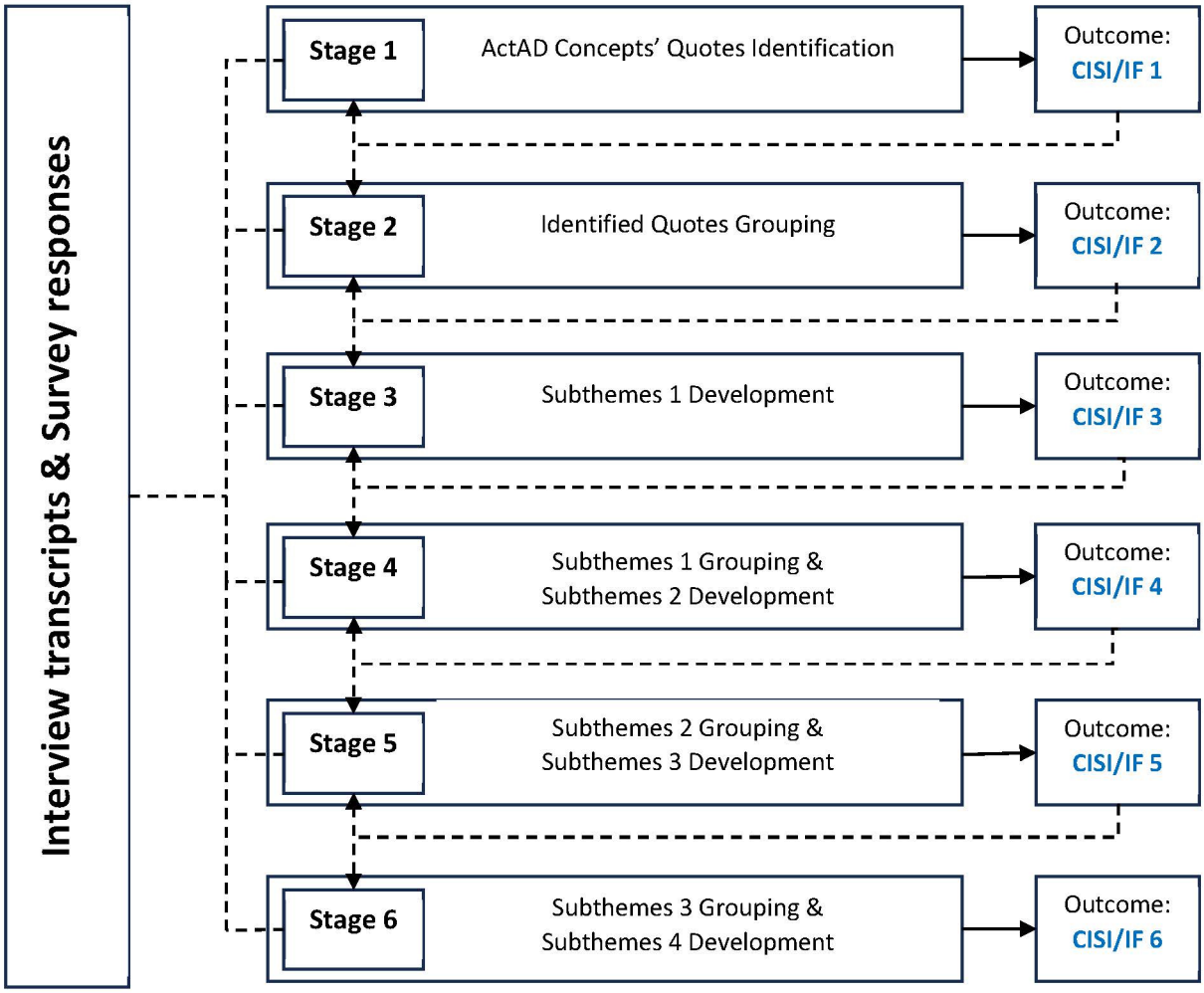

Figure 2. Summary of iterative thematic analysis.

4. Findings

The influence of stakeholder involvement in DT adoption in the construction industry is a function of stakeholder involvement embeddedness in an organisation digitalisation approach. Stakeholder involvement embeddedness can be defined as the extent to which the digitalisation approach encompasses appropriate stakeholder involvement practices. As illustrated in Figure 3, stakeholder involvement embeddedness enables changes in behaviour and motivation for DT adoption. This is achieved through the catalytic influence

of an organisation's adequate stakeholder communication framework and stakeholder landscape planning and management. Additionally, stakeholder involvement embeddedness systemically drives positive changes in an organisation's digitalisation approach, digitalisation limitations and determinants of adoption. The positive systemic changes emanating from the catalytic influence of stakeholder involvement, including the change in adoption behaviour, subsequently impact DT adoption outcomes.

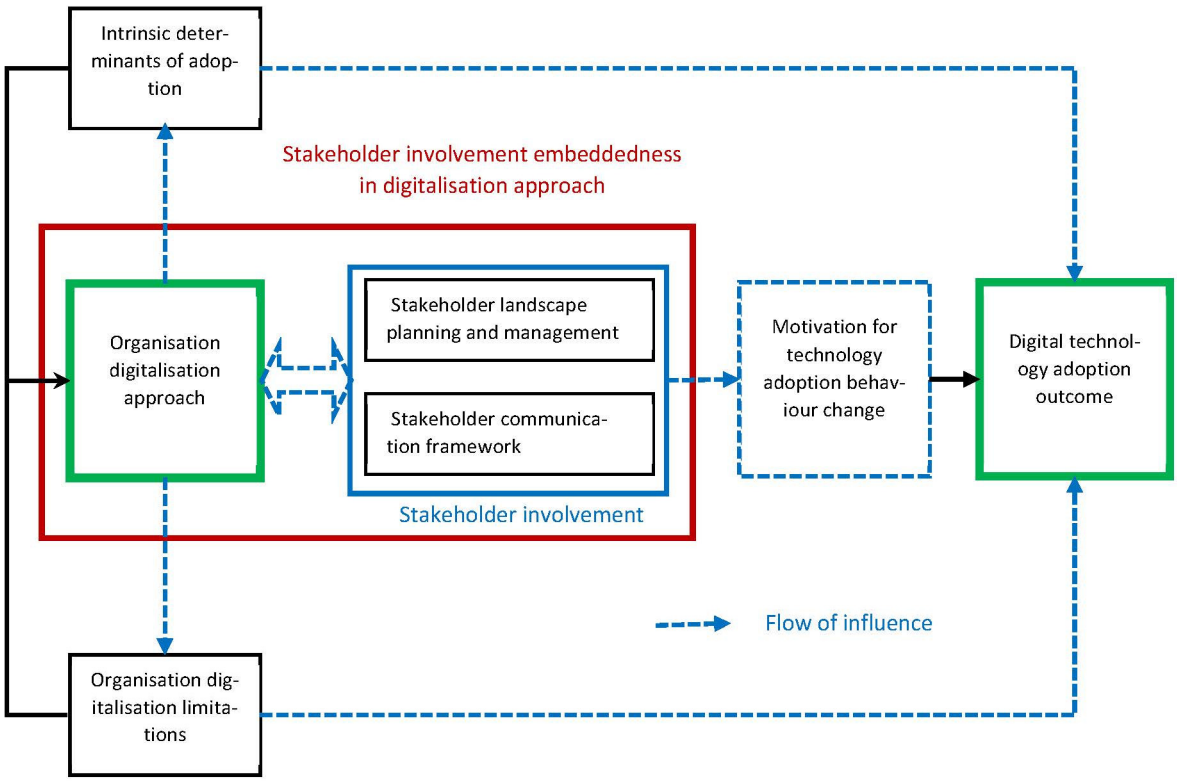

Figure 3. Influence of stakeholder involvement in the adoption of digital technologies.

It is the prerogative of digitalisation decision-makers such as leaders and managers, government agencies, financial institutions and DT deployment teams to follow an approach that is inclusive of good stakeholder involvement practices. This is crucial for achieving the following four involvement goals:

- Aligning an organisation's vision and stakeholder digitalisation needs.
- Planning and making informed involvement decisions, such as the choice of communication tools, techniques and channels.
- Using stakeholder group-appropriate communication tools, techniques and channels.
- Ensuring that the digitalisation vision and benefits are communicated effectively among all stakeholder groups, including architects, engineers, construction workers, DT vendors and suppliers, and construction project managers.

Such an approach enables positive behaviour and systemic changes for improved adoption outcomes. To ensure sustainable DT deployment and good adoption outcomes in an increasingly evolving DT ecosystem, construction project managers and digitalisation leaders, in particular, need to create an environment and an organisational culture that foster timely tailored engagements with all actors—individuals, groups or organisations—who affect or are affected by the achievement of their respective organisation's digitalisation objectives.

4.1. Stakeholder Involvement Embeddedness in a Digitalisation Approach

Stakeholder involvement embeddedness in an organisation's digitalisation approach dictates how the stakeholder landscape is planned and managed, and how communication

occurs between and with stakeholder groups. It depicts an organisation's stakeholder involvement practice, which encapsulates an organisation's stakeholder landscape planning, stakeholder management and stakeholder communication framework. It simultaneously mitigates digitalisation limitations and intrinsic determinants of adoption. This culminates, primarily, in changes in the motivation for DT adoption behaviour, and consequently, into better DT adoption outcomes. Stakeholder involvement embeddedness in a digitalisation approach is therefore, directly or indirectly, catalytic to changes in the organisational digitalisation approach, organisational digitalisation limitations and the intrinsic determinant of adoptions. In the absence of stakeholder involvement embeddedness in an organisation's digitalisation approach, adoption is likely to be problematic and the digitalisation process marred by multiple systemic difficulties.

4.1.1. Stakeholder Digitalisation Approach

The approach to digitalisation is one of the many essential elements that has far-reaching implications throughout the technological deployment and organisational change processes that culminate in DT adoption in the construction industry context. In its complexity and details, it provides ground for digitalisation considerations and informs an organisation's digital stakeholder involvement strategy for better DT adoption outcomes, as highlighted by one participant:

> "*An approach that is user-centric with incremental implementation allows prioritising user needs and preferences when selecting and implementing digital technologies, ensuring they are intuitive and aligned with user workflows; introducing digital technologies gradually, starting with smaller, manageable changes and building upon successes to foster acceptance and confidence among stakeholders*".
>
> **(Participant 9)**

It is inclusive of two dimensions: digitalisation prerogative, and digitalisation leadership and management. Digitalisation prerogative describes an organisation's drive, motivation and need to embark on a digitalisation and digital transformation journey. It consists of DTs' types and characteristics, organisational strategic investment decisions, organisation digitalisation maturity level and DTs' implementation contextual drivers. It is the basis for digitalisation decisions and the subsequent DT selection. Stakeholder involvement at this level is likely to be for strategic reasons. This will have adoption implications as the digitalisation process unfolds, based on decisions taken, including decisions on stakeholder landscape management and stakeholder involvement practices, as observed by one participant:

> "*It was just one person's single mindedly making the decision: well, this is how I want it and you do it this way. . . Talking down to people rather than saying can we do it this way? What's available? How do we go ahead. . .? It was a recipe for disaster, and it basically failed, and it just wasted time. So, there was no plan. So, if you try and circumvent the support of the stakeholders that you have, you're never going to get it right. It's highly likely that you will fail*".
>
> **(Participant 17)**

The digitalisation leadership and management dimension include digital leadership attributes, managerial competencies, and leadership and management styles. It was identified as a key determinant of an organisation's stakeholder involvement practice and the subsequent DT adoption. It is fundamental to the choice and appropriateness of stakeholder engagement strategies for both horizontal and vertical engagements. It is also pivotal to the digitalisation project direction, implementation progress and challenges, and the technological uptake across organisations in the industry. Participants made the following remarks:

"*I think leadership and management should have a good incremental strategy or approach to digitalisation and clear communication, proper training and education to address skill gap; this is essential to creating stakeholder buy-in and the use of digital technologies*".

(Participant 22)

"*By adopting user-centric strategies, organisations can enhance the likelihood of successful adoption of digital technologies and maximise the benefits of digitalisation initiatives*".

(Participant 15)

4.1.2. Stakeholder Landscape Planning and Management

This is the essence of stakeholder involvement practice. It addresses two critical stakeholder involvement aspects: firstly, stakeholder landscape mapping needs, roles definition and targeted action specification. Secondly, it addresses the engagement with and between the difference stakeholder groups. There are different stakeholders who play different roles in different digitalisation processes, stages and construction specialties. Their actions can enable or hinder DT adoption. The adequacy of the planning and management of the stakeholder landscape determines how stakeholders are involved in practice and how this affects DT adoption.

"*We follow a stakeholder involvement planning and management process; it involves: Identifying stakeholders, assessing stakeholder interests, developing engagement strategies, maintaining communication and collaboration with stakeholders throughout the project, gather feedback from stakeholders regularly and adapt our approach as needed to address their needs and concerns. By following this process, we ensure that stakeholders are actively involved and engaged in the digitalisation project, leading to better outcomes and increased support for the initiative*".

(Participant 4)

Stakeholder group engagement is critical to stakeholder landscape planning and management. It entails bringing the different stakeholder groups at their respective levels on board and achieving DT implementation buy-in. A key consideration is the choice of strategies tailored to the specific digitalisation roles and needs of each stakeholder group, and how to convey context-specific digitalisation messages. Adoption behaviour change actions are planned at this level, to ensure the involvement of all relevant stakeholders, and to maximise their respective contributions to adoption. Essential to the attainment of stakeholder involvement objectives, stakeholder group engagement is achieved through an organisational stakeholder communication framework, as described below.

4.1.3. Stakeholder Communication Framework

Engagement with and between stakeholder groups occurs within a given organisation communication framework. The robustness of this framework determines the scope and quality of engagements between stakeholders. It also defines the modalities and tools of engagement with the different stakeholder groups at all organisational levels.

"*We have a stakeholder engagement and collaboration philosophy: Involve stakeholders early and throughout the digitalisation process, seeking their input, feedback, and involvement to create a sense of ownership and commitment to the changes*".

(Participant 29)

"*Overall, good stakeholder involvement mechanisms are critical for aligning digitalization efforts with organizational goals, maximizing value creation, and driving long-term success*".

(Participant 11)

There are two dimensions to this: firstly, the organisation communication strategy and culture, and secondly, the stakeholder involvement mechanism and engagement tools. There exist organisational communication strategies and cultures that drive digitalisation

communication, influence stakeholder involvement practices, and affect the consistency of engagements with and between stakeholder groups explicitly or implicitly. Linked to the leadership, management approach and stakeholder landscape planning, the communication strategy depicts communication targets and goals. This affects the level/type of engagement between different stakeholder groups at the different organisational levels for the achievement of digitalisation objectives and DT adoption.

> "*We create tailored strategies to engage with each stakeholder group effectively: communication and collaboration; we maintain open communication channels and collaborate with stakeholders throughout the project*".
>
> **(Participant 3)**

> "*You communicate in different ways with different people. So, if we're communicating upwards to leadership, it's usually about just simply demonstrating value... When you're talking to more kind of peers and juniors, it's a more pragmatic discussion: you can talk in more detail about how it impacts and how it improves what they're doing. It's trying to demonstrate particularly with live projects, actual case studies where it's brought that value*".
>
> **(Participant 11)**

Good involvement mechanisms and engagement tools are essential to good stakeholder involvement practices and the achievement of stakeholder involvement objectives. Consistent engagements with and between stakeholder groups help meet their respective digitalisation obligations. Stakeholder engagement tools include technologies that facilitate stakeholder involvement. They enable better communication regardless of location or time zones. They also facilitate seamless information exchange and provide collaborative abilities at micro, meso and macro levels.

4.2. Organisational Digitalisation Limitations

Throughout the digital transformation journey, limitations hamper the achievement of an organisation's digitalisation objectives. These limitations can be classified into two major categories: digitalisation stakeholder mix/composition, and DT implementation limitations. The latter stem from various implementation challenges, project risks, a lack of detailed organisational digitalisation processes, and additional factors, such as the organisation's inadequate digitalisation approach, and poor leadership, planning and management. This has ramifications for different elements of digitalisation lifecycle, leading to gaps between organisational digitalisation objectives and DT adoption. Stakeholder involvement practices can act positively on these limitations, by enabling knowledge sharing across all levels, and stakeholders' common understanding of digitalisation objectives.

> "*Several limitations hindered the adoption of digital technologies: lack of awareness of the benefits or existence of digital technologies, resistance to change, high implementation or training costs, technologies that are too complex or difficult to use, Insufficient training or support resources, security concerns, legacy systems, and compatibility issues with existing systems. Addressing these barriers is essential to promote successful adoption of digital technologies within an organisation*".
>
> **(Participant 10)**

> "*Ensuring that the users understand the purpose of the initiative and 'what's in it for them' definitely helps make things a lot smoother. However, this is often challenging due to complexity*".
>
> **(Participant 3)**

With the complexity of digitalisation, different stakeholder groups play different roles at different stages of the process, by providing different digitalisation expertise. Cumulative stakeholder actions contribute towards progress in DT adoption. Challenges stemming from inadequate stakeholder planning, identification and management result in

digitalisation stakeholder mix limitations. This is exacerbated by the uncertainty regarding the movement of stakeholders from non-stakeholder, internal stakeholder or external stakeholder to the digitalisation stakeholder mix. Stakeholder involvement practice can contribute positively to the digitalisation stakeholder mix formation, by facilitating stakeholder groups' transition from non-stakeholders to an external stakeholder or internal stakeholder. Stakeholder involvement is not always undertaken as an integral part of the digitalisation process. Yet, when adequately planned and managed, stakeholder involvement alleviates digitalisation limitations.

4.3. Intrinsic Determinants of Adoption

DT adoption across organisations is affected by intrinsic conditions. Regardless of stakeholder involvement efforts, these factors influence attitudes toward the technology, and the manifestation of DT adoption and non-adoption behaviours.

> "*Several factors affect the adoption of digital technologies: Ease of Use…, Perceived Benefits…, Support and Training…, Leadership Support…, Organisational culture…, Compatibility..., and external factors such as market trends, regulatory requirements, and industry standards also influence technology adoption. These factors collectively shape the willingness of stakeholders to adopt digital technologies within an organisation*".
>
> **(Participant 27)**

These can be classified into two groups: characteristics relating to individuals, teams and organisations, and DT implementation scope and mechanisms. The characteristics of individuals, teams and organisational contexts include individual competencies and attributes, team structures and dynamics, organisational culture, and the broader digitalisation context. These exist independently of stakeholder involvement practice. At their respective levels, individuals, teams and organisation context characteristics are pre-determinant of possible adoption behaviours. The scope of implementation and the related implementation mechanisms are closely associated with the pace of digitalisation and DT adoption. Complex and larger digitalisation projects are more prone to potential adoption difficulties. The related implementation mechanisms need to be able to address the complexities around the digitalisation processes and organisational change, resources mobilisation, technical capacity building and multi-level engagements. DT adoption is implicitly dependent on the digitalisation scope and the effectiveness of organisational DT implementation mechanisms.

4.4. Motivation for Behaviour Change and Digital Technology Adoption

Stakeholder involvement creates a positive attitude toward the technology and the perception of its benefits among the different stakeholders, therefore influencing stakeholder motivation for behaviour change and DT adoption in the industry. The existence of a good stakeholder involvement process in the industry's digitalisation journey, or lack thereof, has implications on how DT become adopted.

> "*Stakeholder active participation in the digitalisation process helped to address concerns and overcome resistance to change, leading to smoother adoption and implementation*".
>
> **(Participant 20)**

> "*The more consultation that you can do increases the chances of the new processes being fully adopted and integrated into the business*".
>
> **(Participant 11)**

> "*Stakeholders buy-in and support increased acceptance and enthusiasm for the new technologies among employees and other stakeholders*".
>
> **(Participant 29)**

The influence of stakeholder involvement on the motivation for change and motivation to adopt DT is actioned through the interplay between the organisation's adoption-enabling

mechanisms and the related processes for creating perceived technology adoption benefits. Stakeholder involvement and its relationship with other elements of the digitalisation activity system have ramifications beyond mere engagements between stakeholders. Its influence stretches across dimensions and manifests itself in the motivation for behaviour change and DT adoption, therefore contributing to positive digital adoption outcomes. An organisation's culture is key in this regard in tackling stakeholder involvement and DT adoption challenges.

> "*Organisational culture plays a pivotal role: A culture that values innovation and embraces change fosters adoption of new technologies. If stakeholders see clear advantages or improvements from using the technologies, they're more likely to adopt them*".
>
> **(Participant 6)**

Organisations put in place mechanisms that can enable the achievement of positive adoption outcomes. The mechanisms encompass different activities that create an environment that is conducive to the adoption of implemented DTs. Stakeholder involvement implicitly reinforces these mechanisms. Examples include training provision agreements, digitalisation role definitions, digitalisation competencies development and digitalisation resource mobilisation. Stakeholder involvement ensures that the complexity around creating such an environment is better understood. Stakeholder involvement also improves efficiencies in managing the intricacies of the interrelated adoption-enabling elements.

5. Discussion

The influence of stakeholder involvement stems from the extent to which stakeholder involvement practice is embedded within an organisation's digitalisation approach. Digitalisation processes in the construction industry generally affect DT adoption progress [59]. An organisation's digitalisation approach primarily determines the effectiveness of these processes, including stakeholder landscape planning and management. In this regard, Alnuaimi, et al. [60] argue for organisational flexibility, digital leadership and strategic planning in digitalisation. In the breadth of stakeholder management and involvement best practices, it is therefore the prerogative of each organisation's management team to choose an appropriate digitalisation approach, and stakeholder involvement best practices and guidelines. This choice has to be aligned with the stakeholder's context and the organisation's digitalisation needs [29]. The ultimate influence of stakeholder involvement is reflected in the consequential behaviour change and motivation to adopt DTs.

Good stakeholder landscape planning and management is pertinent to gaining an understanding of stakeholder complexity and the development of stakeholder involvement strategies to facilitate DT adoption. In this regard, digitalisation leaders and managers can refer to existing stakeholder management guidelines [61] and theories such as stakeholder theory [62] and institutional theory [63]. Institutional theory and the related notion of stakeholder legitimacy, for example, allows for the distinction between stakeholders based on different types of stakeholder legitimacies, which in turn has implications for organisational stakeholder involvement modalities and practices [64]. Practitioners' perception of stakeholder attributes and behaviours has a large influence on the best ways of dealing with stakeholders' interests [10].

Different systemic elements contribute to the overall adoption of digital technology. The digitalisation approach, for example, has been directly linked to adoption challenges such as people resistance [40]. Shojaei and Burgess [13] note that collaborative culture, human-centric and committed leadership and training, and skills development are critical in DT adoption in the UK construction industry. DT adoption enablers and barriers, such as organisational culture and leadership [65], users' digital literacy [66], early innovators [22], and innovation champions [67], affect digitalisation. However, industry stakeholder involvement practice has an overarching influence, spanning technical, implementation, resources and adoption behaviour dimensions.

There are different limitations and barriers to DT adoption in the construction industry [68]. As the industry's digital transformation journey continues, unavoidable digitalisation limitations necessitate the development of mitigating strategies for adoption progress [69]. Better measures are essential to address stakeholder involvement barriers that affect DT adoption in the industry [70]. Progress will be influenced by redesigning organisational business and stakeholder processes [43]. The pressures of digitalisation, digital transformation and DT adoption in the industry have inherent organisational demand for process reshaping and complexity solving [71]. The complexity of the relationships between multiple stakeholders and the modalities of stakeholder involvement in practice can lead to stakeholder mix limitations due to inadequate stakeholder engagement. Poor engagements between the different stakeholder groups and the related tensions [7,41] have a detrimental influence on DT adoption. Organisations in the construction industry therefore need to rethink their stakeholder involvement practices to achieve better digital adoption outcomes.

The involvement of the different stakeholders, or the lack thereof, at a project's early planning stages has repercussions for the manifestation or diffusion of any potential tensions and conflicts that might arise in the future [16]. Organisations need to put in place mitigating strategies for the management of the complexity around stakeholder involvement. This will improve DT adoption motivation in the industry, where, as argued by Osunsanmi, Aigbavboa, Oke and Liphadzi [20], stakeholder willingness remains a major challenge. Yet DTs also play an enabling role in stakeholder involvement practice. Relevant DTs ensure stakeholders' timely collaboration and improved productivity [72]. DTs have the potential not only to improve organisational performance, but also construction project stakeholder engagement [9].

6. Conclusions

This study's findings indicate that DT adoption outcomes can be improved when stakeholder involvement is embedded within an organisational digitalisation approach. Stakeholder involvement embeddedness in the digitalisation approach, or lack thereof, impacts the motivation for DT adoption behaviour change and DT adoption, as DTs' value is communicated across the changing digitalisation stakeholder landscape through adequate involvement mechanisms. As such, DT adoption is mediated by stakeholder involvement practice, which is deeply rooted in an organisation's communication framework, and the leadership's approach to stakeholder landscape planning and management. Moreover, stakeholder involvement embeddedness alleviates the impact of systemic limitations and intrinsic determinants of adoption pertaining to the digitalisation process and DT adoption. In the absence of stakeholder involvement embeddedness in a digitalisation approach, a situational assessment of adoption progress and stakeholder involvement practice, based on stakeholder involvement embeddedness, can provide the foundation for corrective actions. Stakeholder involvement's catalytic role transcends an organisation's digitalisation processes at micro, meso and macro levels, while enabling value creation for all digitalisation stakeholders and positive change in stakeholders' perception of DT adoption benefits.

This study contributes to the body of knowledge on stakeholder engagement and technology adoption by highlighting the catalytic role of stakeholder involvement embeddedness in fostering behaviour change and DT adoption while minimising prevalent stakeholder involvement and adoption challenges. The contribution is twofold: firstly, and theoretically, the ActAD framework-based analysis provided descriptive capabilities, highlighting the breadth of the digitalisation stakeholder landscape, the dynamics of stakeholder involvement, and the interconnectivity between stakeholder involvement practice and DT adoption. Secondly, and practically, the findings can be useful to leaders, managers and academics who are involved in digitalisation as an assessment and strategic digitalisation planning tool for stakeholder involvement and the achievement of better digitalisation outcomes. This study's findings shed light on how digitalisation limitations can be positively impacted through adequate organisational stakeholder involvement prac-

tices and, although derived from the construction industry, they have the potential to be applicable to similar digitalisation environments.

A limitation of this study is its sole focus on the influence of stakeholder involvement in DT adoption without exploring the influence of stakeholder, leadership and management attributes. Further exploration of these influential factors would generate additional insight, practical considerations and research-informed guidelines to achieve digitalisation progress in the industry and other sectors. In this regard, the authors are undertaking further investigation to explore digitalisation similarities with the healthcare sector and the role of leadership in stakeholder involvement in a complementary study.

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Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

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Appendix A

Table A1. Thematic Analysis Summary.

STAGE 3	STAGE 4		STAGE 5
	INITIAL	REVISED	
Revit **[CISI/IF 3.1]**, Sharepoint **[CISI/IF 3.2]**, Yammer **[CISI/IF 3.3]**, MS Teams **[CISI/IF 3.4]**, Zoom **[CISI/IF 3.5]**, BIM **[CISI/IF 3.6]**, Powerpoint presentation **[CISI/IF 3.7]**, Meetings **[CISI/IF 3.8],** Communication tools effectiveness **[CISI/IF 3.9]**	Tools and technologies for stakeholder involvement **[CISI/IF 4.1*]**	**[CISI/IF 4.2*] and [CISI/IF 4.4*]** merged into ***Organisation communication strategy and culture*** **[CISI/IF 4.5]**	**STAKEHOLDER COMMUNICATION FRAMEWORK** **[CISI/IF 5.3]**
Stakeholder communication to eliminate resistance to change **[CISI/IF 3.10]**, Mechanisms to get stakeholder feedback **[CISI/IF 3.11]**, Weekly meetings **[CISI/IF 3.12]**, Existing memorandum of understandings **[CISI/IF 3.13]**, Building trust in technology **[CISI/IF 3.14]**	Organisational communication strategy and mechanisms **[CISI/IF 4.2*]**		
Continuity of teams **[CISI/IF 3.15]**, Breakdown in relationship **[CISI/IF 3.16]**, Lack of understanding of procedures to follow **[CISI/IF 3.17]**, being on board and committed **[CISI/IF 3.18]**	Consistency of engagement with and between stakeholder groups **[CISI/IF 4.3*]**	**[CISI/IF 4.1*] and [CISI/IF 4.3*]** merged into ***Stakeholder involvement mechanism and stakeholder engagement tools*** **[CISI/IF 4.6]**	
Top-down and bottom-up approach **[CISI/IF 3.19]**, horizontal and vertical communication **[CISI/IF 3.20]**, communication within teams and across hierarchical structures **[CISI/IF 3.21]**	Organisational communication culture **[CISI/IF 4.4*]**		

Table A1. *Cont.*

STAGE 3	STAGE 4		STAGE 5
	INITIAL	REVISED	
Technology benefits awareness **[CISI/IF 3.22]**, Perceived extra workload due to digital technology **[CISI/IF 3.23]**, Digitalisation investment size **[CISI/IF 3.24]**, Digital technology awareness creation **[CISI/IF 3.25]**, Technology availability and relevance **[CISI/IF 3.26],** Building trust in technology **[CISI/IF 3.27]**, Willingness to adopt new technology **[CISI/IF 3.28],** Technology value presentation **[CISI/IF 3.29]**	Perceived technology adoption benefits creation process **[CISI/IF 4.5*]**	**[CISI/IF 4.5*]** becomes ***Perceived technology adoption benefits creation process*** **[CISI/IF 4.12]**	**MOTIVATION FOR DIGITAL TECHNOLOGY ADOPTION and BEHAVIOUR CHANGE** **[CISI/IF 5.6]**
Building teams competencies **[CISI/IF 3.30]**, Providing training **[CISI/IF 3.31]**, Assigning digitalisation roles **[CISI/IF 3.32]**, Roles of champions **[CISI/IF 3.33]**, Mobilisation of digitalisation resources **[CISI/IF 3.34]**	Adoption enabling mechanism **[CISI/IF 4.6*]**	**[CISI/IF 4.6*]** becomes ***Adoption enabling mechanisms*** **[CISI/IF 4.11]**	
Spectrum of stakeholders involved in project **[CISI/IF 3.35]**, Service providers **[CISI/IF 3.36]**, Internal stakeholders and external stakeholders **[CISI/IF 3.37]**, Globally stakeholders and local stakeholders' roles **[CISI/IF 3.38]**	Digitalisation stakeholder landscape, roles, and targeted actions **[CISI/IF 4.7*]**	**[CISI/IF 4.15*]** Becomes ***Digitalisation stakeholder landscape, roles, and targeted actions*** **[CISI/IF 4.3]**	**STAKEHOLDER LANDSCAPE PLANNING and MANAGEMENT** **[CISI/IF 5.2]**
Leverage stakeholder engagements **[CISI/IF 3.39]**, Different messages for difference stakeholder groups **[CISI/IF 3.40]**	Stakeholder groups Engagement **[CISI/IF 4.8*]**	**[CISI/IF 4.8*]** becomes ***Stakeholder groups engagement*** **[CISI/IF 4.4]**	
Divide between technical and non-technical staff **[CISI/IF 3.41]**, Senior vs. junior technological misunderstanding **[CISI/IF 3.42]**, Teams composition consistency for project continuity **[CISI/IF 3.43],** Project saboteurs **[CISI/IF 3.44]**	Digitalisation stakeholder mix/composition limitation **[CISI/IF 4.9*]**	**[CISI/IF 4.9*]** becomes ***Digitalisation stakeholder mix/ composition limitations*** **[CISI/IF 4.7]**	**ORGANISATIONAL DIGITALISATION LIMITATIONS** **[CISI/IF 5.4]**
Inadequate change and project management **[CISI/IF 3.45],** Framework/guide use **[CISI/IF 3.46]**, Lack of engagement with stakeholder **[CISI/IF 3.47]**, Leadership and management lack of understanding of project environment **[CISI/IF 3.48]**	Digital technologies implementation limitations **[CISI/IF 4.10*]**	**[CISI/IF 4.15*]** becomes ***Digital technologies implementation limitations*** **[CISI/IF 4.8]**	
Internal drive and readiness to adopt technology **[CISI/IF 3.49]**, Digital enthusiasm and literacy **[CISI/IF 3.50]**, Old school vs. new generation graduates **[CISI/IF 3.51]**, nervousness about new technology **[CISI/IF3.52]**,	Individual characteristics **[CISI/IF 4.11*]**	**[CISI/IF 4.11*]**, **[CISI/IF 4.13*]** **and** **[CISI/IF 4.14*]** merged into ***Individual, teams and organisation context characteristics*** **[CISI/IF 4.9]**	**INTRINSIC DETERMINANTS OF ADOPTION** **[CISI/IF 5.5]**
Agreements with service providers **[CISI/IF 3.53]**, Training mechanisms **[CISI/IF 3.54]**, Digitalisation level **[CISI/IF 3.55]**, Type of support provided **[CISI/IF 3.56]**, Organisation technical expertise and digitalisation structure **[CISI/IF 3.57]**	Technology implementation scope and mechanisms **[CISI/IF 4.12*]**	**[CISI/IF 4.12*]** becomes ***Digital technologies implementation scope and mechanisms*** **[CISI/IF 4.10]**	
Organisation size **[CISI/IF 3.58]**, Digitalisation project needs **[CISI/IF 3.59]**, Industry resistance to change **[CISI/IF 3.60]**, Difference in culture **[CISI/IF 3.61]**, Construction industry context **[CISI/IF 3.62]**, Broader context characteristics	Organisational characteristics, culture, and context **[CISI/IF 4.13*]**		

Table A1. *Cont.*

STAGE 3	STAGE 4		STAGE 5
	INITIAL	REVISED	
Teams' composition **[CISI/IF 3.63]**, conflicts between generations **[CISI/IF 3.64]**, Teams specialties **[CISI/IF 3.65]**, Motivated users **[CISI/IF 3.67]**, Work experience and related promotion and responsibilities **[CISI/IF 3.68]**	Teams' characteristics **[CISI/IF 4.14*]**	**[CISI/IF 4.11*]**, **[CISI/IF 4.13*]** **and** **[CISI/IF 4.14*]** merged into ***Individual, teams and organisation context characteristics*** **[CISI/IF 4.9]**	**INTRINSIC DETERMINANTS OF ADOPTION**
		[CISI/IF 4.12*] becomes ***Digital technologies implementation scope and mechanisms*** **[CISI/IF 4.10]**	**[CISI/IF 5.5]**
Complexities of tools **[CISI/IF 3.69]**, Functionalities, intuitiveness and user interface **[CISI/IF 3.70]**, Emerging technologies **[CISI/IF 3.71]**, Speed of new technologies becoming obsolete **[CISI/IF 3.72]**	Digital Technology type and characteristics **[CISI/IF 4.15*]**	**[CISI/IF 4.15*]** **and** **[CISI/IF 4.18*]** merged into ***Digitalisation prerogative*** **[CISI/IF 4.1]**	**ORGANISATIONAL DIGITALISATION APPROACH**
Digitalisation decision making **[CISI/IF 3.73]**, Choice of technology **[CISI/IF 3.74]**, Digital technologies roll out process **[CISI/IF 3.75]**	Selection of digital technology **[CISI/IF 4.16*]**		
Forward thinking leaders **[CISI/IF 3.76]**, Technology enthusiast manager **[CISI/IF 3.77]**, Thinking ahead of innovations **[CISI/IF 3.78]**, Reactive vs. proactive thinker **[CISI/IF 3.79]**, Managers' lack of understanding of field and industry **[CISI/IF 3.80]**	Leadership, management competencies and styles **[CISI/IF 4.17*]**	**[CISI/IF 4.16*]** and **[CISI/IF 4.17*]** merged into ***Digitalisation leadership and management*** **[CISI/IF 4.2]**	**[CISI/IF 5.1]**
Forced adoption **[CISI/IF 3.81]**, Experimental implementation, hype-based decision **[CISI/IF 3.82]**, Compulsory government-driven adoption **[CISI/IF 3.83]**	Digitalisation prerogative **[CISI/IF 4.18*]**		

"*" in stage 4 indicates initial themes that were later grouped into the revised themes.

References

1. Verhoef, P.C.; Broekhuizen, T.L.J.; Bart, Y.; Bhattacharya, A.; Dong, J.Q.; Fabian, N.E.; Haenlein, M. Digital transformation: A multidisciplinary reflection and research agenda. *J. Bus. Res.* **2021**, *122*, 889–901. [CrossRef]
2. Ghosh, A.; Edwards, D.J.; Hosseini, M.R. Patterns and trends in Internet of Things (IoT) research: Future applications in the construction industry. *Eng. Constr. Archit. Manag.* **2021**, *28*, 457–481. [CrossRef]
3. Vial, G. Understanding digital transformation: A review and a research agenda. *J. Strateg. Inf. Syst.* **2019**, *28*, 118–144. [CrossRef]
4. Chowdhury, T.; Adafin, J.; Wilkinson, S. Review of digital technologies to improve productivity in new Zealand construction industry. *J. Inf. Technol. Constr.* **2019**, *24*, 569–587.
5. Hassan, A.M.; Negash, Y.T.; Hanum, F. An assessment of barriers to digital transformation in circular construction: An application of stakeholder theory. *Ain Shams Eng. J.* **2024**, *15*, 102787. [CrossRef]
6. Dolla, T.; Jain, K.; Delhi, V.S.K. Strategies for digital transformation in construction projects: Stakeholders' perceptions and actor dynamics for Industry 4.0. *J. Inf. Technol. Constr. (ITCon)* **2023**, *28*, 151–175. [CrossRef]
7. Storvang, P.; Clarke, A.H. How to create a space for stakeholder involvement in construction. *Constr. Manag. Econ.* **2014**, *32*, 1166–1182. [CrossRef]
8. Teisserenc, B.; Sepasgozar, S. Adoption of Blockchain Technology through Digital Twins in the Construction Industry 4.0: A PESTELS Approach. *Buildings* **2021**, *11*, 670. [CrossRef]
9. Oesterreich, T.D.; Teuteberg, F. Understanding the implications of digitisation and automation in the context of Industry 4.0: A triangulation approach and elements of research agenda for the construction industry. *Comput. Ind.* **2016**, *83*, 121–139. [CrossRef]

10. Yang, R.J.; Wang, Y.; Jin, X.-H. Stakeholders' Attributes, Behaviors, and Decision-Making Strategies in Construction Projects: Importance and Correlations in Practice. *Proj. Manag. J.* **2014**, *45*, 74–90. [CrossRef]
11. Mashali, A.; Elbeltagi, E.; Motawa, I.; Elshikh, M. Stakeholder management challenges in mega construction projects: Critical success factors. *J. Eng. Des. Technol.* **2022**, *21*, 358–375. [CrossRef]
12. Olanipekun, A.o.; Sutrisna, M. Facilitating digital transformation in construction: A systematic review of the current state of the art. *Front. Built Environ.* **2021**, *7*, 660758. [CrossRef]
13. Shojaei, R.S.; Burgess, G. Non-technical inhibitors: Exploring the adoption of digital innovation in the UK construction industry. *Technol. Forecast. Soc. Chang.* **2022**, *185*, 122036. [CrossRef]
14. Li, H.; Han, Z.; Zhang, J.; Phibin, S.P.; Liu, D.; Ke, Y. Systematic identification of the influencing factors for the digital transformation of the construction industry based on LDA-DEMATEL-ANP. *Buildings* **2022**, *12*, 1409. [CrossRef]
15. Arifin, J.; Hamsal, M.; Furinto, A.; Kartono, R. A literature review of digital transformation in the construction industry. In Proceedings of the 3rd South American International Industrial Engineering and Operations Management, Asuncion, Paraguay, 19–21 July 2022.
16. Heravi, A.; Coffey, V.; Trugunarsyah, B. Evaluating the level of stakeholder involvement during the project planning processes of building projects. *Int. J. Proj. Manag.* **2015**, *33*, 985–997. [CrossRef]
17. Turner, C.J.; Oyekan, J.; Stergioulas, L.; Griffin, D. Utilizing industry 4.0 on the construction site: Challenges and opportunities. *IEEE Trans. Ind. Inform.* **2021**, *17*, 746–756. [CrossRef]
18. Klaus-Rosinska, A.; Iwko, J. Stakeholder management-one of the clues of sustainable project management-an underestimated factor of project success in small construction companies. *Sustainability* **2021**, *13*, 9877. [CrossRef]
19. Mursu, A.; Luukkonen, I.; Toivanen, M.; Korpela, M. Activity theory in information systems research and practice: Theoretical underpinning for an information systems development model. *Inf. Res.* **2007**, *12*, Paper 311.
20. Osunsanmi, T.O.; Aigbavboa, C.O.; Oke, A.E.; Liphadzi, M. Appraisal of stakeholders' willingness to adopt construction 4.0 technologies for construction projects. *Built Environ. Proj. Asset Manag.* **2020**, *10*, 547–565. [CrossRef]
21. Woodhead, R.; Stephenson, P.; Morey, D. Digital construction: From point solutions to IoT. *Autom. Constr.* **2018**, *93*, 35–46. [CrossRef]
22. Newman, C.; Edwards, D.; Martek, I.; Lai, J.; Thwala, W.D.; Rillie, I. Industry 4.0 deployment in the construction industry: A bibliometric literature review and UK-based case study. *Smart Sustain. Built Environ.* **2021**, *10*, 557–580. [CrossRef]
23. Zhang, J.; Zhang, M.; Ballesteros-Perez, P.; Philbin, S.P. A new perspective to evaluate the antecedent path of adoption of digital technologies in major projects of construction industry: A case study in China. *Dev. Built Environ.* **2023**, *14*, 100160. [CrossRef]
24. Li, J.; Greenwood, D.; Kassem, M. Blockchain in the build environment and construction industry: A systematic review, conceptual models and practical use cases. *Autom. Constr.* **2019**, *102*, 288–307. [CrossRef]
25. Zulu, S.L.; Saad, A.M. A sensemaking perspective of digitalisation in construction organisations. *Sustainability* **2023**, *15*, 2344. [CrossRef]
26. Prebanic, K.R.; Vukomanovic, M. Realizing the need for digital transformation of stakeholder management: A systematic review in the construction industry. *Sustainability* **2021**, *13*, 12690. [CrossRef]
27. Bussy, N.M.d.; Kelly, L. Stakeholders, politics and power: Towards an understanding of stakeholder identification and salience in government. *J. Commun. Manag.* **2010**, *14*, 289–305. [CrossRef]
28. Mahajan, R.; Lim, W.M.; Sareen, M.; Kumar, S.; Panwar, R. Stakeholder theory. *J. Bus. Res.* **2023**, *166*, 114104. [CrossRef]
29. Vos, J.F.J.; Achterkamp, M.C. Stakeholder identification in innovation projects: Going beyond classification. *Eur. J. Innov. Manag.* **2006**, *9*, 161–178. [CrossRef]
30. Leonidou, E.; Christofi, M.; Vrontis, D.; Thrassou, A. An integrative framework of stakeholder engagement for innovation management and entrepreneurship development. *J. Bus. Res.* **2020**, *119*, 245–258. [CrossRef]
31. Wood, D.J.; Mitchell, R.K.; Agle, B.R.; Bryan, L.M. Stakeholder identification and salience after 20 years: Progress, problems, and prospects. *Bus. Soc.* **2021**, *60*, 176–245. [CrossRef]
32. Atkin, B.; Skitmore, M. Editorial: Stakeholder management in construction. *Constr. Manag. Econ.* **2008**, *26*, 549–552. [CrossRef]
33. Pouloudi, N.; Currie, W.; Whitley, E.A. Entangled stakeholder roles and perceptions in health information systems: A longitudinal study of the UK NHS N3 network. *J. Assoc. Inf. Syst.* **2016**, *17*, 107–161.
34. Mitchell, R.K.; Agle, B.R.; Wood, D.J. Toward a theory of stakeholder identification and salience: Defining the principle of who and what really counts. *Acad. Manag. Rev.* **1997**, *22*, 853–886. [CrossRef]
35. Kujala, J.; Sachs, S.; Leinonen, H.; Heikkinen, A.; Laude, D. Stakeholder engagement: Past, present, and future. *Bus. Soc.* **2022**, *6*, 1136–1196. [CrossRef]
36. Freeman, E.R. The politics of stakeholder theory: Some future directions. *Bus. Ethics Q.* **1994**, *4*, 409–421. [CrossRef]
37. Ingenbleek, P.T.M.; Dentoni, D. Learning from stakeholder pressure and embeddedness: The roles of absorptive capacity in the corporate social responsibility of Dutch agribusiness. *Sustainability* **2016**, *8*, 1026. [CrossRef]
38. Mainardes, E.W.; Alves, H.; Raposo, M. A model for stakeholder classification and stakeholder relationships. *Manag. Decis.* **2012**, *50*, 1861–1879. [CrossRef]
39. Freeman, R.E. *Strategic Management: A Stakeholder Approach*; Pitman: Boston, MA, USA, 1984.

40. Hewavitharana, T.; Nanayakkara, S.; Perera, A.; Perera, P. Modifying the Unified Theory of Acceptance and Use of Technology (UTAUT) Model for the Digital Transformation of the Construction Industry from the User Perspective. *Informatics* **2021**, *8*, 81. [CrossRef]
41. Oesterreich, T.D.; Teuteberg, F. Behind the scenes: Understanding the socio-technical barriers to BIM adoption through the theoretical lens of information systems research. *Technol. Forecast. Soc. Chang.* **2019**, *146*, 413–431. [CrossRef]
42. Romero, D.; Flores, M.; Herrera, M.; Resendez, H. Five management pillars for digital transformation integrating the Lean thinking philosophy. In Proceedings of the IEEE International Conference on Engineering, Technology and Innovation (ICE/ITMC), Valbonne, France, 17–19 June 2019.
43. Kopp, R.; Dhondt, S.; Hirsch-Kreinsen, H.; Kohlgruber, M.; Preeneen, P. Sociotechnical perspectives on digitalisation and Industry 4.0. *Int. J. Technol. Transf. Commer.* **2019**, *16*, 290–309. [CrossRef]
44. Zhao, Y.C.; Zhang, Y.; Tang, J.; Song, S. Affordances for information practices: Theorizing engagement among people, technology, and sociocultural environments. *J. Doc.* **2021**, *77*, 229–250. [CrossRef]
45. Engestrom, Y. Expansive learning at work: Toward an activity theoretical reconceptualisation. *J. Educ. Work* **2001**, *14*, 133–156. [CrossRef]
46. Zomer, T.; Neely, A.; Sacks, R.; Parlikad, A. Exploring the influence of socio-historical constructs on BIM implementation: An activity theory perspective. *Constr. Manag. Econ.* **2021**, *39*, 1–20. [CrossRef]
47. Miettinen, R.; Paavola, S. Reconceptualizing object construction: The dynamics of building information modelling in construction design. *Inf. Syst. J.* **2018**, *28*, 516–531. [CrossRef]
48. Korpela, M.; Soriyan, H.A.; Olufokunbi, K.C. Activity analysis as a method for information systems development. *Scand. J. Inf. Syst.* **2000**, *12*, 191–210.
49. Myers, M.D. *Qualitative Research in Business Management*; Sage Publications: London, UK, 2009.
50. Yin, R.K. *Case Study Research: Design and Methods*; Sage Publications: London, UK, 2009.
51. Priya, A. Case study methodology of qualitative research: Key attributes and navigating the conundrums in its application. *Sociol. Bull.* **2021**, *70*, 94–110. [CrossRef]
52. Cresswell, J.; Plano, C.V. *Designing and Conducting Mixed Method Research*, 2nd ed.; Sage: Thounsand Oak, CA, USA, 2011.
53. Jansen, H. The logic of qualitative survey research and its position in the field of social research methods. *Forum Qual. Soc. Res.* **2010**, *11*, 1–20.
54. Kallio, H.; Pietila, A.-M.; Johnson, M.; Kangasniemi, M. Systematic methodological review: Developing a framework for a qualitative semi-structured interview guide. *J. Adv. Nurs.* **2016**, *72*, 2954–2965. [CrossRef]
55. Elbeck, M. Selecting a free web-hosted survey tool for student use. *e-J. Bus. Educ. Scholarsh. Teach.* **2014**, *8*, 54–68.
56. Cucolas, A.-A.; Russo, D. The impact of working from home on success of scrum projects: A multi-method study. *J. Syst. Softw.* **2023**, *197*, 111562. [CrossRef]
57. Welsh, E. Dealing with data: Using Nvivo in the qualitative data analysis process. *Forum Qual. Sozialforschung/Forum Qual. Soc. Res.* **2002**, *3*. [CrossRef]
58. Blair, E. A reflexive exploration of two qualitative data coding techniques. *J. Methods Meas. Soc. Sci.* **2015**, *6*, 14–29. [CrossRef]
59. Wang, M.; Wang, C.C.; Sepasgozar, S.; Zlatanova, S. A systematic review of digital technology adoption in off-site construction: Current status and future direction towards Industry 4.0. *Buildings* **2020**, *10*, 204. [CrossRef]
60. Alnuaimi, B.K.; Singh, S.K.; Ren, S.; Budhwar, P.; Vorobyev, D. Mastering digital transformation: The nexus between leadership, agility and digital strategy. *J. Bus. Res.* **2022**, *145*, 636–648. [CrossRef]
61. Karlsen, J.T. Project stakeholder management. *Eng. Manag. J.* **2002**, *14*, 19–24. [CrossRef]
62. Eskerod, P.; Huemann, M.; Savage, G. Project stakeholder management: Past and present. *Proj. Manag. J.* **2016**, *46*, 6–14. [CrossRef]
63. Dacin, M.T.; Goodstein, J.; Scott, W.R. Institutional theory and institutional change: Introduction to the special research forum. *Acad. Manag. J.* **2002**, *45*, 45–57. [CrossRef]
64. Huybrechts, B.; Mertens, S.; Rijpens, J. Explaining stakeholder involvement in social enterprise governance through resources and legitimacy. In *Social Enterprise and the Third Sector: Changing European Landscapes in a Comparative Perspective*; Defourny, J., Hulgard, L., Pestoff, V., Eds.; Routledge: London, UK, 2014.
65. Oorschot, S.v. Digitalisation and temporary agencies: Impact on the business model and internal organisation. *Res. Hosp. Manag.* **2021**, *11*, 241–248. [CrossRef]
66. Kwiatkowska, E.M.; Skorzewska-Amberg, M. Digitalisation of healthcare and the problem of digital exclusion. *J. Manag. Bus. Adm. Cent. Eur.* **2019**, *27*, 48–63. [CrossRef]
67. Ernstsen, S.N.; Whyte, J.; Thuesen, C.; Maier, A. How innovation champions frame the future: Three vision for digital transformation of construction. *J. Constr. Eng. Manag.* **2021**, *147*, 05020022. [CrossRef]
68. Kavuri, A.S.; Soetanto, R.; Goodier, C.; Murguia, D.; Szczygiel, M. Scenarios for the digitalisation of the construction industry. In Proceedings of the 36th Anual ARCOM Conference, Virtual, 7–8 September 2020.
69. Bajpai, A.; Misra, S.C. Barriers to implementing digitalization in the Indian construction industry. *Int. J. Qual. Reliab. Manag.* **2021**, *39*, 2438–2464. [CrossRef]
70. Hwabamungu, B. Barriers to stakeholder involvement in the digitalisation of the United Kingdom construction industry. In Proceedings of the 22nd International Conference on e-Society, Porto, Portugal, 8–11 March 2024.

71. Oti-Sarpong, K.; Pärn, E.A.; Burgess, G.; Zaki, M. Transforming the construction sector: An institutional complexity perspective. *Constr. Innov.* **2022**, *22*, 361–387. [CrossRef]
72. Craveiro, F.; Duarte, J.P.; Bartolo, H.; Bartolo, P.J. Additive manufacturing as an enabling technology for digital construction: A perspective on Construction 4.0. *Autom. Constr.* **2019**, *103*, 251–267. [CrossRef]