AR4R010 MSc 4 Graduation Laboratory

Reshaping the Past, Building the future

The interconnectedness of ESG values and digital functions within real estate developments

The visual was created using a digital function (ideogram) to visually represent a digital interpretation of 'building the future, reshaping the past' within the context of ESG values and digital functions in real estate development. The visual is designed to evoke and provoke thoughts on the dualities of digital functions: its potential to transform and its inherent challenges (digital vs. non-digital). While digital functions are often associated with efficiency and innovation, ESG values might call for a more human-centric approach, raising critical questions about the interconnection of both. This visual serves as an entry point to the interconnection explored in this study.

Colophon

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Abstract

The real estate industry is increasingly challenged to integrate sustainability into its operations, more specifically by the growing importance of Environmental, Social, and Governance (ESG) values. Simultaneously, the advancement of digital functions is reshaping industries worldwide, including the real estate industry, by transforming operational strategies and processes. This convergence places significant pressure on the industry to adopt ESG values while understanding their interconnection with digital functions.

As a result, this research explores the dynamic interplay between ESG values and digital functions, focusing on how their integration can enhance sustainable development in real estate. Employing a multi-stakeholder, chain-oriented approach, the study examines key ESG value constellations and their interconnection with digital functions. Real estate developers, as key actors in initiating, planning, and managing real estate development projects, are positioned as the primary focus group for this research for understanding and addressing this interconnection.

The main objective is to add onto academic literature and develop practicalities and insights that provide real estate developers with actionable insights to navigate the complexities of ESG values and digital functions effectively. By advancing understanding in this area, the study aims to contribute to the future of real estate development characterised by sustainability, transparency, and resilience, aligning with broader global goals for environmental and social responsibility.

Key words ESG values, digital functions, real estate development, strategic development stage, interconnection

Executive summary

Introduction

The real estate sector is increasingly influenced by the growing importance of Environmental, Social, and Governance (ESG) values and the integration of digital functions. As sustainability and technological innovation shape the industry, real estate developers play a crucial role in aligning project strategies with these concepts. As a result, this study explores the interconnectedness of ESG values and digital functions, focusing on how this relationship can enhance sustainable and resilient real estate developments during the strategic development stage.

Aim of research

The aim of this research is to investigate the interconnection between ESG values and digital functions within real estate developments, in particular during the strategic development stage. By understanding this interconnection, the study seeks to provide insights that enable real estate developers to embed ESG values and become familiar with the interconnection with digital functions, fostering informed and effective decision-making processes for responsible resource allocation.

For this research, ESG is conceptualised as values to reflect their subjective and evaluative nature, guiding the behaviour and decision-making processes of individuals and organisations. This perspective is grounded in the understanding that values, as defined by Roe and Ester (1998), are enduring concepts that shape how actions and results are assessed, characterised by their future-oriented challenges. As a result, by framing ESG as values, the research emphasises their role as guiding principles that inform sustainability, social responsibility, and ethical governance within the context of real estate development. This conceptualisation not only aligns with the intrinsic evaluative character of ESG values but also provides a ideas for understanding their influence on both individual and collective actions within the real estate value chain.

On the other hand, digital tools are conceptualised as functions to capture their role in facilitating or enhancing specific tasks and processes within an organisational or project-based context. This framing highlights the operational nature of digital functions, focusing on their capacity to support or hinder objectives such as efficiency, innovation, and collaboration. By defining digital tools in terms of functions, the research acknowledges the technological mechanisms that underpin data-driven decision-making, resource management, and the realisation of ESG values. This approach provides a practical research perspective through which the interconnection between technology and ESG can be examined, offering insights into how digital functions are interconnected to achieve ESG values.

Problem statement

The interconnection of ESG values and digital functions remains a fragmented and underutilised within the real estate industry and more specifically real estate developments. Real estate developers, as key initiators and managers of projects, face challenges arising from the absence of robust ESG value constellations and lack of available and suitable digital functions within this context for sustainable and responsible real estate developments, leaving significant gaps in the practical application for the interconnection of both.

Research questions

To address these issues, the research is structured around the following main-question:

How can the interconnection between ESG values and digital functions be enhanced across the real estate industry chain during the strategic development stage?

Supported by the sub research questions:

1. Which constellations of ESG values are prioritised during the strategic development stage?
2. What digital functions are available and suitable during the strategic development stage?
3. What is the interconnection between ESG values and digital functions?
4. How can ESG values and digital functions be integrated during the strategic development stage?

Research methodology

The research adopts a qualitative approach, including semi-structured interviews and an expert panel discussion. Thus, a chain-oriented perspective is used to reflect the interconnected roles of stakeholders (e.g. real estate developers, contractors, investors, and municipalities). While this approach provides a comprehensive view, the lack of representation from smaller organisations and trade associations is a noted limitation.

Practical usefulness and relevance

The findings of this research have practical implications for real estate developers, offering ideas to align ESG values with strategies and digital functions. By integrating ESG values with digital functions, developers can potentially enhance resource efficiency, stakeholder engagement, and compliance. These insights support the implementation of ESG-digital driven functions during the strategic stage, contributing to long-term value creation from the outset of real estate developments.

Theoretical research

This study builds upon academic discussions by defining ESG as values, subjective, evaluative constructs that guide behaviour and decision-making. This conceptualisation is combined with an exploration of digital functions, illustrating how technological advancements can support and amplify ESG values. The study builds on existing literature, offering a refined understanding of how these elements can interact to drive sustainable real estate developments.

Industry perspectives

Interviews with industry professionals highlight the cautious yet gradual adoption of ESG values and digital functions. Interviewees acknowledge the importance of these elements but face systemic and collective challenges, including the dependency on external stakeholders and a lack of available and suitable digital functions. The limited representation of smaller organisations and trade associations further underscores the need for more inclusive engagement to address sector-wide issues effectively.

Output and results

ESG values

The research underscores the growing recognition of social values as fundamental to achieving long-term sustainability in the real estate sector. Social values, including equity, diversity, and community well-being, are increasingly acknowledged as essential components of sustainable development. However, their qualitative and context-specific nature poses challenges for

measurement and integration, contrasting sharply with the quantifiable metrics of environmental values. This complexity necessitates innovative methodologies and collaborative efforts to assess and implement social impact effectively.

Despite the challenges, social values are pivotal in fostering inclusive and equitable developments, with a focus on improving quality of life for communities. These values call for a shift in organisational strategies, embedding them within business models and aligning them with environmental and governance objectives. This integration reinforces the interconnectedness of ESG dimensions, where decisions made today shape both environmental and societal outcomes for future generations.

The study also highlights a disparity in prioritisation across ESG values, with environmental metrics dominating due to their alignment with established frameworks and data-driven approaches. Social and governance values, by contrast, face operational challenges and a lack of standardisation, which limits their transformative potential. Governance remains predominantly compliance-driven, underscoring the need for deeper integration and strategic alignment with other ESG dimensions.

Based upon research findings a list of prioritised ESG value constellations from participants can be stipulated (table 1) for real estate developers.

Theme	Value constellation	Values included
Environmental	Resource efficiency and circularity	Waste, circularity, re-use, biobased construction, disassembly, material passports, local production
	Carbon management	Carbon emissions, carbon footprint, embodied carbon, cooling and heating, Paris Proof, net-zero
	Biodiversity and ecology	Biodiversity, reforestation, vegetation, ecology, climate adaptation
	Water and sustainable infrastructure	Water, climate adaptation, local production
	Measurement and global goals	MPG (Environmental Performance Score), alignment with the UN Sustainable Development Goals (SDGs), Paris Proof, Net-zero, MPG
Social	Human-centric experience (or biological fundamentals)	Experience, comfort, health, daylight, home feeling, wellbeing, facilities and amenities, leisure features
	Equity and inclusion	Diversity, inclusion, ethics, social impact, affordability, vulnerable communities
	Community and interaction	Resident and user involvement, walkability and walk score, interaction, routing, liveability, location
	Work and employee Satisfaction	Work environment, employee satisfaction, human-centric environment
Governance	Accountability and transparency	Accountability, evidencing and proofing, transparency, certification, reporting, audits, compliance
	Regulation and compliance	Compliance with laws and regulations, CREMM (Carbon Risk Real Estate Monitor), CSRD (Corporate Sustainability Reporting Directive), ESG-related taxations, EU taxonomie, MVO, SFRD
	Organisational strategy and culture	Organisational ambition and objectives, organisational benchmarks, organisational influence, organisational responsibility, organisational culture, short- and long-term objectives
	Collaborative governance	Design team partners, organisational partners, political direction, social governance
	Impact and proof	Broad prosperity, societal impact, investor insights, socially responsible entrepreneurship (MVO), financing
	Ethics and integrity	Ethics, extended producer responsibility, autonomy, audits

Table 1 ESG constellations (author, 2024)

Digital Functions

This study builds upon previous research (Betti & Sarens, 2020; Wynn & Lam, 2023; Yeow et al., 2018; Singh et al., 2023) by emphasising the paradigm shift in perceiving digital technologies not merely as tools but as dynamic functions. Digital functions exhibit a dual character: while they can enhance efficiency, transparency, and collaboration, they can also impede objectives if misaligned with organisational goals or overused.

The findings reveal that digital functions have significantly shaped how ESG values are prioritised and operationalised, favouring quantifiable metrics while presenting challenges for integrating qualitative dimensions, such as social and governance values. Their data-driven nature amplifies the focus on environmental metrics, which align seamlessly with digital systems. However, this focus risks marginalising social and governance values, which are qualitative, context-dependent, and often challenging to standardise. As a result, ESG values risk being reframed as compliance-driven, sidelining their broader transformative potential.

Key challenges identified include digital overload, resource allocation inefficiencies, and misalignment of digital solutions with real needs. While digital functions facilitate data collection, tracking, and visualisation, they often fail to address intangible societal impacts, such as social equity and cultural preservation. Behavioural and cultural hesitance further hinder adoption, with a lack of uniformity, market leaders, and understanding impeding effective implementation. Additionally, financial and operational barriers, particularly for smaller organisations, exacerbate issues of exclusion and inequitable access to digital infrastructure and expertise.

Despite these challenges, digital functions have the potential to drive systemic change by linking stakeholders and revealing interdependencies across ESG dimensions. To realise this potential, digital functions must complement, rather than replace, human-centric approaches, especially in addressing social and governance values. For instance, while digital systems can enhance transparency and accountability, achieving meaningful social outcomes often requires direct human interaction.

Interconnection

The interconnection between ESG values and digital functions is grounded in common grounds, particularly in their reliance on data and systemic impact. Digital functions excel in processing and analysing measurable metrics, aligning strongly with the quantifiable nature of environmental values. However, challenges arise in linking digital functions with social and governance values due to their qualitative and compliance-focused characteristics.

Both ESG values and digital functions aim to drive systemic change; ESG through sustainability and digital functions through efficiency and accuracy. The study identified three shared foundations between them:

	ESG values	**Digital functions**
Data-driven nature	Rely on data/metrics	Excel in data/metric processing and analytics
Systemic impact	Aims to create systemic change through sustainability	Aims to create systemic change through efficiency
Stakeholder engagement	Requires a multi-stakeholder approach to succeed	Requires a multi-stakeholder approach to succeed

Table 19 Common grounds (author, 2025)

The findings underscore a strong interconnection between environmental values and digital functions, as the former's measurable metrics align seamlessly with the latter's analytical capabilities. This synergy promotes collaboration across the value chain, fostering accountability and reducing siloed efforts.

Conversely, social values are harder to interconnect due to their qualitative, context-dependent, and preconditional nature. The absence of standardised metrics for social values highlights the need for participatory, human-centric approaches to complement digital systems. Governance values, often compliance-driven, also limit the transformative potential of their interconnection with digital functions.

Ultimately, digital functions ability to connect diverse stakeholders and systems is central to their role in enhancing ESG values. By enabling transparency, collaboration, and shared accountability, digital functions help bridge gaps within the value chain. Without this integration, efforts risk fragmentation and reduced impact.

Integration

This research underscored the potential and challenges of integrating ESG values with digital functions in real estate development during the specific stage. While integration promises sustainable progress and accountability, practical gaps persist.

A key barrier is the absence of universal data standards, hindering scalability and consistent engagement with ESG values. Digital functions enable data collection, storage, and sharing but rely heavily on data quality and uniformity. Without alignment, initiatives remain fragmented, inefficient, and difficult to scale.

Collaboration emerged as crucial for effective integration. Stakeholders must work together to shape how data is processed and utilised, as ESG integration cannot succeed in isolation. However, a lack of standardised data formats, certifications, and methods creates inefficiencies and transparency issues, further complicated by fragmented EU regulations.

Participants emphasised the need for unified data-sharing platforms to streamline processes, improve transparency, and align ESG values with digital functions. Such platforms would support interoperability, standardisation, collaboration, and regulatory compliance.

Challenges include the real estate sector's conservative nature, hesitancy to invest in ESG-aligned digital tools, and the proliferation of uncoordinated digital platforms. Addressing these issues through standardisation and collaborative platforms is vital to aligning ESG values with digital innovation effectively.

Conclusion

The findings of this study underscore the industry's need for a strategic, integrated approach to technology adoption, as opposed to uncontrolled implementation, to enhance sustainability and efficiency (Kane et al., 2015; Wang, 2023). As outlined in Chapter 1.5, the initial strategic development phase plays a critical role in laying the foundation for stakeholder alignment, defining roles and responsibilities, and shaping the overall project scope. This phase emerges as a pivotal opportunity to strengthen the interconnection between ESG values and digital functions across the real estate industry, particularly for developers.

The research identifies a strong synergy between environmental values and digital functions, underpinned by their shared reliance on quantifiable, data-driven metrics. Digital tools facilitate the measurement, tracking, and visualisation of environmental performance, fostering collaboration among stakeholders and advancing environmental sustainability. However, social values—being inherently qualitative and context-sensitive—require a more human-centred

approach, while governance often remains narrowly compliance-focused, limiting its transformative potential.

ESG-driven digital functions should extend beyond tracking metrics to actively enable stakeholder collaboration, informed decision-making, and alignment of ESG values across the real estate chain. By prioritising engagement, addressing gaps in the integration of social and governance values, and standardising data practices, digital functions can drive systemic change, scalability, and long-term sustainability. The proposed value-driven framework (Table 20) offers developers actionable steps to bridge the gaps between ESG values and digital functions. This framework provides practical guidance for making informed decisions about digital and non-digital strategies for ESG values, promoting a holistic and integrated approach.

To operationalise these findings, the study outlines thirteen concrete steps (Table 20) for enhancing the interconnection of ESG values and digital functions from the outset of real estate developments, paving the way for a more sustainable and collaborative industry.

	Steps	Objective	Implementation	Relevance
1	**Strategic ESG baseline**	Establish the level of ESG maturity to guide actions	Identify strengths, gaps, and priorities for ESG values at the project or organisational level	Ensures values are context-specific and relevant to the project's needs
2	**Identify ESG values**	Recognise both tangible and intangible ESG values	Engage stakeholders in workshops or surveys to co-create a prioritised ESG value map that aligns with project objectives and regulatory frameworks	Ensures balanced consideration of all ESG values, avoiding an overemphasis on measurable metrics
3	**Map ESG interdependencies**	Highlight overlaps and dependencies between environmental, social, and governance values	Map how ESG values influence and depend on one another, ensuring system thinking	Avoids siloed implementation and promotes broader ESG integration
4	**Visibility bias**	Mitigate overemphasis on quantifiable metrics, particularly environmental values	Document ESG values alongside environmental goals	Prevents marginalisation of social and governance values, ensuring a balanced ESG strategy
5	**Evaluate necessity**	Assess whether digital functions are needed and aligned with specific ESG values	Identify tasks where digital functions add value and recognise areas requiring human-centric approaches	Avoids unnecessary digitalisation, ensuring efficient resource allocation
6	**Define operational scale**	Determine whether the main focus is on the building, local area, or portfolio level	**Building Level:** Granular focus on individual project impacts (e.g., energy efficiency). **Local Area:** Broader socio-environmental impacts (e.g., liveability). **Portfolio:** Strategic decision-making and benchmarking across multiple projects.	Tailors digital strategies to project-specific operational needs and objectives
7	**Select digital functions**	Select appropriate digital functions to operationalise ESG values effectively	**Measuring and collecting:** Ensure consistent and accurate ESG data. **Storing and organising:** Use scalable systems like data lakes. **Exchanging and sharing:** Foster interoperability through APIs. **Visualising and analytics:** Employ dashboards for performance insights. **Collaborating and sharing:** Enhance transparency through stakeholder platforms.	Aligns digital functions with ESG values to drive scalability, efficiency, and impact.
8	**Foster stakeholder collaboration**	Promote engagement across the value chain to align ESG objectives	Facilitate shared decision making and data sharing among stakeholders	Builds collective accountability and reduces fragmentation of ESG values.
9	**Select data formats and standards**	Address inefficiencies caused by fragmented data standards and certifications	Advocate for unified data standards and interoperable platforms to enable stakeholder engagement	Enhances comparability, scalability, and transparency of ESG data across stakeholders
10	**Integrate feedback loops**	Establish mechanisms for continuous improvement and refinement of ESG-digital driven interconnection	Regularly review performance through stakeholder feedback, data insights, and iterative evaluations	Ensures the framework evolves to meet emerging challenges and opportunities

11	**Multi-stakeholder governance**	Develop governance mechanisms to coordinate collaboration and accountability	Establish advisory groups or governing bodies with representatives from all stakeholders to oversee ESG values and digital functions	Ensures equitable decision-making and shared ownership of ESG values
12	**Inclusive and equitable participation**	Avoid excluding smaller organisations or underrepresented stakeholders in ESG driven digital efforts	Provide training, accessible functions, and support systems to enable participation across all stakeholders, regardless of resource capacity	Promotes inclusivity
13	**Establish ESG accountability mechanism**	Build systems for tracking, reporting, and rewarding progress toward ESG values	Link digital functions with performance-based metrics, certifications, and financial incentives to drive compliance and continuous improvement	Encourages sustained commitment to ESG values

Table 20. Value-driven framework (Author, 2025)

While the study underscores these challenges, it provides a foundation for understanding how ESG values and digital functions can interconnect, offering actionable insights for developers. Future research should involve a broader range of stakeholders, including underrepresented organisations and trade associations, to foster a more comprehensive understanding of industry dynamics. Additionally, the use of quantitative methods to assess the impact of ESG-driven digital functions would further enhance both the practical and theoretical contributions of this field. Ultimately, this research contributes to the advancement of sustainable, resilient real estate practices by aligning ESG values with digital functions to address the sector's complex challenges.

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1.

Introduction

1.1 Context

In today's world, principles related to the environment, social, and governance have become central across various industries. As worldwide issues like climate change, social inequality, and responsible governance come to the centre stage, organisations recognise the growing need to integrate ESG principles into their fundamental operations, strategies, and reporting. The real estate sector holds a crucial role due to its broad effect on environmental sustainability, social well-being, and economic resilience. The need for sustainable growth and the rapid pace of urbanisation create additional challenges for the industry. Consequently, the real estate sector is compelled to expand its limits to meet the growing demands caused by sociological and environmental changes.

Additionally, technology has become an essential part of nearly all aspects of our lives. Digital technologies encourage innovation and bringing about transformations across various industries around the world (Wang, 2023). As a result, industries encounter the extra challenge of moving towards a digital future in a manner that is both responsible, efficient, and effective, all while technology keeps advancing.

While innovation and technology present significant potential, the industry is progressing slowly towards evolution, particularly regarding digital functions and property technology (PropTech) (Tan & Miller, 2023; Wang, 2023), all the while integrating ESG principles into its operations. This hesitance to embrace change also hinders progress in aligning with the frameworks of Industry 4.0 and 5.0.

Although the real estate industry holds significant importance, surpassing that of the oil, automotive, and banking sectors, it continues to depend on conventional practices. This highlights a significant gap and potential for development and innovative thinking through the adoption of new methods and strategies. These opportunities have the ability to address the challenges posed by ESG and digital functions (Mattarocci & Scimone, 2022; Maarbani, 2017).

1.2 Market and industry

The significance of environmental, social, and governance (ESG) principles has grown within the real estate sector, especially following the COVID-19 pandemic and in response to the United Nations' Sustainable Development Goals (SDGs) and the SFRD and CSRD directives aimed at promoting global sustainability (Lee et al., 2024; Saxena et al., 2022). While technological advancements have frequently exacerbated environmental issues, there is a growing consensus on the necessity of integrating ESG (Environmental, Social, and Governance) principles into business strategies (Eichholtz et al., 2010, 2013; Lee et al., 2022; Onishi et al., 2021; Henisz et al., 2019). Additionally, industry 4.0 (and 5.0) provides the potential to evaluate an organisations environmental, social, and governance (ESG) metrics. However, the interconnection between digital functions and ESG value creation is still poorly utilised (Saxena et al., 2022).

Given the increasing importance of (global) issues including climate change, social injustice, and ethical governance, it is relevant for businesses, politicians, and investors to learn about the factors that impact ESG principles. According to Khaw et al. (2024), it promotes informed

decision-making, ethical corporate conduct, fulfils stakeholder expectations, boosts competitiveness, and helps create a more sustainable future.

In addition, the real estate industry is currently experiencing digital functions driven by technical developments, such as PropTech, and intensified by factors like climate change and the COVID-19 pandemic (Tan & Miller, 2023; Wang, 2023; Lee et al., 2024). Consequently, digital functions is altering the industry in terms of sustainability, marketability, and commercial viability, going beyond conventional models that emphasise design and system improvements to address performance behaviour (Balogun et al., 2020; Gijzen, 2013; Yalina & Rozas, 2020). However, it matters for the industry to strategically apply technology in order to conform with increasing industry standards. This calls for a shift towards integrated and strategic application of technology, rather than uncontrolled implementation, to improve sustainability and efficiency (Kane et al., 2015; Wang, 2023).

The transition from conventional methods to adaptable, digitally integrated processes utilising AI, robotics, and the Internet of Everything (IoE) is referred to as the progression towards Industry 4.0 and 5.0. Nonetheless, the precise academic definitions and technologies related to these terms remain in transition and have yet to be firmly established (De Giovanni, 2023; Kwilinski et al., 2023; Lee et al., 2024; Starr et al., 2020; Wang, 2023; Schwab, 2017; Lu, 2017). Although there is a strong push to adopt digital functions, the available literature indicates an opposition that hinders the integration with the economic and environmental developments represented by Industry 4.0 and Marketing 4.0 (Ullah et al., 2018; Dash et al., 2021; Starr et al., 2020). So, it remains relatively vague.

Beyond that, the process of digital functions in the real estate sector represents a shift in redefining ordinary methods and enhancing the effectiveness of activities associated to real estate (Lee et al., 2024). Nevertheless, the determination of the real estate workforce to adapt to digital developments and the challenges related to digital functions require a deeper look (Starr et al., 2020; Tan & Miller, 2023; Latif et al., 2023; Phan & Boge, 2023).

This means to effectively respond to these transitions, it makes sense to conduct additional research on the abilities and capabilities of the workforce, the performance of enterprises that uphold environmental, social, and governance (ESG) principles, and the progress in digital functions. The significance of this study is highlighted in the works of Kwiliński et al. (2023), Lee et al. (2024), JLL (2023), Saull et al. (2020), Warren & Myers (2022), and Warren & Myers & Cradduck (2021). The introduction of Environmental, Social, and Governance (ESG) values and digital functions pose challenges as well as opportunities for the real estate industry. In order to evolve and remain resilient, the industry could embrace change and foster new ideas in response to emerging trends and concepts in ESG values and digital functions, which extend beyond mere business objectives or plans.

1.3 Key takeaways

Previous studies looked into the momentum of ESG within the industry, which has been influenced economic, environmental and social reasons and at the process of digitisation in the real estate sector, which has been influenced by the emergence of Industry 4.0 and 5.0. Previous studies attempted to comprehend the integration of these developments. Thus, a number of insights have been understood:

1. The real estate sector plays a crucial role in the development of both the global and local economies. The current situation necessitates a reassessment of conventional

methods and practices in light of the impacts of the COVID-19 pandemic and climate change.

2. The increased focus on ESG values following the pandemic indicates a transition towards the implementation of ethical, responsible, and sustainable business practices.
3. Digital functions presents opportunities for enhanced efficiency and effectiveness in sustainability, data management, communication, and cost reduction. To fully realise their potentials, enterprises and key stakeholders, including government authorities, need a clear approach.
4. Although the supposed advantages of digital functions are acknowledged, the industry remains hesitant to embrace these advancements, leading to various challenges.
5. The real estate sector is influenced by the emerging paradigms of industry 4.0 and 5.0, which underscore the importance of digital functions, innovation, and adaptability. These principles indicate a transformation in the business models across various industries.
6. The existing body of research concerning ESG and digital functions indicates that, to date, no notable differences or advantages have been discerned. Nonetheless, there exist further issues within the literary texts.
7. The real estate sector is undergoing transformations in its operations, transactions, data handling, communication methods, reporting, and management practices. Nonetheless, the readiness of the workforce to adapt to emerging technologies often serves as a sign of uncertainty.

In addition, Phan and Boge (2023) have highlighted the importance of acknowledging digital functions as an integral element of current operations within the real estate industry. The distinction between the enhancement of the initial and advanced stages in real estate development (Figure 1) is particularly significant (Phan & Boge, 2023). This emphasises the dynamic context of the real estate industry and the importance of time.

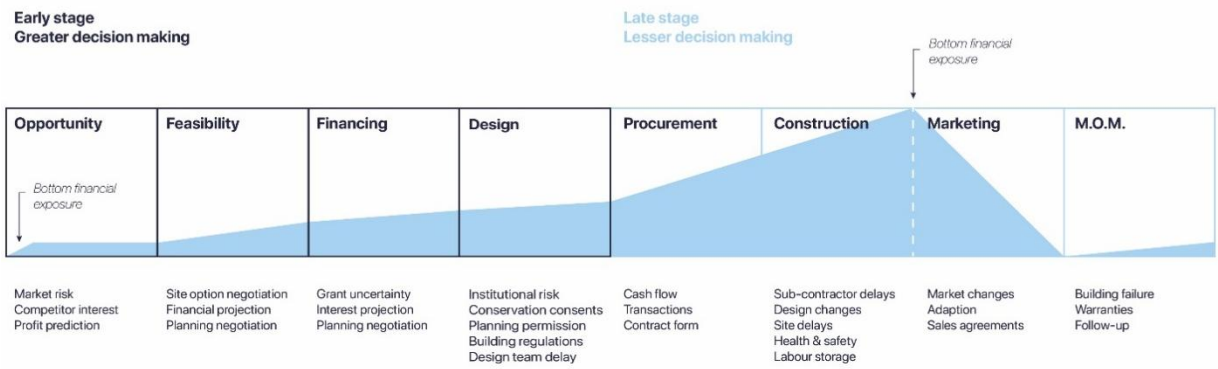

Figure 1. Property development timeline (Phan & Boge, 2023).

1.4 Research aim

This study seeks to explore the interconnection between ESG values and digital functions, focussing specifically on understanding and further development of ESG values. The aim is to establish guidelines and/or ideas that delineate strategies for improving ESG values and digital functions within real estate developments. A crucial aspect will involve emphasising conceptual thinking that can help in understanding the interconnections of ESG values and digital functions.

Furthermore, the research seeks to add on existing literature and practices for defining, measuring, and implementing ESG values within strategic decision-making. By doing so, the study aspires to help real estate developers with methods that enable consistent and impactful ESG integration with informed decision-making and contribute to a sustainable and resilient future.

1.5 Research scope

Phan and Boge's (2023) observation highlights the significance of acknowledging digital functions as an integral component of real estate development. Their research delineates the differences between possible enhancements and obstacles encountered during both the initial strategic and advanced stages of development, placing particular focus on the strategic phase. The initial strategic phases of development are important for this research, as they lay the foundation for project objectives, stakeholder alignment, roles and responsibilities, and the overall project scope.

Furthermore, the study focusses on real estate developers as the main audience because of their involvement in the initiation, planning, and management of real estate development projects. Real estate developers play a pivotal role in the decision-making process. Their decisions have a direct influence on principles related to ESG and the significance of digital functions in this context. This research aims to explore how real estate developers can effectively navigate decision-making processes, offering focused insights and recommendations that highlight the relationship between ESG and digital functions.

2.
Problem statement

The real estate sector is experiencing a transformation driven by increasing challenges related to ESG values and digital functions, prompting reassessment of conventional methods and processes. This transition is influenced in part by the effects of the COVID-19 pandemic and climate change. Nonetheless, as highlighted by Khaw et al. (2024), there is an absence of a clear academic definition and consensus within the industry regarding the principles of Environmental,

Social, and Governance (ESG). The current ESG values observed within the real estate value chain seem to lack cohesion and integration. Furthermore, although digital functions presents opportunities for the advancement of ESG values, its incorporation within the industry has been limited.

Both ESG values and digital functions show significant potential for promoting sustainable growth and enhancing resource management (Mattarocci & Scimone, 2022; Maarbani, 2017). However, the real estate sector encounters a gap between ESG values and digital functions, which limits its capacity for sustainable growth and efficient resource allocation. This research seeks to address the existing gap by examining the relevant constellations of ESG values and how they can be linked with digital functions.

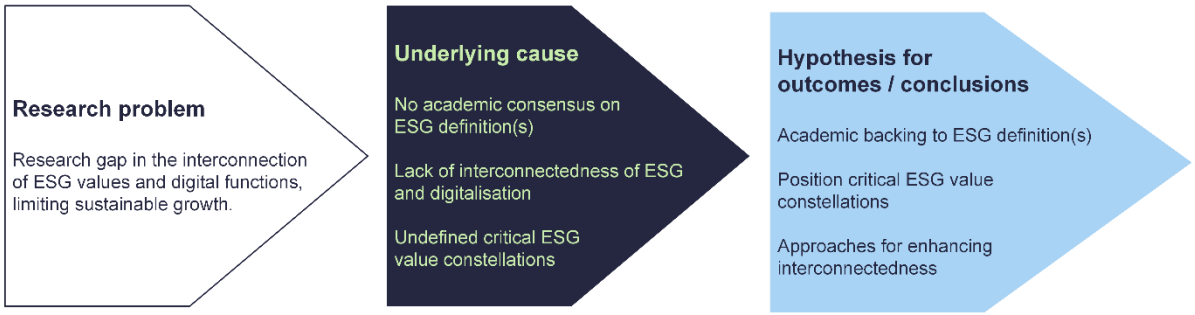

Figure 2. Research problem process scheme (Author, 2024).

3. Research objective

Previous studies suggests that the real estate sector is setting trends in industry transformations. The ability of the industry to integrate ESG values and utilise the interconnection with digital functions is increasingly important to having sustainable growth, transparency, and resilience. While literature poses certain challenges, particularly regarding getting the attention of professionals and the implementation of methods, the potential benefits are acknowledged and significant. Further research will focus on cultivating an understanding of the complexities to support other academic research and the real estate industry in learning, innovating, and thriving within an increasingly environmentally and socially considerate landscape.

3.1 Main research question

Because of this, it is valuable to develop research questions to grasp the complex dynamics and challenges for a deeper understanding of the interconnection in ESG values and digital functions. Therefore, the main goal is to explore methods for finding significant ESG value constellations and to analyse the interconnection with digital functions. Applying a chain-oriented approach that involves various stakeholders (e.g. contractors, private owners, investors, housing corporations, construction organisations, pension funds, banks, technology and software firms, as well as public entities like municipalities). As previously mentioned, the research focusses on real estate developers, who are crucial in initiating, selecting, and managing development projects, thereby establishing themselves as key stakeholders in comprehending the interconnection of ESG values and digital functions.

Hence, this study builds upon existing literature and theory using explorative studies of existing literature and an empirical part with semi-structured interviews within the real estate industry chain and a research design panel discussion. Utilising a qualitative approach to discover the specific context, concerns/challenges and perspectives that are relevant within this context. Hence, this research will be organised based on the main research question:

How can the interconnection between ESG values and digital functions be enhanced across the real estate industry chain during the strategic development stage?

3.2 Research sub-questions

In order to provide a solid base for the main research question, several sub-questions will be utilised. The sub-questions create a foundation for the research design and offer insights into the areas of focus of the research objective.

As a result, based upon previous studies about the aforementioned concepts and context, the previously mentioned research questions have been developed. These will be elaborated further for a greater understanding and the development of nuanced understandings of dynamics.

1. *Which constellations of ESG values are prioritised during the strategic development stage?*

It is relevant to identify and understand important constellations of ESG (Environmental, Social, and Governance) values (or data) during the strategic development stage to enable project developers to give priority to these values during this stage, guaranteeing the integration into the core project strategy and scope. This helps in establishing standards and optimising environmental, social, and governance (ESG) values from the start (RIBA, 2020; Hwang & Ng, 2013).

2. What digital functions are available and suitable during the strategic development stage?

On top of that, the second sub-question investigates the digital functions that are suitable and suitable, since digital functions have the potential to improve or hinder the strategic planning. Developing insights on the available digital functions which can be applied, is beneficial for

choosing the most efficient ways to integrate ESG values into the strategic development stage of the project. This encourages real estate developers to familiarise themselves with the available and suitable digital functions to enhance ESG value from the outset (Bryde, Broquetas, & Volm, 2013; Volk, Stengel, & Schultmann, 2014).

3. What is the interconnection between ESG values and digital functions?

This third sub-question seeks to analyse the interconnection(s) between ESG values and digital functions of real estate developments. Identifying gaps to improve this interconnection requires a comprehension of how digital functions, data, and values can mutually reinforce one another. By doing so it seeks to support developers to measure, report, learn, raise awareness or start a conversation about ESG values. Improving that understanding can close current gaps, encourage uniformity, and optimise resource allocation, resulting in more sustainable and accountable project results (Harty, 2005; Bryde, Broquetas, & Volm, 2013).

4. How can ESG values and digital functions be integrated during the strategic development stage?

The sub-questions is relevant in order to develop insights for the integration of ESG values and digital functions. Integration facilitates the conversion of abstract ESG values into tangible, quantifiable actions or any alternatives. By comprehending the utilisation of digital functions to contribute and implement ESG values, project developers could ensure that project objectives are not only specified but also actively controlled and monitored throughout the project lifetime (Azhar, 2011; Harty, 2005).

3.3 Research framework

This research is based upon a systematic research visualised as a Venn-diagram to use the concepts of this research and represent the logical relation between the two main concepts. The diagram seeks to guide the research in a solid manner and find an answer on the interconnection of the arising concepts of ESG values and digital functions during real estate developments.

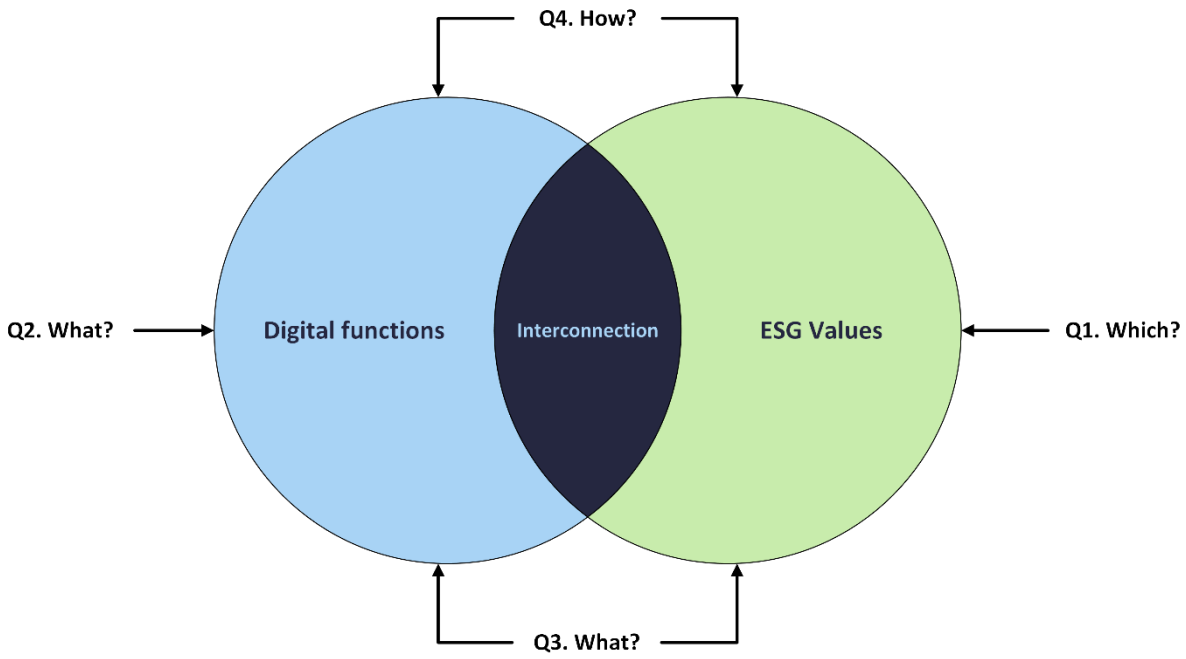

Figure 3. Research framework (Author, 2024).

3.4 Research design

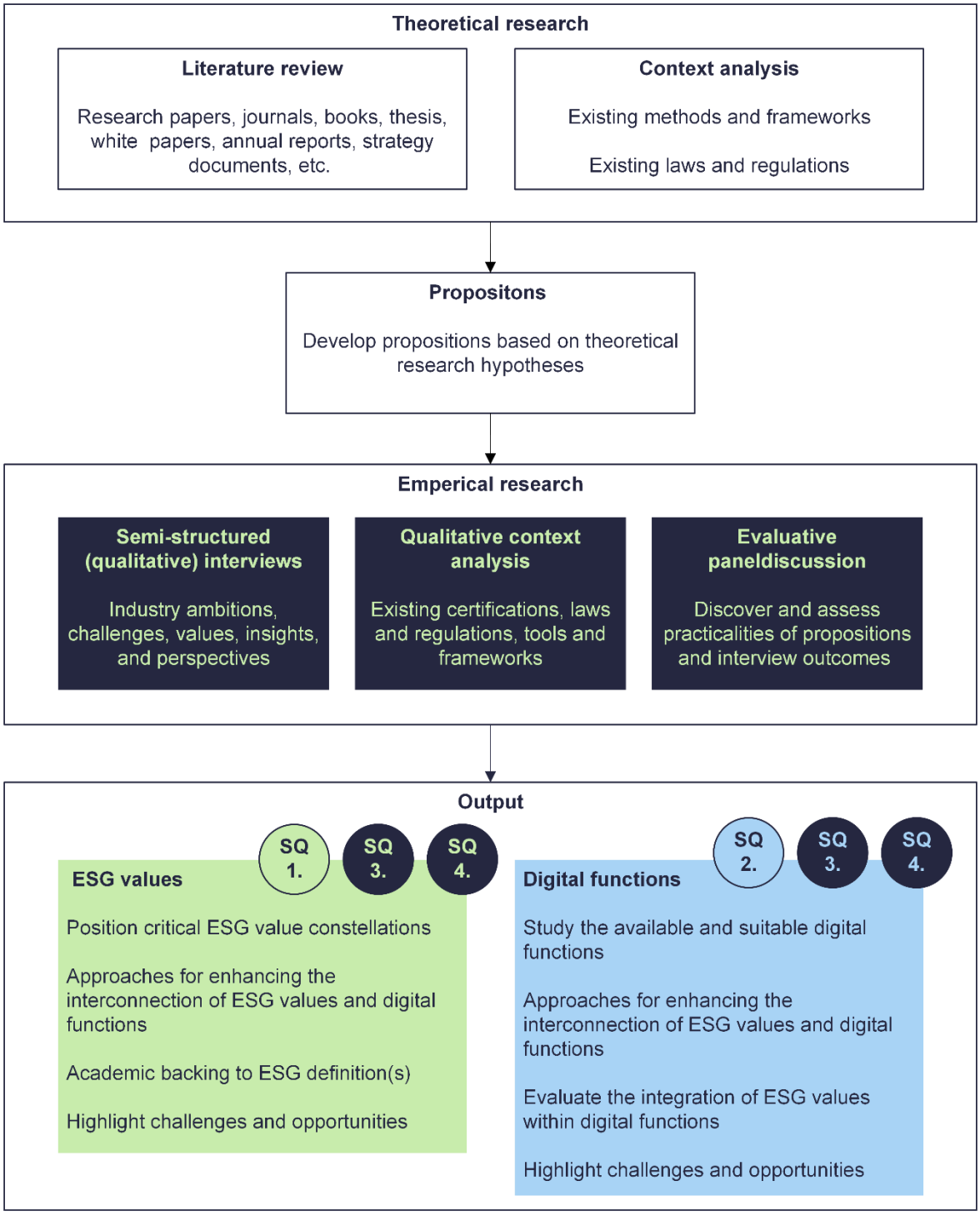

Figure 4 Research design scheme (Author, 2024).

To explore the intricacies of ESG values within the real estate industry and the interconnectedness with digital functions, this research will employ a qualitative approach. The research methodology, designed to investigate the ESG values and their interconnection with digital functions as highlighted in the literature, aims to clarify the research questions through a

combination of qualitative methods. The methodological steps are shaped to the research contemporary focus, leveraging insights from the latest advances within the real estate industry.

The contemporary focus is based on the emergence of these new concepts and befit previous studies only dating from 2015. On top of that, this ensures that the insights are aligned with the most recent discussions and technological advancements. The search strategy was inclusive of terms like "digital transformation," “digital functions,” "real estate," “ESG”, and "Industry 4.0 and 5.0," with the intention of gathering a broad spectrum of contemporary research findings.

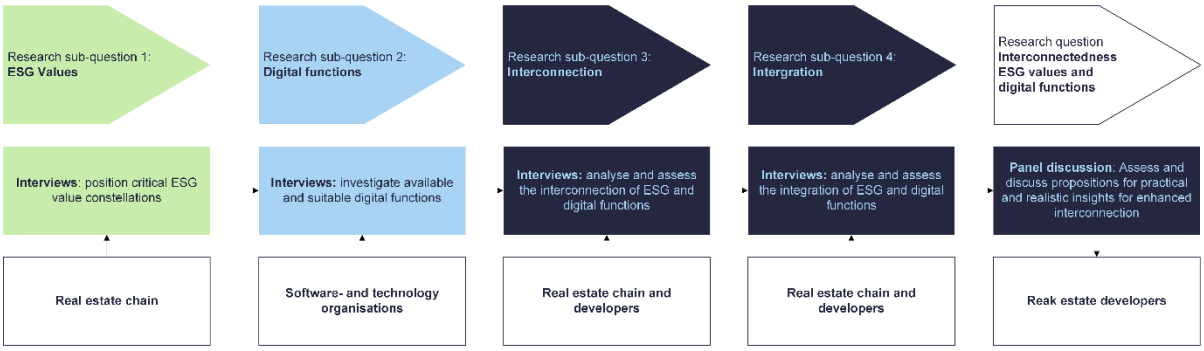

Figure 5 Conceptual framework (Author, 2024).

3.5 Research methods

The approach connects qualitative methods to offer a comprehensive understanding of dynamics and different perspectives. At first, three propositions, derived from the theory, are developed to provoke thought and debate. These propositions aim to bridge theoretical understanding and practical implications, encouraging reflection from multiple perspectives. They stimulate intellectual engagement and contribute to the critical dialogue surrounding the interconnection of ESG values and digital functions.

Secondly, empirical interviews will offer an in-depth look of the real estate industry chain from many different perspectives. Interviews serve as a method for collecting comprehensive information and gaining deep understanding of the market dynamics that exist within the real estate chain (Creswell, 2008). On top of that, the interviews will serve as input to review the propositions to come up with novel findings.

Moreover, an expert panel discussion will be initiated after insights and perspectives of the semi-structured interviews and propositions are developed. The output of the interviews will then be used as input for the discussion. Panel discussion include critical and evaluative discussion activities and group debates of the propositions that may provide significant qualitative data and affirm previous findings from the interviews (Stappers & Giaccardi, 2017). The methods offer several benefits to this: a comprehensive grasp may be attained by combining qualitative methods (Blaikie & Priest, 2019), allowing for the examination of many aspects of the issue under investigation and leading to a more holistic knowledge.

Hence, qualitative research is well-suited for complex themes, like digital functions and ESG value in the real estate industry, since it can address a wide range of study queries and scenarios due to adaptability.

3.6 Practical relevance

The study offers practical value to particularly real estate developers, but also other stakeholders, by looking at actionable insights into the interconnection of ESG values and digital functions during the strategic development stage and using a chain-oriented approach, multiple perspectives will be represented during the research. By addressing challenges and opportunities, the findings seek to guide practicalities, not just theory.

Hence, for real estate developers the study seeks to emphasise on the importance of aligning digital functions with ESG values early in the project life cycle. This approach looks into embedding sustainable practices from the outset, enhancing both compliance and long-term value creation. As a result, developers are equipped with insights to overcome potential challenges and enabling effective decision making and resource allocation.

3.7 Research guidance

In addition, the study is benefited by the organised support and validation offered by scholarly mentors. Regular academic supervision is conducted with biweekly meetings, providing consistent oversight, feedback, and guidance. These meetings facilitate in-depth discussions regarding research advancements, challenges, and strategic adjustments, promoting an academic approach to the project. The knowledge of the mentors plays an essential part in enhancing research methodologies, verifying findings, and ensuring that the study is in accordance with wider academic and industry standards.

Alongside academic supervision, the research is enhanced through a practical and professional insights from Boelens de Gruyter, a private real estate development organisation. The offers practical experience along with crucial industry knowledge, connecting theoretical research with practical applications. At Boelens de Gruyter, the research brings upon practical experience in real estate development processes and managerial choices. The organisation’s setting and mentors provide opportunities for direct engagement with industry professionals, along with access to relevant information, insights, and examples that enhance the educational framework.

3.8 Societal and scientific relevance

The devotion and transformative pressure of the real estate industry to ESG (environmental, social, and governance) values and the integration of digital functions holds considerable social and academic importance, given the industry's dynamic nature and its influence on socioeconomic issues. Therefore, the implementation of ESG values and digital functions practices provides a means to decrease the environmental footprint of the industry, foster equitable society, and attain economic sustainability. These practices also match with the objectives of the United Nations Sustainable Development Goals (UN SDGs). This decision is not merely a response to advancements in technology; it signifies a revaluation of the potential contributions of real estate in fostering a sustainable and resilient future (Saxena et al., 2022; Lee et al., 2024). Moreover, the shift towards Industry 4.0 and 5.0 presents the sector with a chance to lead the adoption of smart and adaptive methodologies. These practices not only promise enhanced efficiency but also contribute to the development of a more sustainable and socially inclusive world (De Giovanni, 2023; Kwilinski et al., 2023; Lee et al., 2024).

4.

Theoretical background

4.1 Environmental, social, and governance values

The concept of ESG derives from ethical and responsible investment, which opposes a profit-focused business approach. It promotes the integration of environmental, social, and governance principles into investment decisions, while also considering economic benefits (Zhang et al., 2023; Tarmuji et al., 2016)..

Environmental, Social, and Governance (ESG) principles have gained increasing significance and acknowledgment in recent years among various stakeholders involved (Rau & Yu, 2023; Newell & Marzuki, 2024). These concepts are increasingly shaping business strategies and performance. Khaw et al. (2024) noted that, despite the growing interest, ESG lacks a clear academic definition. It encompasses various dimensions including organisational environmental impact, social responsibilities, and the governance mechanisms that underpin its activities.

The incorporation of Environmental, Social, and Governance (ESG) concepts into business strategies is renowned for its ability to boost corporate reputation (Murè et al., 2020). However, since there are no exact academic definitions available, this research will define ESG concepts as values. Therefore, it is important to provide a clear definition of the term "values". Roe and Ester (1998) define values as hidden concepts that represent how individuals or organisations assess actions or results. Value often refers to the connection between a person assessing something and the thing being assessed. This connection is marked by durability and implications for the person's future activities. Importantly, values are not just held by individuals but also by groups.

Due to the expansive and ambiguous nature of ESG in academic literature, characterising ESG as values provides an explanation for comprehending its significance in business strategy and performance. By considering ESG as values, it is recognised that these principles are subjective and evaluative in character. This aligns with Roe and Ester's (1998) understanding of values as underlying constructs that impact both individual and group behaviour.

The incorporation of ESG values into business practices necessitates recognising the importance of environmental sustainability, social responsibility, and robust governance frameworks as vital elements for sustained company performance. The values serve as the basis for decision-making processes, shaping the organisational culture and influencing relationships with stakeholders. The values of ESG serve as a set of standards for assessing company actions and results, guaranteeing that they are in line with larger societal and environmental objectives.

Thus, by conceptualising ESG in terms of values, we can enhance our comprehension of their significance in shaping how businesses act and fostering long-term sustainability. This method not only supports in understanding the concept but also highlights the importance of integrating ESG values within businesses and organisations.

4.1.1 Environmental values

The 'E' in ESG refers to the environmental values, which relates to an organisations ecological or environmental impact. This encompasses efforts to reduce carbon emissions, effectively manage natural resources, and reduce environmental harm (Senadheera et al., 2021). It also encompasses initiatives aimed at sustainability, renewable energy, waste reduction, and other relevant areas. The environmental dimension encompasses a range of environmental measures. The objective of such is to reduce negative environmental impacts and foster sustainable development (De Souza Barbosa et al., 2023). Companies can reduce their ecological impact by adopting renewable energy sources, improving energy efficiency, and implementing thorough recycling programmes.

As a consequence, the literature highlights the importance of integrating these environmental values into organisational processes to achieve long-term sustainability and improve corporate reputation. This integration fulfils both the requirements of regulatory compliance and the increasing expectations of stakeholders who emphasise environmental responsibility (De Souza Barbosa et al., 2023). Moreover, implementing these strategies can lead to enhanced financial results by reducing operational costs and alleviating the risks associated with environmental regulations and possible ecological disasters (Taliento et al., 2019).

Ultimately, adopting the term "values" in the context of the environmental aspect of ESG underscores the commitment organisations have to sustainable practices and their role in fostering environmental accountability. This approach aligns with the wider concept of ESG as an umbrella for evaluating and guiding organisations behaviour to achieve sustainable goals (Rajesh, 2020; Bourcet, 2020; Khanchel et al., 2023).).

4.1.2 Social values

The social dimension, represented by the 'S' in ESG (Environmental, Social, and Governance), is gaining growing importance in the real estate industry. This dimension relates to a business's dedication to social responsibility, which includes upholding ethical labour standards, actively engaging with the community, advocating for diversity, and meeting the expectations of stakeholders. Some components encompassed in this context are gender parity, cultural variety, employee well-being, community involvement, and the management of the supply chain (Newell & Marzuki, 2024; Baid & Jayaraman, 2022).

The literature suggests that incorporating these social components into real estate processes not only improves corporate reputation but also fulfils the increasing demands of stakeholders for socially responsible developments (Newell, 2023). The emphasis on social values in ESG highlights the importance of ethical behaviour and social responsibility in fostering sustainable development and maintaining a positive corporate image.

Hence, “values” play a role in the social dimension of ESG, especially within the real estate sector. They set out values for ethical behaviour, community engagement, inclusivity, employee well-being, and the responsible oversight of the supply chain. By integrating these values into business practices, real estate firms can boost their corporate image while also addressing the increasing demands of stakeholders for socially responsible projects.

4.1.3 Governance values

Governance refers to the systems, standards, and procedures that direct a company's decision-making process and ensure its responsibility. This encompasses the organisational structures for corporate governance, the inclusion of diverse members on the board, the promotion of transparency, and the adherence to ethical business practices (Kouaib et al., 2020; Manita et al., 2018). Responsible governance is the practice of operating a business with integrity, fairness, and

accountability. It aims to build trust among stakeholders and improve the organisation's reputation and sustainability.

The importance of governance "values" lies in their role as the ethical underpinning and guiding principles for corporate activity. Values are the fundamental principles and priorities that an organisation holds, which have a significant impact on the decision-making process. The methods by which transparency is upheld and responsibilities are handled. By conceptualising governance in terms of values, organisations highlight their dedication to ethical behaviour and responsibility, both of which are crucial for sustained prosperity and the confidence of stakeholders. This viewpoint emphasises that governance encompasses more than simply adhering to legislation; it also involves cultivating a culture of honesty and accountability within the organisation.

4.2 Digital tools (or functions)

Digitalisation is a trend that profoundly impacts individuals and society. Consequently, the real estate industry is experiencing a surge in digital tools, presenting both opportunities and challenges for innovation (Vigren et al., 2022; Yeow et al., 2018). Organisations can derive significant benefits from digital tools by leveraging digital technologies and integrating digitally-driven innovations; however, they also face various challenges in this process (Vigren et al., 2022).

One of the key advantages of digital tools in real estate is the enhancement of communication, which enables stakeholders to collaborate more effectively through real-time data sharing. Improved data collection and analysis facilitate informed decision-making, allowing organisations to monitor performance metrics and identify trends swiftly. Furthermore, digital tools streamlines reporting processes, ensuring that ESG-related data is accurately collected, tracked, customised, analysed, and communicated to stakeholders, thereby promoting transparency and accountability.

Literature discusses the Internet of Things (IoT), Artificial Intelligence (AI), and Building Information Modelling (BIM) as examples of digital tools that contribute to these benefits (Atkin and Bildsten, 2017; Bröchner et al., 2019). Recent research has also associated digital tools with advancements in technology, the sharing economy, tenant relationships, and the development of new services and business models (Saarikko et al., 2017; Vigren et al., 2022).

Therefore, digital tools in the real estate industry entails the collaboration of numerous organisations and entities to establish an integrated system. This system relies on real estate organisations that own, develop, and lease properties. The process of digital functions has significant effects on the processes, procedures, and interactions within these systems (Vigren et al., 2022).

To fully understand the effects of digital functions, it is relevant to examine its functions, thereby comprehending the roles and operations within the context of an integrated system.

4.2.1 Digital functions

Within the context of digital tools, the concept of "functions" refers to the diverse roles, tasks, and processes that digital technologies facilitate or enhance within an organisation or system. Functions represent the specific ways in which digital technologies and processes contribute to or hinder objectives, as well as their impact on efficiency, innovation, and collaboration (Betti & Sarens, 2020; Wynn & Lam, 2023; Yeow et al., 2018; Singh et al., 2023). In contrast to viewing digital technologies solely as tools, functions can also obstruct objectives and diminish efficiency, innovation, and collaboration. As a result, this research will frame digital tools as

digital functions. By framing them as functions, the research allows for the understanding it may also introduce complexities, inefficiencies, or unintended results that hinder actual benefits.

4.3 Integration

The integration of Environmental, Social and Governance values with digital functions during the early stages of project development, more specifically the strategic stage, is important to develop sustainable and resilient projects. The integration between digital functions and ESG supports the alignment of project goals with the aforementioned sustainability objectives, transparency, efficiency, and stakeholder engagement.

4.3.1 Interconnection

Regarding the interconnection of ESG and digital functions, previous studies suggest, the interconnection between sustainable development goals (SDGs) and digital inclusion is centred on the idea that access to digital technologies and internet play a role in achieving sustainable development (Sadigov, 2022; Trushkina, 2019; Lahouirich et al., 2022), more specifically ESG driven developments.

Moreover, Clark et al. (2022) found that digital functions promotes transparent and accountable governance, community engagement, and access to justice through digital platforms, enhancing democratic processes. This is coherent with the social and economic effects within ESG value creation. In addition, Kwilinski et al. (2023) found that, it can be inferred that digital functions has a favourable impact on ESG, both directly and through spillover effects. This suggests that as digital functions increases, it positively influences the ESG. However, Kwilinski et al. (2023) highlighted a few potential implications:

- Policymakers should prioritise programmes that reduce the digital gaps and provide affordable access to digital services and technologies. This requires inexpensive internet and technological education.
- Governments should strengthen digital infrastructure. This includes high-speed internet, reliable data networks, and cutting-edge technologies. By investing in key drivers, governments may facilitate digital innovation, business, and long-term economic development, improving ESG value creation.
- Organisations should prioritise digital public services for consumers and businesses. This includes electronic government services, online company registration, electronic tax filing, and digital healthcare and education.
- Organisations should promote ESG value creation by exchanging knowledge, technology, and environmentally friendly practices.

The majority of literature indicates that ESG and digital functions have common elements and enhance their respective processes and purposes. Digital functions can play a significant role in advancing the development of ESG values. The incorporation of digital functions allows the collection of extensive data analysis and the management of internal information (Zhao & Cai, 2023). As noted before, ESG promotes the importance of sustainable development for organisations by highlighting the importance of environmental friendliness, social responsibility, and corporate governance in their operations and growth (Rajesh, 2019).

The interconnection between ESG and digital functions comes from an ongoing shift in how businesses generate value for their customers through the use of modern technology and communication strategies. The digital transformation aims to reshape traditional processes to harness the creative potential of data, enhance corporate sustainability, resilience, digital

progress, and organisational improvement, as noted by Li and Zhang (2024). The core aspect is the enhanced distribution of resources (Mattarocci & Scimone, 2022; Maarbani, 2017; Vial, 2019).

According to Li and Zhang (2024), previous research indicate that digital functions can significantly enhance ESG values. There appears to be a significant interconnection between ESG and digital functions. Building on the research conducted by Chen et al. (2022), the literature explores the impact of digital functions on corporate ESG values, focussing on the aspects of information asymmetry and innovation capability within the framework of corporate dynamic capabilities.

In addition of improving corporate economic performances and resilience, digital functions adds value to non-economic areas like the environment, society, governance, and corporate culture (Li and Zhang (2024); Tuukkanen et al. (2022)). The support of digital functions can help enterprises more efficiently refine and enhance their image, customer reputation, and product quality, thereby promoting sustainable growth and as a result their corporate ESG values.

Moreover, digital functions provides a new set of knowledge and resources, thereby enhancing the ability to identify and absorb knowledge and opportunities (absorptive capacity). Ultimately, it may help enterprises create value and achieve better developments. Digital functions can improve corporate ESG values by enhancing absorptive capacity, according to Li and Zhang (2024). In addition, Liu et al. (2024) mention that digital functions has the potential to significantly improve ESG values.

Nonetheless, challenges and limitations exist that need to be addressed regarding the interconnection of ESG values and digital functions. According to Sachs et al. (2019) the most feared challenges is the loss of jobs, theft of digital identity, invasion of privacy, discrimination based on PD (personal data), monopoly positions due to control of big data, challenges to deliberative decision-making processes, cyber warfare, manipulation.

4.4 Desired situation

Currently the real estate industry encounters several aforementioned challenges related to ESG and digital functions. Within this context, real estate developers are pressured to adjust to these changes. However, the current scenario tends to be chaotic, requiring a more desirable future scenario with regards to ESG and digital functions.

The current state of real estate developments demonstrates multiple challenges. The incorporation of ESG tends to be fragmented, sometimes regarded as an extra rather than essential to project development. This leads to inconsistent implementation and less than desirable outcomes (Khaw et al., 2024). In addition, the utilisation of digital functions is constrained by unsuitable strategic development, which hinders the realisation of potential benefits (Latif et al., 2023).

Furthermore, there is a lack of interconnection between stakeholders, which obstructs communication and agreement on ESG and digital operations (Clark et al., 2022). The industry also encounters deficiencies in monitoring and evaluating ESG value creation, which presents difficulties in evaluating progress and implementing enhancements (Fatemi et al., 2018).

Nevertheless, as stated by Fatemi et al. (2018), organisations that implement environmental, social, and governance (ESG) measures can improve their market value and gain a competitive edge. Furthermore, digital functions have the potential to enhance data accuracy, optimise workflows, and streamline decision-making processes (Latif et al., 2023). According to Wang (2023), digital functions has the potential to improve transparency, efficiency, and stakeholder engagement, leading to positive outcomes in terms of ESG value creation.

Thus, the desired situation may entail a smoother incorporation of ESG values with the interconnection of digital functions. This scenario seeks strategies to improve environmental,

social, and governance (ESG) value creation and the implementation of digital functions. Moving from the current scenario to the desired scenario.

4.5 Laws and regulations

The integration of ESG values into organisational and industry structure has become increasingly significant in recent years. Previous studies indicate that a significant factor behind this shift is the increasing influence of laws and regulations aimed at fostering sustainability and social responsibility. The legal frameworks have led to the development of ESG strategies and serve as a foundation for evaluating compliance and performance in this area. Therefore, it is important to examine the laws and regulations concerning ESG to gain a clear understanding of their significance.

4.5.1 Sustainable development goals

The increasing focus on ESG values in recent years can be linked to global efforts, including the United Nations Sustainable Development Goals (SDGs), as well as regulatory frameworks such as the Sustainable Finance Disclosure Regulation and the Corporate Sustainability Reporting Directive (CSRD). As emphasised by Lee et al. (2024) and Saxena et al. (2022), these frameworks have played a significant role in shaping the incorporation of sustainability within business practices and governance structures.

The Sustainable Development Goals (SDGs) have been formulated as a component of the 2030 Agenda for Sustainable Development. This necessitates transformative actions across various sectors and society, demanding collaborative efforts from governments, communities, scientific institutions, and the private sector. Furthermore, the Sustainable Development Goals consist of 17 interconnected objectives that offer a thorough framework for tackling global issues, including poverty, inequality, climate change, and environmental degradation, while promoting peace and prosperity. Also, the alignment with the Paris Climate Agreement highlights the critical need for international collaboration and proactive measures to attain sustainable development (IIASA, 2020).

In addition, the SDGs consist of the concepts of five Ps: prosperity, people, planet, peace, and partnerships. Each of these represent a cornerstone of sustainable development. These are time-bounded targets to aim and ensure inclusivity and equity while promoting resilience and long-term well-being. By encouraging alignment between global objectives and industry practices, the SDGs serve as a guiding framework for integrating ESG values into their strategies to foster sustainable and social responsible progress.

Alongside the references of Lee et al. (2024) and Saxena et al. (2022), the significance of environmental, social, and governance (ESG) factors has grown, partly due to the influence of the United Nations' Sustainable Development Goals (SDGs) and the SFRD and CSRD directives aimed at promoting global sustainability. The Sustainable Development Goals necessitate profound changes globally and within various sectors, requiring collaborative efforts from governments, civil society, educational institutions, and the business community. In alignment with the 2030 agenda, which encompasses 17 Sustainable Development Goals, and the Paris Climate Agreement, member states of the United Nations have established a framework aimed at fostering national action and promoting global cooperation in the realm of sustainable development (IIASA, 2020). The SDGs emphasise time-bound targets aimed at achieving prosperity, addressing the needs of people, safeguarding the planet, promoting peace, and fostering partnerships, collectively referred to as the five Ps.

4.5.2 Corporate sustainability reporting directive

In accordance with the European Green Deal and the Sustainable Development Goals set by the United Nations, legislation within the European Union has been established requiring all large and publicly listed companies to provide detailed information about the risks and opportunities linked to their social and environmental impacts (corporate sustainability reporting, n.d.). The Corporate Sustainability Reporting Directive (CSRD) serves as a fundamental element of the regulatory initiative, having come into effect on January 5, 2023. This directive creates a strong legal framework for the reporting of sustainability-related information, with compliance requirements set to take effect in 2024.

Figure 6 CSRD themes (author 2024)

The CSRD represents a transformative step towards enhancing corporate transparency and accountability in the realm of sustainability. It obliges organisations to provide detailed disclosures about the societal and environmental ramifications of their activities, thereby enabling stakeholders to better understand the impacts of corporate behaviour. Moreover, the directive seeks to equip investors and other stakeholders with the requisite information to assess financial risks and opportunities stemming from climate change and other sustainability challenges. By fostering alignment between corporate practices and broader sustainability goals, the CSRD plays a pivotal role in advancing the EU's agenda for sustainable development and resilience.

Central to the implementation of the CSRD are the European Sustainability Reporting Standards (ESRS), which organisations subject to the directive are required to adopt. These standards aim to balance reporting across the EU, ensuring consistency, comparability, and reliability in the information disclosed. By embedding ESG values within corporate reporting, the CSRD promotes

informed decision-making among stakeholders and reinforcers the EU's commitment to the Paris Agreement and the 2030 agenda.

As a result of the European green deal and the SDG's, EU law requires all large companies and listed companies to disclose information on what they see as the risks and opportunities arising from social and environmental impact (Corporate Sustainability Reporting, n.d.). Consequently, the Corporate Sustainability Reporting Directive came into effect on January 5th, 2023. The regulations outline the requirements for companies regarding the reporting of social and environmental information. Starting in 2024, the updated regulations will guarantee that investors and various stakeholders can access the necessary information to evaluate the effects of companies on individuals and the environment, as well as enable investors to analyse the financial risks and opportunities associated with climate change and other sustainability concerns. Organisations that fall under the CSRD will be required to report in accordance with the European Sustainability Reporting Standards (ESRS).

4.5.3 Sustainable finance disclosure regulation

In addition to the CSRD, the European Union has established a complementary framework called the Sustainable Finance Disclosure Regulation (SFRD). This regulation outlines the requirements for financial market participants to disclose sustainability-related information, thereby enabling investors to make informed decisions about allocating capital towards companies and projects that align with sustainability objectives. By mandating the standardised disclosure of such information, the SFRD claims to enhance market transparency and support the transition to sustainable finance.

The SFDR also provides a mechanism for investors to evaluate the extent to which sustainability risks are integrated into the investment decision-making process. This enables stakeholders to better understand the sustainability performance and resilience of financial products and institutions. In doing so, the SFDR contributes directly to one of the European Union's overarching policy goals: mobilising private capital to accelerate the transition towards a net-zero economy. By fostering informed decision-making and prioritising sustainability considerations, the SFDR plays a critical role in aligning financial markets with the EU's climate and environmental ambitions.

Alongside the CSRD, the EU has established a transparency guidelines known as the Sustainable Finance Disclosure Regulation (SFRD). By outlining the requirements for financial market participants to disclose sustainability information, it assists investors aiming at allocating their funds to companies and projects that align with sustainability goals in making informed decisions. The SFDR aims to enable investors to effectively evaluate the integration of sustainability risks for the investment decision-making process. The SFDR plays a significant role in advancing an important political objective of the EU: to attract private investment which promotes Europe's transition to a net-zero economy (Sustainability-related Disclosure in the Financial Services Sector, n.d.).

Propositions

Following the theoretical background and previous studies, three propositions have been developed for this research. Propositions are declarative statements that assert a claim, designed to be evaluated as either true or false. They serve as tools to provoke thought, encourage debate, and challenge established perspectives. Unlike the ultimate conclusion, propositions do not summarise the findings but distil theoretical insights into concise and debate-worthy statements, fostering critical examination of the research's core themes.

Rooted in the study's theoretical framework and prior research, these propositions are intended to facilitate a focused discussion on the interview outcomes and the insights gathered during the evaluative and critical panel discussion. By transforming abstract concepts into specific claims, the propositions aim to bridge theoretical understanding and practical implications, inviting reflection and interpretation from multiple perspectives.

Ultimately, these propositions serve as a means of advancing discourse within the field, ensuring that key theoretical insights are not only examined but also debated in light of their broader academic and practical relevance. Their role is to stimulate intellectual engagement and contribute to the critical dialogue surrounding the integration of ESG values and digital functions during the strategic development stage of real estate projects.

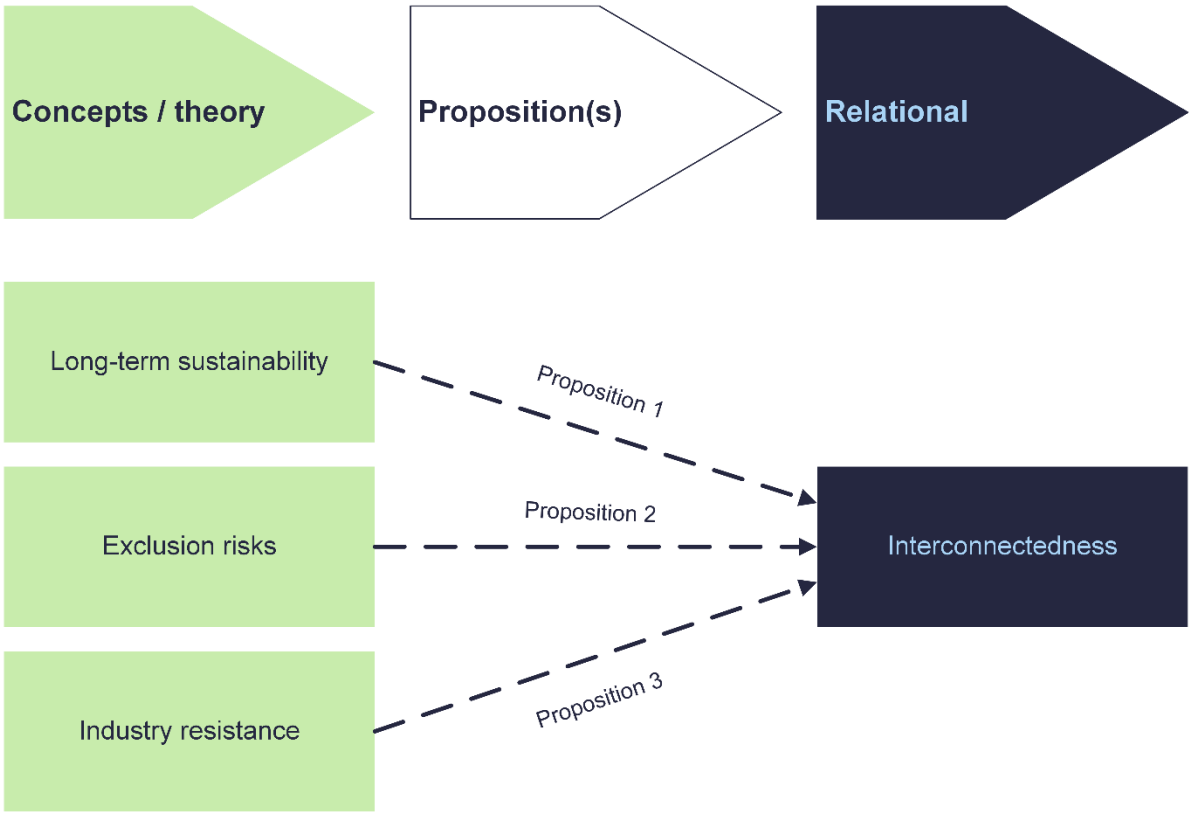

Figure 7 propositional scheme (Author, 2024)

Following Avan and White (2001), propositions are fundamental for this academic research (figure 7), providing criteria for evaluation and ensuring precision in defining and measuring concepts. The propositions serve as empirical indicators to guide interviews and panel discussions, ensuring both theoretical and practical relevance.

Proposition 1 Environmental values are only sustainable when social values are sustained.
Based on chapter 1.3 takeaways and discussions of literature (bullet point 1 and 2)

This proposition challenges the idea that environmental values can exist sustainably independently from social values in real estate projects. It indicates a mutually beneficial connection between environmental and societal values. The proposition suggests that the preservation of environmental values is unfeasible in the absence of consideration for social values. The lack of integration of social values can lead to environmental outcomes that do not reach their full potential and may even have counterproductive effects, particularly when considering the operational consequences of buildings and the long-term aspects of sustainability.

Nevertheless, certain theories may argue that integrating environmental values into organisational processes is necessary for achieving long-term sustainability and improving corporate reputation. This is fundamentally connected to the purpose of complying to regulatory laws and regulations, as well as addressing the increasing expectations of stakeholders to emphasise environmental stewardship (De Souza Barbosa et al., 2023).

It is thus proposed that the realisation of long-term environmental sustainability values occurs only when social values are taken into account in conjunction with environmental values. Through a review of interview and panel discussions outcomes, the proposition will be evaluated and explore the significance of ESG values in more detail. Furthermore, the proposition is based on the perspective of understanding ESG as values, in which environmental, social, and governance values are regarded as subjective and inherently moral. This is consistent with the idea that social values are essential, as they embody ethical commitments. Values are established in moral considerations and subjective judgments about what is deemed important.

Proposition 2: ESG-driven digital functions promote including but risks excluding values (digital vs. non-digital). Based on chapter 1.3 takeaways and discussions of literature (bullet point 3,4,5,6, and 7)

While there is a strong drive to adopt digital functions within the real estate chain, previous studies highlight persistent opposition and challenges that hinder their seamless integration with economic and environmental developments (Ullah et al., 2018; Dash et al., 2021; Starr et al., 2020). These challenges are further compounded by the real estate workforce uneven adaptability to digital innovations and by structural barriers that impede effective implementation (Starr et al., 2020; Tan & Miller, 2023; Latif et al., 2023; Phan & Boge, 2023).

Digital functions undeniably offer the potential to promote inclusion, particularly by centralising and streamlining ESG data/values, facilitating collaboration among diverse stakeholders, and enabling access to real-time insights for better decision-making. These capabilities can empower stakeholders (especially those previously marginalised in the ESG discourse) to actively participate in ESG efforts, provided they have the necessary resources and digital literacy.

However, the rapid digitalisation of ESG processes risks inadvertently excluding certain values (and stakeholders). Consequently, while digital functions have the potential to enhance inclusion of values, they often privilege quantifiable metrics and operational efficiency, which disproportionately align with environmental and governance values. This focus could risks diminishing the emphasis on less quantifiable but equally important social values, such as equity, diversity, and community well-being.

Proposition 3: The success of ESG-driven digital functions depends more on cultural and dynamic chain-oriented developments rather than technological developments. Based on chapter 1.3 takeaways and discussions of literature (bullet point 3, 4, and 7)

Kane et al. (2015) and Wang (2023) mentioned the call for a shift for integrated and strategic applications of digital functions to improve sustainability. Also, the process of digital functions within the real estate sector signifies a transformation in conventional practices and an improvement in activities related to real estate (Lee et al., 2024). Plus, it was observed that while innovation and technology present significant potential, the industry is proceeding gradually in its adoption of digital functions (Tan & Miller, 2023; Wang, 2023), while also integrating ESG values into its operations. The final proposition argues that technology (in isolation) is insufficient to ensure the successful integration of ESG. Instead it necessitates a cultural shift and a chain-oriented approach.

6.
Data management

From the theory and interviews it has become evident that the real estate industry plays a crucial role in embedding and fostering ESG values across the development process. Increased pressures from stricter regulations and elevated investor expectations have driven the industry to place a greater emphasis on ESG considerations. Nonetheless, the integration of ESG values, especially in relation to digital functions, continues to be fragmented and ambiguous, posing difficulties for industry stakeholders in formulating unified strategies. This study will undertake semi-structured interviews with leaders and key stakeholders from renowned organisations within the real estate industry in order to research this issue.

This approach, involving multiple stakeholders, guarantees that the perspectives of those directly engaged in the integration, implementation, and interconnection of ESG values and digital functions are taken into account. This study seeks to explore various perspectives in order to pinpoint effective practices and methodologies that can enhance the integration of ESG values with digital functions in the context of strategic development.

The purpose of these interviews is to gain industry insights on the current challenges, opportunities, perspectives, and strategies for the interconnection of ESG values and digital functions. This input will be helpful in building theoretical findings and could provide new, practical insights to help in the development of a framework for real estate developers. The main

goal is to formulate ideas that enhance the interconnection of ESG values and digital functions, thereby promoting sustainable, responsible, and resilient real estate developments.

6.1 Sampling

Since this research is exploratory and based on a chain-oriented perspective. The selection criteria that were applied when looking for suitable participants is based on the type of focus group: contractors, private owners, investors, housing corporations, contractors, construction organisations, pension funds, banks, tech- and software organisations, and public bodies (municipalities). At least one or two samples are selected from a large array of focus group. As shown in table (2).

Interviewees	Interview theme	Focus group
ABN-AMRO	ESG	Real estate banker
Altera	ESG	Real estate investor
de Alliantie	ESG	Social housing corporation
Dura Vermeer	ESG	Contractor
JAJO	ESG	Contractor
Schroders	ESG	Investment manager
Gemeente Amsterdam	ESG	Municipality
Gemeente Utrecht	ESG	Municipality
Boelens de Gruyter	ESG	Real estate developer
Boelens de Gruyter	ESG	Real estate developer (C-level)
iqbi	Digital functions	Software and technology engineer
Next Sense	Digital functions	Software and technology engineer

Table 2 interview sampling (Author, 2024)

Organisation	#	Reference
ABN-AMRO	1	Real estate banker
Altera	1	Real estate investor
de Alliantie	1	Social housing corporation
Dura Vermeer	1	Contractor

JAJO	2	Contractor
Schroders	1	Investment manager
Gemeente Amsterdam	1	Municipality
Gemeente Utrecht	2	Municipality
Boelens de Gruyter	1	Real estate developer
Boelens de Gruyter	2	Real estate developer (C-level)
iqbi	1	Software and technology engineer
Next Sense	2	Software and technology engineer

Table 3 interviewee referencing (Author, 2024)

6.2 Real estate chain

The focus on the real estate chain in this research is based on the understanding that real estate development is a multifaceted industry involving a wide range of stakeholders. Each stakeholder within the chain, from banks and investors to contractors and public bodies, play an important role in shaping the outcomes of real estate developments. By adopting a chain-oriented perspective, this research aims to capture the interconnectedness and interdependencies that influence the integration of ESG values and the role of digital functions throughout the real estate sector.

Looking into the real estate chain is necessary, as ESG values represent a collective endeavour rather than an isolated effort. Collaboration and alignment among diverse parties and partners is necessary to accomplish maximum impact. The input of various stakeholders guarantees that insights are thorough and represent diverse viewpoints.

This research seeks to examine the understanding and interconnection of ESG values and digital functions throughout the chain, with the goal of identifying synergies and gaps that could either obstruct or promote the interconnection of ESG values. This chain-oriented focus facilitates the identification of practices and collaborative methods that can be utilised to improve project outcomes.

Ultimately, emphasising the real estate chain underscores the significance of collective responsibility and collaborative efforts in promoting ESG values. This analysis offers an in-depth perspective on the ways in which the roles and decisions of various stakeholders can impact the incorporation of digital functions and ESG values in the strategic development phase, ultimately fostering a more resilient, sustainable, and effective methodology for real estate development.

6.3 process of analysis

This research focuses on professionals within the real estate industry, with a particular emphasis on the project developer's perspective. They play an important role in initiating, managing and opting real estate developments. To gain a comprehensive understanding of the industry's current standings, the study will adopt a chain perspective . This approach allows for a broader analysis and deeper comprehension of the various perspectives (e.g. contractors, owners and investors, policy makers, developers, architects, and consultants, software, tech, and public bodies) and contexts in real estate development.

6.3.1 In-depth interviews

To generate original propositions or explanations regarding Environmental, Social, and Governance (ESG) value creation and behind the role of digital functions to contribute to

Environmental, Social, and Governance (ESG) value creation in the real estate industry, this research will predominantly rely on interviews to gather and generate qualitative data. The target audience will consist primarily of real estate developers and with a broader view on real estate professionals (e.g. contractors, owners and investors, policy makers, developers, architects, and consultants, software, tech, and public bodies), as they have impact on the developers strategies and business approaches. These professionals play a role in identifying and resolving potential challenges, as well as simulating and evaluating a range of variables that impact ESG.

Hence, to investigate the appropriate target audience, it is necessary to first identify organisations and professionals who have an impact on ESG value creation and digital functions.

A purposive sample and discussion with Boelens de Gruyter will be employed from the aforementioned principles to select appropriate participants. The inclusion of professionals involved in digital functions and ESG is essential for gaining insights by focusing on a specific group of individuals. Following the initial sample, professionals who possess knowledge of pertinent and information-rich material can be identified using a purposive snowball sampling technique, where one participant provides a reference for another. This approach will help ascertain the correlation between digital functions and ESG value creation. The determination of the interview sample size will be dependent upon the research project's scope and time constraints (Bryman, 2016). The number of interviews will depend on the response rate, with an intended sample size of approximately 10-15 qualitative interviews selected from five to ten focus groups.

6.3.2 Panel discussion

Workshops serve to evaluate the ESG values, value creation, and impact of digital functions in real estate developments. The workshop promotes a cooperative atmosphere, allowing various stakeholders to participate in a meaningful discussions, which promotes a thorough understanding. Workshops aim to encourage active engagement and prompt feedback, which in turn facilitates the development of new concepts and the appropriate improvement of approaches. In addition, workshops facilitate the gathering of both qualitative and quantitative data. Group discussions and activities generate valuable qualitative data, while structured tasks and assessments produce quantitative data, allowing for a comprehensive perspective (Blaikie & Priest, 2019; Creswell, 2008).

Ultimately, workshops foster consensus and dedication among stakeholders, meaning that the proposed ideas are both practical and appealing.

6.3.3 Data analysis

The data analysis plan specifies how the obtained data will be analysed during the research process. The qualitative approach aims to provide insight on the research's questions and objectives. Thus, two sorts of data are gathered: qualitative and quantitative. The qualitative data is gathered through in-depth interviews, workshops, and a few case studies. In contrast, case studies and workshops provide quantitative information. However, qualitative data will remain the primary focus because quantitative data will be scarce given the study methods that will be used (Blaikie & Priest, 2019). The quantitative data will be largely utilised to validate hypotheses or insights and enhance claims.

6.3.4 Data analysis steps

Steps	Actions	Objective

1. Data preparation	Transcribe all qualitative data from interviews and workshops to ensure accuracy.	Verify and clean quantitative data for inconsistencies or missing values.
2. Qualitative data analysis	Use coding to identify key themes and patterns, focusing on ESG values and digital functions.	Organise codes into values related to core research questions.
3. Qualitative analysis	Compare and integrate findings from both qualitative methods analyses to enhance validity.	Identify correlations between qualitative data to provide a comprehensive understanding.
4. Interpretation and reporting	Create tables, timelines, and tables to illustrate key findings. Compile the analysis into a coherent report, offering practicalities for real estate developers.	Interpret results in the context of research objectives, focusing on the interconnection of ESG values and digital functions

Table 4. Data analysis steps (Author, 2024).

6.4 Data management

This section outlines the approach for the handling of data throughout the research project. It aligns with the TU Delft standards and to ensure the collection, processing, and handling of data is rigorous, ethical, and compliant with institutional and legal standards. The collection methods used will encompass qualitative methods: semi-structured empirical interviews and a expert panel discussion. The data collected from will the methods will be coded and analysed using Atlas.ti software provided by the TU Delft.

6.4.1 Data collection

The research employs exclusively quantitative methods, specifically interviews with professionals in the real estate sector and expert panel discussions with developers. These methods allow for detailed insights into ESG values and digital functions. The interviews will gather multiple perspectives and insights, while the panel discussion will facilitate a critical discussion for practical insights. Both will allow for a deeper understanding of the interconnectedness of ESG values and digital functions. The data collected will be carefully addressed for research objectives and provide nuanced understandings.

6.4.2 Data storage and security

All collected data will be securely stored on TU Delft's approved platform: OneDrive. Which are employed to maintain confidentiality for digital data, such as audio recordings and transcripts, which will be organised into separate, access-controlled folders. Any physical data, including signed consent forms, will be kept in securely. Access to the data is restricted to the researcher and supervisors, ensuring compliance with GDPR and institutional policies. These measures are implemented to protect participant confidentiality and preserve data integrity.

6.4.3 Data processing and analysis

The processing of qualitative data will be conducted with meticulous attention to detail. Audio recordings from interviews and expert panel discussions will be transcribed manually and anonymised to ensure participant confidentiality. Thematic analysis will then be employed to identify patterns and extract key insights related to ESG and digital functions. Atlas.ti software, licensed through TU Delft, will support the coding and analysis of the transcribed data, ensuring accuracy and traceability throughout the process.

6.4.4 Data sharing and accessibility

In keeping with open science principles, anonymised findings and datasets will be shared through the MSc thesis, which will be published only in the TU Delft masters repository. To maintain participant confidentiality, all sensitive data will be anonymised prior to dissemination. Proprietary data from Boelens de Gruyter will not be included in outputs, respecting the confidentiality. This approach ensures the research contributes to academic discourse while upholding ethical and legal standards.

6.4.5 Data retention and destruction

Research data will be stored securely for a period of ten years, in compliance with TU Delft's retention policies. After this period, digital data will be deleted using approved methods, while physical data will be shredded. These practices ensure that data is responsibly managed and disposed of, aligning with GDPR and institutional requirements.

6.4.6 Ethical and legal compliance

Ethical and legal compliance underpins all stages of the research. Informed consent will be obtained from participants prior to their involvement, ensuring they are fully aware of the research objectives, procedures, and their rights to withdraw at any point. The study adheres to GDPR, TU Delft guidelines, and international ethical standards, reflecting a commitment to the protection of participants and the integrity of the research process.

6.5 Goals and objectives

The overarching objective of this research is to explore the interconnectedness of ESG values and digital functions for real estate developers during the strategic development stage. The underlying objective will focus on how real estate developers can enhance ESG value within their real estate developments. A secondary objective is to investigate the role of digital functions in supporting and optimising these values. To achieve these aims, the research adopts a chain-oriented perspective, recognising the interconnected roles and responsibilities of various stakeholders throughout the development process.

A key focus of the study is to identify which ESG values are most relevant (strategic stage), ensuring that real estate developers are equipped to make informed, consistent, and effective decisions regarding sustainability, social, and governance values. Furthermore, the study evaluates digital functions to support ESG values, assessing their applicability and usefulness during the strategic stage.

The research also seeks to integrate ESG values with digital functions by developing ideas that enhance decision-making and data monitoring processes. This integration aims to optimise values and establish a clear ideas for developers to incorporate ESG values into their workflows. Lastly, the study undertakes a gap analysis to examine the current state of ESG values and digital functions within the industry, identifying areas for improvement and outlining steps to bridge these gaps.

6.5.1 Deliverables

This research will produce a range of outputs designed to advance knowledge and provide practical guidance for industry professionals. The primary deliverable will be a comprehensive

research report detailing the findings, including literature reviews, propositions, methods, qualitative data from interviews and panel discussions, data analysis, and final conclusions.

An anonymised dataset will accompany the report, providing insights from interviews and discussions with industry experts. These datasets will ensure transparency and enable further analysis while maintaining participant confidentiality. A key output of the research will be a framework ideas for real estate developers, detailing insights for interconnecting ESG values with digital functions to improve decision-making processes and achieve sustainable outcomes.

6.5.2 Dissemination and audiences

The findings of this research will be relevant to a wide audience within the real estate industry, with a particular focus on real estate developers. By looking into a chain-oriented perspective, the research seeks to provide insights that reflect the diversity of roles and viewpoints within the sector. Especially, since it seem like chain-oriented efforts.

After the research, practical insights will be shared with Boelens de Gruyter in the form of company briefs and reports, tailored to their interests and operational needs. A presentation will be given based upon the research while maintaining confidentiality and anonymity of participants. As previously mentioned, in keeping with open science principles, anonymised findings and datasets will be shared through the MSc thesis, which will be published only in the TU Delft masters repository.

Through these dissemination efforts, the research aims to bridge a gap between academic theory and industry practicalities, empowering real estate developers to integrate ESG values and digital functions into their projects more effectively and sustainably from the outset in specific.

7.
Coding and outputs

7.1 Coding process and analytics

For the qualitative analytics and coding of interviews, Atlas.ti was commenced to systematically create and apply coding based on raw data (quotes). Coding groups were created based on each sub-question of this research and the theoretical background, grounded in the raw data. This process facilitated a structed and in-depth analysis of the interviews.

Raw data	**First order concept**	**Second order themes**	**Coding groups**
Illustrative quote	*Concepts*	*Themes*	*Aggregate dimensions*
"We have nine themes at the moment where climate change and resource use, circular economy, waste, biodiversity, pollution are included. Those are the main E-themes and we also have integrity in business. Things like corruption, bribery, supply chain relationship, code of conduct, and internal culture. Then we have social themes where we focus on the consumer and then we are also concerned with customer satisfaction and the number of complaints, delivery points, things like that. That everyone is well involved. Then we have health and safety of our employees on site, recruitment, training, development, and retention of good employees."	Climate change, resource use, circular economy, waste, biodiversity, and pollution	Climate change, circular economy, biodiversity	Environmental values
	Integrity in business, corruption, bribery, supply chain relationship, code of conduct, internal culture	Corruption, bribery, reliable partners, organisational culture	Governance values and ethics
	Customer satisfaction, number of complaints, delivery points, involvement, health and safety, recruitment, training, development, retention of employees	Experience, health and safety, training, employee satisfaction	Social values
"E is largely compliance. I find S the most important. I also think Governance is relevant, but not from the point of view to only document things (which governance by its very nature stands for). It is more about ethics."	The importance of social value within the context of ESG	Contextual importance	Social value and ethics
	Environmental values are largely compliance and regulatory	Compliance and regulatory	Compliance and Environmental values
Well the S is very much about location, so proximity to amenities. With that, you serve the social needs of your customer. You also have a social interaction, within a company that is stimulated by walkways and how the building is designed. Creating leisure elements in buildings is also important. So where people can chill out, where they don't sit behind a desk for a while. Gardens, outdoor spaces, light, good air quality, ergonomic chairs, happy employees, healthy employees. This is also project specific.	Location, proximity to amenities, walkways, building design, leisure elements, relaxation facilities, gardens, outdoor spaces, light, good air quality, ergonomic chairs, happy employees, healthy employees	Location, experience, quality, employee satisfaction	Social values
*“we had a prize set out to who manages to save the most energy in the next three month**s** by changing your behaviour you could win a getaway for the weekend. What we saw in those three months, compared to the average we saved 40%. So that is a piece of social value by giving back data. You reward people’s behaviour*	Data insights and incentives promote social values and behavioural changes.	Data insights, incentives, behavioural changes	Social values and digital functions

Table 5 x Value constellations coding process (Author, 2024)

Raw data	First order concept	Second order themes	Coding groups
Illustrative quote	*Concepts*	*Themes*	*Aggregate dimensions*
"I think the energy labels we have now that I think are really a washout because that's just static. That means that when you design or when you sell you do a one-off inspection or sample well it will be A++. What I also said at the beginning is that if the user makes unsustainable use of the building, yes, you can have a nice A certificate hanging on the wall, but in reality it might be a B in reality. By means of continuous data reading, you can attach a dynamic energy label to a building, which allows you to see over time, well, in summer it might be an A, but in winter it's a B. That means that if we want to make the building more sustainable, we have to focus purely on the winter section."	Static labels, unsustainable use of buildings, in-use impact, continuous data reading, dynamic energy label, sustainable choices, dynamic impact making	Dynamic labels, continuous data monitoring, dynamic impact making	Data monitoring
We have two sets of software. On the one hand, we have the platform, which is very much data driven. That's data collection, data analysis, showing data to the customer. But we actually mix that with another piece and that is a lot of building simulations. The core piece of our platform is where we run building simulations, autonomously. That's all based on EnergyPlus and Radiance. We do all that without a UI, so we do all that on the server. We can actually run that in real time from those kinds of simulations. Those simulations help us give better advice on what we're missing with the building, so the performance gap, what improvements you can add, what those improvements would do to the building, things like that. And I do really see that just doing it on data alone is not enough. You really do need that building knowledge to come to the right advice and the right strategy.	Data platform, data collection, data analysis, data visualisation, building simulations, autonomous, EnergyPlus, Radiance, UI, server, advice based on data and simulations, performance gap, improvements, data alone is not enough, building knowledge, strategy	Data monitoring, data analysis, data visualisation, building simulations, performance gaps, resource allocation, strategy and advice based on data	Digital functions
We connect to the building, we connect to Schneider, so we take all the data from Schneider and we take all the data from B-Grid. We then put that into our own Digital Twin. A Digital Twin you can actually describe, there are lots of descriptions for it, but for us a Digital Twin actually really means a data model of the building. A data model that has the relationships in the building. That's purely data, it doesn't actually have a real 3D space. But we do eventually combine that with a building energy model, which is a 3D model, which is actually what we use to simulate. Because those are combined we can run simulations. So the Digital Twin for us is that data model. We can combine that very well with our building energy model.	Data collection, digital twin, digital twin description, data model, 3D model, building simulations, interconnect data and 3D models, building energy model	Data monitoring, building simulations, digital twin, data model	Digital functions

Table 6 Digital functions coding process (Author, 2024)

Raw data	First order concept	Second order themes	Coding groups
Illustrative quote	*Concepts*	*Themes*	*Aggregate dimensions*

So you also have to make people aware of the fact that for them there is also a financial incentive behind it. Because the investor has that data, so the investor can say at board level or at portfolio level, this property is the worst performing in my portfolio if I'm going to make an investment then that property should be prioritised. That means the return on your sustainability investment is higher. If I already have an A++ level, you are better off investing an old building and that you get much more value for money.	Financial incentive, investors have data, worst performing asset, investment priorities, return on investments, sustainable investments, value for money	Financial benefits, data monitoring, data insights, sustainable resource allocation	Resource management
Just a word about the product, if you look at how we take that to the customer, it's actually first we give insights, because the customers don't really know what is happening to their building and where it is going. Once you have the initial insights, you can make the easy adjustments first, and once those are done, then the question is, okay what is next? So we see that at least 90% of our customers right now are mainly in that advice piece. also strategies based on actually the measurements that you've already done initially.	Insights into what is happening in buildings, responsible resource management and resource allocation, advice based on data insights, strategies based on data insights, initial data collection	Data insights, data importance, resource management, advise and strategies based on data	Resource management
I think digitisation can start to help a lot in a piece of evidence and especially documenting things.	Helpful function for evidence and documenting things	Evidence and documenting	Reporting
That's a next step we do need to take as an organisation. So now we simply say in the reporting, what are we doing about ESG? If we can develop a good tool for that, that's a valuable contribution.	Manual reporting of ESG, valuable to develop a tool for ESG reporting	Valuable function for ESG reporting	Reporting
Super important. I think that is the most important thing to really accelerate. What I notice, the euro is embedded in everything. The way we report, how we make sure we stay within budget in a project. Everywhere that's all precisely digitised, so that people keep a grip on what they're doing and that it doesn't go over budget or that your turnovers are met.	Important to accelerate in digitalisation, financials are embedded everywhere, financials play a major role, people keep a grip on what they are doing, budget control, achieving financial goals	Importance of digital functions, financial function, budget control, resource management	Resource management

Table 7 Interconnection of ESG and digital functions coding process (Author, 2024)

Raw data	**First order concept**	**Second order themes**	**Coding groups**
Illustrative quote	*Concepts*	*Themes*	*Aggregate dimensions*

So we do notice that you get more and more insight into your own data. That you just see more and more ways of, oh, can I make this data better and make this data better. Of course, this is a never-ending project to get all the data flows internally right. But we are really working hard on it. So it does help a lot.	More and more data insights, different ways of making data better, never-ending project, make sure to get data flows right, successful optimisation	Data insights, data optimisation, continuous optimisation, optimisation of data flows	Efficiency and optimisation
Yes, continuously, so we have sensors everywhere here as well, measuring CO2 levels, humidity, 2 or 3 other elements, so we actually always have a map of whether the air quality is healthy. We have also linked certain limiting values to it. So we always have alerts if it's not healthy enough and then the installations make adjustments.So that is one way we can guarantee that our office buildings always have a healthy living environment.	Data measuring, linking limiting data values, alerts if values are not met, automatic systematic adjustments, ensuring a healthy living environment, measuring CO^2 levels, humidity	Data streams, data measuring, atomisation, healthy environment	Data streams, data collection, and social values
As a result, comfort also came at the expense of your energy efficiency. *By making that data flow insightful and correlating it in a data platform, we were eventually able to make a kind of prediction.*	Comfort, energy efficiency, data flow insights, correlating data flows, data platforms, predictions based on data	Social values, data processing, data collecting, data platforms	Social values, data flows, and data collection
Yes because you have to have the cooperation of your residents because in some cases they have the energy contract. That means they have to sign the authorisation we, an independent service provider, are allowed to read that data. Because it's actually their data. So you can tell from that data whether someone is at home or not. You can tell from that data whether someone is at night or a night person or a morning person. You can create data profiles from it. So because of privacy laws, the user has to actually give real permission for us to see that data. So if you don't have that data or that consent, then you don't have a full picture of your property. So that's why you also look for incentives through such a weekend getaway, gamification, to still persuade residents/tenants to sign.	Cooperation of residents, energy contracts, authorisation, independent service providers, data ownership, data profiles, privacy laws, consent for data collecting, not having a clear image of the property, incentives to persuade consent, gamification	Cooperation, data ownership, data profiles, privacy laws, data consent, incentives, gamification	Privacy, incentives, and data partners
That helps a lot, you know, just the joint action in things. Such as a social alliance. This is actually one of those things that normally CEOs don't discuss with each other, but in which everyone is super open with each other, like, okay, let's just share all the reference projects with each other, like, what is normal now? Can we then set a goal and can we all stick to that goal? Those are the conversations you have and I think that is really super valuable, because you help each other a bit and you know what you are doing, but really more substantive.	joint actions supports a lot, social alliances, open communication, shared objectives, setting objectives, valuable conversations, helping each other, know what you are doing.	Collaboration, cooperation, open communication, shared values, knowledge	Collaboration, cooperation, and data sharing
We really have a lot of partners, from PropTech, green experts, ESG consultants, CBRE, PGGM and Circular experts, really in every area you have to bring in the experts, because trying to invent the wheel on your own just doesn't make sense.	Partnering, experts, relevant to bring in experts, does not make sense to reinvent the wheel on your own	Partnerships, expertise	Data partners

Table 8 Integration of ESG and digital functions coding process (Author, 2024)

7.2 Coding output ratio

The coding output ratios illustrate the proportion of data streams generated by the qualitative interviews. This emphasises the generation of comprehensive data inputs and outputs for the study.

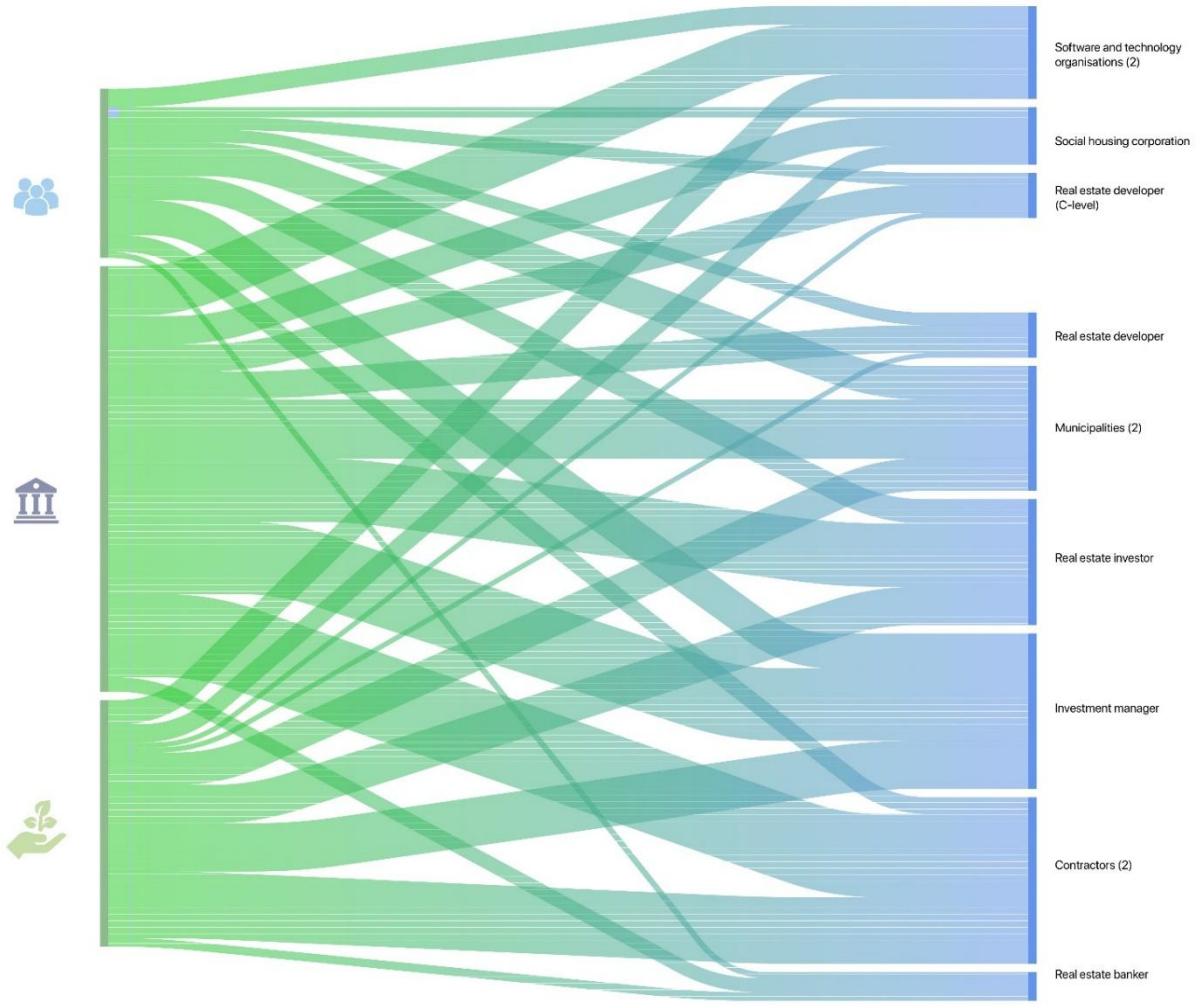

Figure 8 Coding output ratio ESG values (Author, 2024)

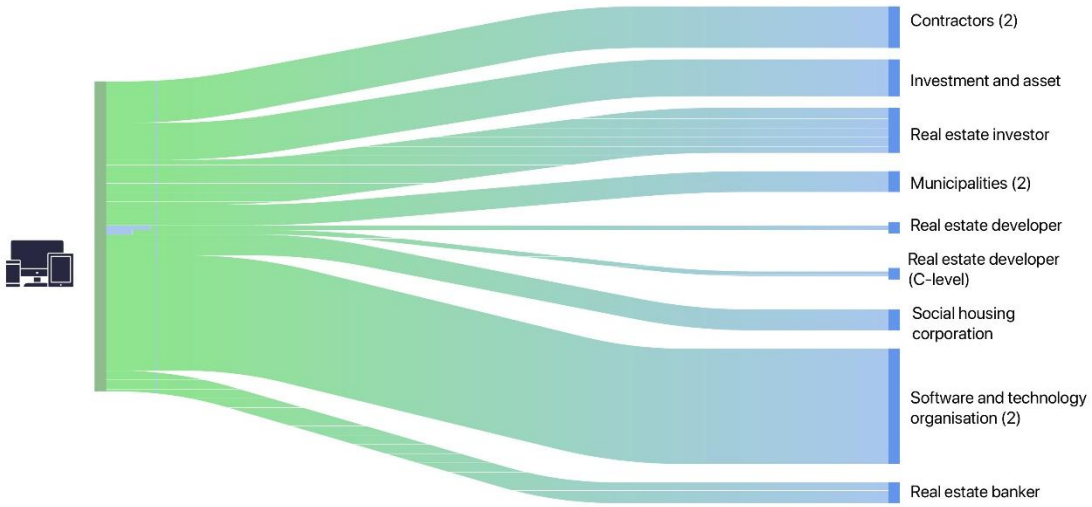

Figure 9 Coding output ratio digital functions (Author, 2024)

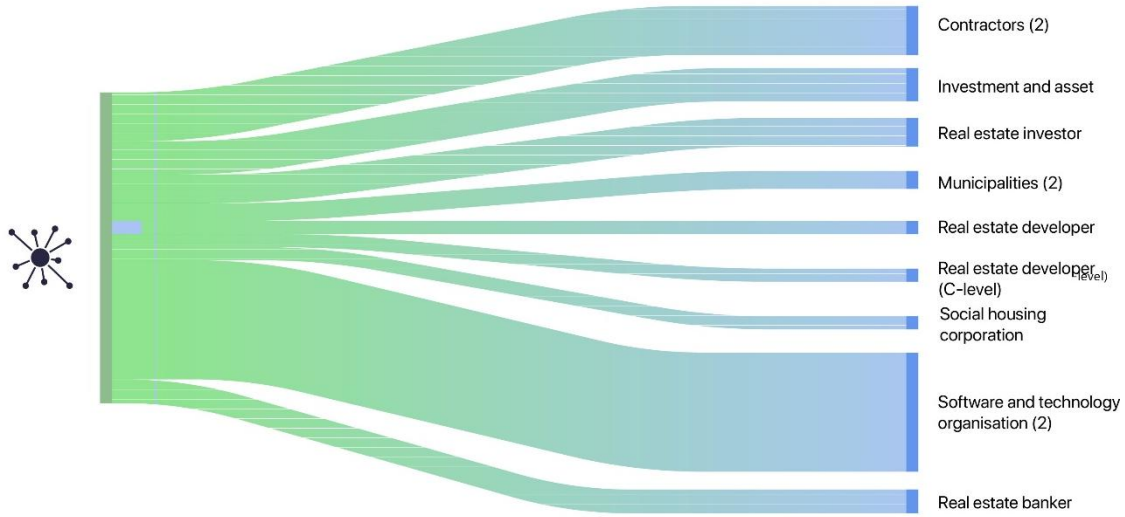

Figure 10 Coding output ratio interconnection (Author, 2024)

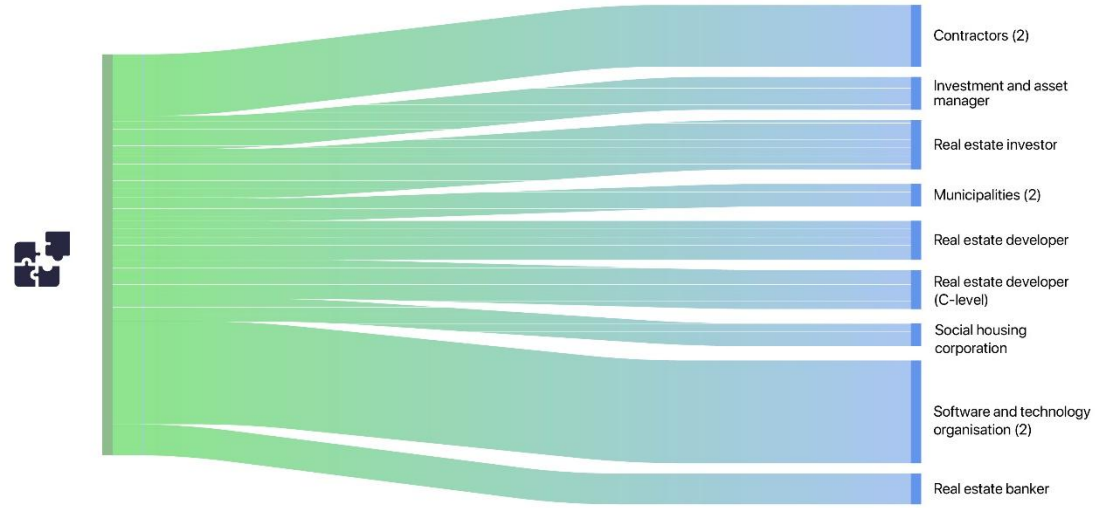

Figure 11 Coding output ratio integration (Author, 2024)

7.3 Research outputs

Interviewees were asked on their perspectives on ESG values, with numerous participants indicating a robust comprehension of environmental values grounded in professional experience, established frameworks and assessments, as well as the associated laws and regulations. Their insights have brought light to the moral dimension of ESG, suggesting that it should be motivated by intrinsic commitment rather than merely regulatory compliance. This corresponds with the methodology of ESG values rather than the ESG concepts proposed by Roe & Ester (2023).

The evolving regulatory landscape (e.g. CSRD), have been seen as both a challenge and opportunity. While such regulations can drive more robust ESG practices, they also develop pressures to comply with extra laws- and regulations. Whereas some organisations strategically decide to comply with lower levels for lesser devotion.

Moreover, quantifying ESG values was mentioned as essential for assessing actual impact and progress. But, some interviewee pointed out that meeting of measuring values for certification or labelling often involves ticking generic boxes (e.g. BREEAM) highlighting the challenges organisations face in meeting ESG values and the need for a more nuanced approach than certifications alone. For example, some highlighted the pitfalls of certification systems:

"You have to tick all the boxes to meet a BREEAM Excellence or a GRESB 5-star [...] That sticker is not a measure of a sustainable building or a sustainable operation." – *Investment Manager*

The sentiment illustrates the necessity for methods that truly incorporate ESG values into sustainability plans. Participants shared instances of ESG values that have the potential to amplify impact. A participant emphasised the necessity of taking into account the long-term consequences for future generations, promoting a time-aware (dynamic) strategy for sustainability. It was said that ESG encompasses both ecological and social elements, with social being the value that was the most imprecise. One interviewee articulated a profound dedication to social sustainability, emphasising that meaningful efforts within this dimension produce substantial outcomes.

Furthermore, a participant from a municipality emphasised the importance of balancing social, environmental, and economic values, underscoring the need for transparency in the decision-making process. The significance of social elements in governance was examined, particularly in the context of extensive urban development initiatives. Another interviewee described a program termed "Social Return," which stipulates that a segment of municipal contracts be allocated to social initiatives, thereby demonstrating a dedication to enhancing local community benefits within development projects. Also, the "doughnut economy" framework was mentioned as a model for coordinating ecological limits with social foundations, incorporating ESG values into urban planning.

Consequently, the interviews demonstrate that ESG values are not theory but are intricately integrated into organisational strategies and operations. The emphasis on sustainability, social impact, and transparency, along with the incorporation of these values into business practices, reflects an increasing awareness.

7.3.1 Social values

From the research it becomes clear that social values are gaining momentum among interviewees. Especially, regarding social equity. There was understanding that social values, (e.g. affordable housing and community cohesion) are fundamental for long-term sustainability. Interviewees were encouraged to embed social values into their business models, ensuring their operations benefit the communities they serve.

However, participants highlighted the challenge in measuring social impact. Nevertheless, the significance was acknowledged within the context of sustainability. A robust focus on diversity and inclusion within organisations and communities were highlighted, along with initiatives aimed at ensuring equitable access to housing and services, demonstrating a commitment to social justice. Health and safety, especially within the construction sector, have surfaced as important societal values.

Furthermore, the matter of social return was addressed. One interviewee emphasised that projects should always incorporate a social aspect, such as providing benefits to the community. Another interviewee stressed the importance of social return by saying:

“What we are mainly focusing on as a municipality are the S values. We also do that together with the economic affairs department. However, we also have a Social Return office. This means when we commission a contract a percentage of the entire contract must be spent on social values for the city. So companies give something back socially.” – *Minicipality*[1]

The aforementioned notions promote the enhancement of social values, supporting the idea that sustainable practices should always take into account the social context. Unlike environmental values, which are quantifiable and measurable, social values remain personal (qualitative in nature) and challenging to measure. One of the interviewees elaborated on the challenges associated with quantifying social values in contrast to environmental values. The social values of ESG are complex (e.g. values such as affordability, diversity, and inclusion). Measuring social values necessitates dynamic methodologies and cooperation among various stakeholders. For instance, information regarding community impact, inclusivity, and well-being is essential but complicated for measurement, requiring the effective collection of these qualitative dimensions. Therefore, measuring social values remains a complex but potentially essential process for achieving robust impact. It was found that most participants are only able to measure quantitative values within the environmental department. Whereas it is becoming increasingly important to include social values. To support this, it was suggested to focus on dynamic labelling with real-time data to have maximum impact.

"It's about how that property is being used [...] dynamic tools can help quantify both environmental and social performance." – *Software and technology engineer*[1]

Therefore, incorporating social values into environmental strategies calls for long-term perspectives. Decisions made today affect future generations, highlighting the importance of sustainable developments that provide advantages for both the environment and society on the long run. To support this, a real estate developer emphasised the significance of generating social value alongside environmental value.

"it is all about the use. I also think it is much more about which functions you put into your building, which is not only the best for the building but also best for the neighbourhood. We have to make more conscious choices about that." – *Real estate developer*[2]

7.3.2 ESG values

Ultimately, the study identified a set of ESG values that were mentioned during the interviews. These values reflect the multidimensional nature of sustainability and highlight the varying prioritisation of ESG values across the real estate chain. Unlike the list (table 9) it becomes clear that environmental values are the most dominant, driven by their quantifiability and alignment with existing frameworks. As a result, the disparity revealed a hierarchy of ESG values, where environmental metrics dominate, while social and governance values face challenges in operationalisation and integration.

Environmental values	Social values	Governance values
Waste	Experience	Accountability
Biobased construction	Availability	Organisational ambition and objectives (Business model)
Biodiversity	Affordability	Audits
Circularity	Resident/user involvement	Autonomy
Carbon emissions	Comfort	Organisational influence
Carbon footprint	Daylight	Organisational benchmarks
Cooling and heating	Diversity	Evidencing and proofing
Ecology	Ethics	Broad prosperity
Embodied carbon	Work environment	Certification

Reforestation	Health	
Re-use	Walkability / walk score	Law and regulations
Climate adaptation	Routing	CREMM compliance
Local production	Inclusion	CSRD / SFRD compliance
Disassembly	Interaction	Organisational culture
Material passport	Liveability	Ethics
MPG	Location	Extended producer responsibility
Paris Proof	Social impact	Financing
Net-zero	Employee satisfaction	Investor insights
Vegetation	Human-centred	GRESB
Water	Home feeling	Short- and long term objectives
SDG	Facilities and amenities	Societal impact
	Leisure features	Employee satisfaction
	Wellbeing	MVO
	Biological fundamentals	Operational Excellence
	P-GAP	Design team partners
	Vulnerable communities	Organisational partners
		Political direction
		Reporting
		Social governance
		ESG driven taxations
		Organisational responsibility
		Transparency

Table 9 ESG value from interviews (Author, 2024)

7.3.3 **Digital functions** (digital vs. non-digital)

Building upon previous studies and the concept of digital "functions" (Betti & Sarens, 2020; Wynn & Lam, 2023; Yeow et al., 2018; Singh et al., 2023), the interviewees promoted the paradigm shift of viewing digital technologies merely as tools but to recognise their role as dynamic functions. This perspective emphasises the dual character of digital functions. Namely the potential to enhance efficiency, innovation, transparency, and collaboration, but also the potential to obstruct objectives and diminish outcomes.

Moreover, the study revealed critical insights challenges associated with digital functions to drive ESG values. While digital functions hold the promise for advancing ESG values, interviewees emphasised several challenges that hinder their implementation and impact. One recurring issues was the notion of digital overload; overload of digital communication and information, making it hard to manage tasks. Interviewees observed the tendency to over-digitalise without fully assessing if the actual issue requires a digital solution. Digital functions were criticised for neglecting intangible values (namely social values, e.g. social equity and cultural preservation). The misalignment often results in ineffective resource allocation or diminished impact.

The findings underscore digital functions have profoundly influenced how ESG values are prioritised and operationalised, favouring quantifiable metrics while challenging the integration of qualitative dimension. The data-driven nature amplifies the focus on environmental values (e.g. carbon emission and resource efficiency), which align well with digital systems. This focus risks marginalising social and governance values, as these are often qualitative, context-dependent and harder to standardise.

By enabling data collection and predictive modelling, digital functions create a visibility bias, where measurable metrics are prioritised over intangible outcomes (e.g. well-being or ethical governance). This reductionist approach reframes ESG as a compliance and data-driven approach, sidelining social and governance values. Then again digital functions also enable a systemic view of sustainability by linking stakeholders and revealing interdependencies or

common grounds across ESG dimensions. It can therefore be argued that digital functions should be complementary, other than a replacement of methods

In addition, financial and operational challenges were frequently observed. High (initial) costs, technical expertise, insufficient operational readiness were identified as some challenges, especially for smaller organisations. Potentially resulting in exclusion of organisations. One noted that digital functions are often perceived as complex and expensive. Some organisations were not willing to do investments within this context. The issue of exclusion, particularly in individuals or (smaller) organisations lacking digital infrastructure, resources or literacy, underscores the importance of adopting inclusive approaches to digital functions. On top of that, participants advised against excessive dependence on digital functions. Although digital functions holds promise for enhancement, an excessive focus on technology could overshadow the significance of human-centric approaches that are crucial for social sustainability and governance due to the personal and qualitative nature. A sustainability manager highlighted the importance of bringing about behavioural changes in relation to digital functions, indicating that just collecting and illustrating data is insufficient without motivating others to change their actions.

A notable finding was the limited impact of digital functions on social value. Although these functions have demonstrated effectiveness in addressing environmental metrics, compliance with laws and regulations, and facilitating certification or labelling, they usually do not adequately address societal metrics or impacts. Many interviewees emphasised that social values frequently require direct (human) interaction, which cannot easily be replicated by digital functions alone. This limitation sheds light on a relevant gap in the actual impact of digital functions related to ESG. Challenges related to data reliability and integration were also highlighted. Inaccuracies in data collection could lead to discrepancies in reporting and hinder responsible decision making. Additionally, integrating data from disparate systems often results in incomplete data resulting in complicated processes. One interviewee pointed out that many digital functions fail to communicate with one another, making the standardisation and interpretation of data more challenging. Interviewees also discusses resource allocation issues, where efforts to achieve certifications overshadow genuine efforts for ESG values.

In addition to previous studies (Ullah et al., 2018; Dash et al., 2021; Starr et al., 2020)., behavioural hesitance in adopting digital functions remains another challenge. Employees and stakeholders frequently expressed reluctance, driven by a lack uniformity and frontrunners. Moreover, it was mentioned that behavioural or cultural changes remain of one of the most challenging yet essential aspects in digital functions.

Finally, the complexity of data exchange remains a challenge. The research has highlighted the inefficiency of data exchange and standardising data. While organisations are streamlining API's for data integration, many digital functions still find challenges within the scalability and scattered data. Despite the opportunities, interviewees identified challenges for leveraging ESG driven digital functions (table 10). Addressing these issues require the alignment of digital functions with organisational goals and cultural/societal needs.

	Digital	**Non-digital**
Effectiveness	Tendency to prioritise quantifiable metrics, neglecting qualitative ESG outcomes	Susceptible to human error and inefficiency, limiting the scope and accuracy of insights.
Flexibility	Dependence on rigid systems and standardisation restricts adaptability to ESG contexts	Limited flexibility due to the labour-intensive nature of manual processes.
Cost (initial investments)	High initial costs for implementation and training, particularly for small organisations	Long-term inefficiencies stemming from reliance on repetitive manual processes.
Scalability	Difficulty in scaling solutions for smaller organisations with limited technical infrastructure.	Significant duplication of effort when expanding non-digital processes.
Inclusion	Risk of excluding stakeholders with limited digital literacy or access to technological infrastructure.	Challenges in engaging geographically dispersed or underrepresented stakeholders.

Long-term impact	Over-digitalisation may misalign with qualitative ESG goals and long-term objectives.	Limited capacity for consistent monitoring or measurement of long-term outcomes.
Integration complexity	Complexities in integrating digital systems with existing organisational processes.	Coordination challenges without centralised systems, particularly across multiple teams or organisations.
Resource allocation	Risk of resource misallocation by focusing solely on compliance-driven metrics.	Difficulty in prioritising impactful actions without adequate data for guidance.
Data privacy (ownership)	Concerns over data ownership and compliance with privacy regulations.	Avoids privacy concerns but may result in incomplete data for informed decision-making.
Behavioural influence	Limited impact on behavioural change due to an over-reliance on (statistical) data.	Reliant on personal interaction, which may not scale effectively.
Error sources	Susceptible to technical glitches or system malfunctions.	Prone to human error during manual data collection or analysis (misinterpretation).
Cultural sensitivity	Risk of failing to account for cultural or contextual nuances in digital solutions.	Inconsistent responses to culturally specific ESG issues without systematic frameworks.
Dynamic insights	Over-reliance on real-time data risks overlooking intangible or long-term trends.	Limited capacity for real-time insights or responsiveness
Standardisation	Over-standardisation risks neglecting project-specific or contextual ESG needs.	Lack of consistency in methodologies limits comparability across projects or organisations.

Table 10 Challenges digital vs. non-digital (Author, 2024)

During the interviews it was found that digital functions can be categorised based upon their key functions (or features): collecting, tracking, storing, exchanging, visualising, and sharing data. These functions have been highlighted in table 11 to elaborate on the findings. Moreover, the operational scale affects the digital functionality as highlighted in table 12.

Digital function	Elaboration
Measuring and collecting	Measuring and collecting consistent and accurate ESG data. This step provides the core for evaluation, decision-making, and further digital processes.
Storing and organising	Centralised systems (e.g. data lakes and cloud platforms) are common for storing large datasets, ensuring accessibility and scalability.
Exchange and sharing	Facilitating seamless data exchange between systems and stakeholders through API integrations, enabling benchmarking and standardisation across diverse platforms.
Visualising and analytics	Employing data dashboards and analytics to interpret ESG metrics, identify trends, and track performance against goals.
Sharing and collaborating	Enhancing stakeholder engagement and transparency through collaborative platforms, enabling effective decision-making and resource allocation.

Table 11 Types of digital functions (Author, 2024)

Operational scale	Elaboration	Benefits
Building level	At this scale, digital functions focus on granular metrics for evaluating building-specific impacts	Streamlined data capture; improved accuracy and transparency; decision-making.
Local area or neighbourhood	Integrates datasets for larger-scale developments, addressing broader social and environmental impacts, and tracking compliance and performance across multiple stakeholders.	Simplified audit and assurance; identify areas of improvement; stakeholder engagement.
Portfolio or regional	Aggregates data from multiple projects for strategic decision-making, enabling benchmarking and performance tracking against overarching ESG values.	Benchmarking; performance tracking and goal setting; decision-making; improved accuracy and transparency.

Table 12 scalability of digital functions (Author, 2024)

Moreover, the research provided the identification of several ESG driven digital functions. These have been highlighted into table 13 to identify the available digital functions.

Available function	Data capabilities	Primary function	Operational scale
Scaler	Data visualising and analytics	ESG data collection and reporting for real estate decarbonisation	Portfolio or regional
Measurabl	Data storing and organising	ESG data management and reporting platform for real estate	Portfolio or regional
Deepki	Data visualising and analytics	ESG data intelligence and performance monitoring for real estate	Portfolio or regional
Healthy Workers	Data measuring and collecting	Building optimisation platform focusing on health and sustainability	Building; local area or neighbourhood
NL Greenlabel	Data measuring and collecting	Certification and consultancy for sustainable outdoor spaces	Local area or neighbourhood
Properli	Data storing and organising	Real estate management platform	Portfolio or regional
CitiesDAO	Data sharing and collaborating	Decentralised platform for urban development initiatives	Local area or neighbourhood
Smart Real Estate	Data sharing and collaborating	Technology solutions for intelligent building management	Building; portfolio or regional
Brains4buildings	Data visualising and analytics	Research initiative for smart building technologies	Building
Schneider Electric	Data measuring and collecting	Energy management and automation solutions	Building; portfolio or regional
bGrid	Data measuring and collecting	Smart building sensor networks	Building
SRI (Smart Readiness Indicator)	Data visualising and analytics	Assessment framework for building smartness	Building
Building Balance	Data visualising and analytics	Building performance analysis and optimisation	Building
Energy+	Data measuring and collecting	Energy management solutions	Building; portfolio or regional
Radiance	Data visualising and analytics	Lighting simulation and analysis tool	Building
Signify (sensors)	Data measuring and collecting	Lighting and sensor solutions for smart buildings	Building
Mymesh	Data measuring and collecting	Wireless lighting control systems	Building
Priva	Data measuring and collecting	Climate control and building automation systems	Building
ABB	Data measuring and collecting	Electrification and automation solutions	Building; portfolio or regional
BMS (Building Management System)	Data storing and organising	Integrated systems for building operations management	Building
DigiGO	Data exchange and sharing	Digital platform for the built environment	Portfolio or regional
P-GAP	Data measuring and collecting	Measure the emotional understanding of customers	Building

Table 13 availability and suitability digital functions (Author, 2024)

7.3.4 Interconnection

Following the study, the interconnection of ESG values with digital functions represents major challenges and opportunities for real estate developers. The interconnection holds the potential for promoting sustainability and accountability. However, it is fraught with practical and theoretical gaps (table 10).

As previously revealed, the study exhibit a strong interconnection of environmental values and digital functions, predominantly due to their quantifiability and measurability. This aligns with the robust present-day focus in the industry on regulatory compliance and performance-driven metrics.

However, this reliance on quantifiable outcomes underscored pitfalls: overemphasis on measurable environmental values might marginalise qualitative or less tangible dimensions of ESG. This raises a pertinent question; if the use of digital functions risk reducing sustainability to a checklist exercise rather than fostering transformative impact. Conversely, social values demonstrate a weaker interconnection with digital functions, a finding consistent with the broader challenge of quantifying and operationalising social metrics. Social values are inherently qualitative, context-specific, and dynamic, making them less amenable to the rigid, data-driven paradigms that underpin digital functions.

The study presented that many contemporary and existing digital systems inadequately address these values, often focusing on environmental metrics and the regulatory governance compliance (e.g. while digital platform might efficiently measure energy use and temperature, it lacks comparable sophistication in evaluating qualitative outcomes, such as the comfort of buildings or community impact of developments). This underscores the relevance of human-centric methods and hybrid approaches that combine digital functions with participatory and qualitative approaches to address gaps.

Moreover, it was identified that governance values are primarily linked to operational and regulatory compliance (strategic enablers). This dimension of ESG operates at an overarching level, ensuring compliance with laws, regulations, and corporate governance structures (e.g. Corporate Sustainability Reporting Directive (CSRD) and Sustainable Finance Disclosure Regulation (SFDR)). Digital functions play a facilitative role here, streamlining the reporting and audit processes for governance metrics. Platforms enabling standardised data collection, benchmarking, and certification have proven effective in fulfilling these requirements. However, this operational framing may oversimplify governance values, reducing them to compliance metrics rather than dynamic principles capable of driving ethical and strategic transformation within organisations.

This operationalisation of governance also highlights a potential disconnect: while digital functions ensure adherence to regulations, they may not adequately foster innovative or proactive governance practices (e.g. transparent stakeholder engagement or long-term value creation. Governance).

Interviewees frequently encountered difficulties in demonstrating accountability or tangible impact, which required data collection and analysis. This highlights the necessity for reliable data to mitigate the risks associated with harming the credibility and efficacy of ESG values/data. The findings indicate that the advancing nature of ESG metrics facilitate the interconnection of ESG values with digital operations. Through digital functions, interviewees are empowered to collecting, tracking, storing, exchanging, visualising, and sharing their ESG values. This allows interviewees to make informed decisions for responsible resource allocation. This was highlighted by one interviewee:

“If you start digitising, which is basically very manual now, all that, you get so much more insight. The effect is much better. You can much better, as you just said, put your resources somewhere.” – investment manager

7.3.5 Integration

The research provided insights into the integration of ESG values and digital functions. Some major challenges and opportunities were represented for real estate developers. It was shows that the integration holds promising potential for promoting sustainable development and accountability. However, it is fraught with practical and theoretical gaps.

Although the integration seems valid in theory, its use in practice exposed notable discrepancies. A recurring theme was dynamic labelling and real-time data. This was highlighted by the concept of social values and their qualitative, personal, and context-dependent characteristics, underscoring the significance of these dynamics. Nonetheless, the lack of universal data standards complicates the scalability of integrating ESG values with digital functions. In the absence of universal data standards or key performance indicators, digital functions are unable to consistently engage with ESG values throughout real estate developments. This leads to disconnected initiatives and a lack of efficiency. The lack of alignment hinder the wider adoption of scalable integration.

The study shows that the metrics of ESG values are important to demonstrate progress and achieve scalability. Digital functions promote collecting, tracking, storing, exchanging, visualising, and sharing data, yet these functions remain dependent on data quality. likewise, it became clear that collaboration within the real estate chain is essential in shaping the ways in which data is processed, shared, and utilised overall. The differing experiences of the interviewees underscored the significance of collaborative approaches now more than ever. The study indicates that the influence of ESG values relies on collaborative strategies rather than being achievable by a single independent entity.

Moreover, one major limitation in the digital landscape, according to interviewees, is the lack of standardisation in data formats, certifications, labels, and methods. As a result, without consistent and standardised data, comparison and successful integration cannot be critically assessed. Due to the sprawl of these subjects integration becomes difficult for successful integration. The absence oof a unified standard in the Netherlands (let alone the European Union) exacerbates this issues, leading to inefficiencies, increased costs, reduced transparency, and ultimately ineffective sustainability. In addition, the laws- and regulations coming from the EU results in scattered approaches of ESG and digital functions since no clear or accepted framework has been established. One interviewee noted that it has resulted in a market and many (smaller) organisations that have to decide and manage themselves what to do. On top of that, a widely adopted digital function or platform might resolve this issue; nonetheless there remains a lack of uniform agreement on which entity is best suited for the interconnection of ESG values in digital functions.

Also, the relevance and efficacy of digital functions driven by ESG values are especially dynamic, highlighting the significance of the strategic development phase. The diversity complicates efforts to establish universal functions or processes, highlighting the necessity for collaborative foundations. The inherently conservative nature of the real estate industry presents additional challenges for the integration of ESG values and digital functions. This aligns with the previous studies and literature. The unwillingness or the lack of resources of stakeholders for upfront and long-term investments is another major conflict for the integration.

Lastly, the current landscape of data management in the real estate sector is characterised by interviewees as fragmented and a proliferation of digital functions and platforms. One interviewee pointed out that the "wild growth" of digital functions leads to inefficiencies, a lack of clarity, and financial losses, which contradict the principles of sustainability. Participants expressed a significant interest in an unified data-sharing platform that could improve processes, minimise waste, and improve the overall sustainability of real estate developments.

Eventually, the lack of an absolute market leader within the Netherlands (or the European Union) leads to significant requests regarding the methods for achieving consistent and scalable integration in ESG-driven digital functions. Based upon the interviewees, unified data-

sharing functions have the potential to tackle these challenges by offering a standardised basis for the collection, processing, and analysis of data. Especially for the strategic development stage such platforms could promote better integration of ESG values and digital functions. Based upon the findings a few key takeaways can be stipulated for the integration:

- Interoperable and compatible with existing functions.
- Support comparison, labelling, and certification of ESG metrics across developers and projects.
- Facilitate collaboration by providing accessibility and transparency to data for all stakeholders
- Align with European (or local) regulations to ensure broader applicability and scalability

7.4 Propositions

Findings proposition 1 Environmental values are only sustainable when social values are sustained.

The symbiotic relationship between environmental and social values is brought to light by the first proposition, which states that environmental values are only sustainable when social values are sustained. In turn, the insights gathered from interviewees reinforce this viewpoint, highlighting that environmental values are unable to realise their full potential in the absence of social values. This idea was supported by one interviewee mentioning:

"Environmental and social is something that you find within ESG, I think, that comes out better and less in a concept like sustainability." – *real estate investor*

Furthermore, the interviews indicated an agreement that environmental values are often shaped by regulatory frameworks, including CSRD and BREEAM certifications. Although these frameworks establish a foundation for environmental compliance, they often concentrate primarily on measurable metrics, potentially neglecting wider implications. In contrast, social values present more difficulties in measurement and quantification, yet have proven necessary in fostering sustainable outcomes. The sentiment highlights the importance of social values in relation to sustainability. Expanding on this point, one participant noted:

"If you can link building comfort to absenteeism, productivity, or happiness, you create an incredible business case. [...] You would much rather optimise that 90% [of costs related to people] because it yields much more return than focusing solely on the 1% spent on environmental costs." – *Software and technology*[2]

Although there is a significant alignment with the proposition, challenges continue to exist. Particularly, as social values are fundamentally contextual and frequently differ based on the requirements of particular communities or initiatives. participants in the study highlighted challenges in assessing social impact in contrast to environmental metrics, which tend to be more standardised and quantifiable. One participant in the interview expressed:

"Social values are so different for everyone. You can't force them to be successful. For example, we've tried creating common rooms in our residential buildings, but some tenants just aren't interested in participating." – *Real estate investor*

To tackle these challenges, interviewees proposed inventive ways, including the use of real-time data and dynamic labels to evaluate the relationship between environmental and social values. These methodologies could provide a deeper insight into the real use of buildings and their effects on individuals and communities. This was supported by another participant:

"You can make a very energy-efficient building, but then it will either be very cold or very hot. So in the end, it is about comfort. Partly. So that is about well-being. So we can see how much a building is used and when and how often. That is a bit more on the S side I would say". – *Software and technology engineer*[2]

Furthermore, frameworks such as Kate Raworth's doughnut economy model were recognised as viable strategies for harmonising environmental and social values. This framework highlights the importance of functioning within ecological boundaries while maintaining a solid social structure.

Therefore, the assertion that environmental values can only be sustained alongside the preservation of social values is backed up by the research findings. The moral and practical foundation of successful environmental efforts is rooted in social values. Nevertheless, recognising this synergy, or symbiosis, necessitates confronting challenges, such as the contextual nature of social values and the difficulties associated with measuring and quantifying their impact. Nonetheless, embracing digital functions and emphasising intrinsic motivation has the potential to move organisations beyond mere compliance-driven actions, fostering the development of more sustainable outcomes.

Additionally, one of the interviewees elaborated on the difficulties associated with quantifying social values when compared to environmental values. The intricacy highlights the necessity for a comprehensive and equitable strategy that appreciates both environmental and societal values. Moreover, incorporating social values into environmental strategies necessitates a long-term perspective. Decisions made today must take into account what they mean for future generations, highlighting the necessity for sustainable developments that provide advantages for both the environment and society in the long term. One interviewee, a real estate developer, emphasised the significance of generating social value alongside environmental value.

"it is all about the use. I also think it is much more about which functions you put into your building, which is not only the best for the building but also best for the neighbourhood. We have to make more conscious choices about that." – *Real estate developer*[2]

Thus, it can be argued that the sustainability of environmental values depends on their coherence with social values, as both aspects are crucial for fostering resilient and flourishing societies. Consequently, a symbiotic relationship promotes a more holistic approach to sustainability that considers human needs alongside protecting the planet. Furthermore, one participant expressed their understanding of sustainability as encompassing 'people, planet, profit'. It has been proposed that sustainability encompasses an optimal balance among these three components. Their viewpoint emphasises that social values are essential alongside environmental values to attain genuine sustainability.

"For me, sustainability is a balance between people, planet and profit. And that you are clear about, or transparent about, the choices you make in it. So there's also a big social component to that. I think we do have the idea that ESG really could be a game changer to indeed become a

more sustainable city and also to be able to do much more in the area of social aspects." – Minicipality[1]

Discussion

Ultimately, the proposition may oversimplify the balance between environmental and social values. Although it appeared true that social values play a crucial role in achieving genuine sustainability, this argument may inadvertently minimise the significance of exacting environmental measures that are frequently necessary for regulatory compliance and maintaining sustainable development. It is important to recognise that environmental values, influenced by regulatory frameworks and stakeholder expectations, may possess intrinsic value, regardless of societal values.

The proposition implies that the alignment of social and environmental values is consistently achievable; however, as noted by interviewees, there currently exist practical challenges. The integration of social values for sustainability is often complicated due to their personal and context-dependent nature. Other than that, participants highlighted the significance of comfort, affordability, and well-being, while also acknowledging the difficult challenge of attaining these ideals without giving up immediate environmental values.

Moreover, while the proposition fits into the idea of recognising ESG as values, acknowledging their personal and moral dimensions, it must also consider the difficulties in quantifying social values in contrast to environmental values. A number of those interviewed highlighted the challenges they face regarding the tendency for social values to be diminished to mere superficial gestures or inadequately assessed in practice, especially when compared with the straightforward metrics that exist for environmental values. This difference indicates that although the incorporation of social values is a noteworthy goal, a research gap persists between theories and actual implementation. In support of this notion, one participant remarked:

"In terms of social I always find it difficult [...] For example, we have a building with 500 flats or so, but all those tenants are different. You can say there is a common room and you can organise anything you want with your neighbours. We really did do that with several assets. But some people just do not like it. You cannot force them to. You have to be social or something. They just want to make ends meet and stay with their family. Things like that make it quite difficult in that S, because it's so different for everyone." – *Real estate investor*[1]

As a consequence of these findings, the proposition underscores the importance of incorporating social values to achieve real sustainability. Nonetheless, it is necessary to consider the intrinsic differences that exist between environmental values and social values, along with the practical challenges associated with social values. Subsequently it is noticed that social values are increasingly recognised as important by interviewees, thereby gaining momentum. Particularly, considering the concept of dynamic labels or the possibilities presented by real-time data for enhanced insights, it may prove beneficial to adopt more sustainable practices.

Findings proposition 2 ESG-driven Digital functions promote including but risks excluding values (digital vs. non-digital).

Despite the significant momentum towards embracing digital functions, previous studies highlights a resistance that restricts the alignment with economic and environmental progress (Ullah et al., 2018; Dash et al., 2021; Starr et al., 2020). Furthermore, the dedication of the real estate chain to embrace digital functions and the associated challenges of digital

functions necessitates a more in-depth study (Starr et al., 2020; Tan & Miller, 2023; Latif et al., 2023; Phan & Boge, 2023).

The discussion showed that digital functions may face exclusion of values due to challenges like the digital divide, disparities in workforce adaptability, and resistance within organisations. The misalignment of digital functions may also create a sense of alienation for individuals who lack the necessary resources or training and a robust focus on environmental metrics or certification.

Throughout the research, numerous interviewees provided insights into the significant impact of digital functions on enhancing ESG values. However, they also highlighted relevant challenges associated with exclusion and the interplay between digital and non-digital functions. At times, organisations may find it more beneficial to utilise non-digital functions.

Digital functions can offer accessible and real-time insights that enable those being interviewed to make informed decisions with respect to time. Digital functions further enhance data accessibility by centralising and streamlining complicated data for a greater number of people, including interviewees who are not data engineers like ESG/sustainability managers and investors. This ability promotes a feeling of belonging, as both individuals and organisations can now interact with ESG values (or data) that may have previously been out of reach or difficult to digest.

In addition, the capacity of digital functions to facilitate responsible and sustainable resource allocation underscores their significance in fostering inclusion. Accordingly, the imposed European Commission regulation for a directive (EPBD) was mentioned to encourage the use of data measuring and data bases. One interviewee elaborated on the significance of this directive for the real estate industry, emphasising the importance of data exchange and collecting within the industry. This may facilitate a more holistic approach for enhancing knowledge, standards, and awareness.

"So the EPBD says you have to have a database of measured data. So that shouldn't come from your utility bill, that should really come from a measurement sensor and have a database of sensors. That should be split into how much am I doing on heating, how much am I doing on cooling, how much am I doing on other building-related installations." – *Technology and software engineer*[1]

The interviews highlight a critical issue: Social values are often measurable only after a project's completion (e.g., tenant satisfaction, community cohesion). As such, they are treated more as preconditions rather than guarantees for success, limiting their integration into digital frameworks.

As a result, while ESG-driven digital functions may promote including, they simultaneously include risks of excluding certain values.

Discussion

Although digital functions holds the potential for comprehensive ESG related resource management, they also include risks creating new forms of exclusion. In certain situations, conventional methods continue to hold significance due to their flexibility, focus on human needs, and cost-effectiveness. Consequently, organisations may evaluate if digital functions truly corresponds with their ESG values or unintentionally compromises them through exclusion. This understanding emphasises that inclusion cannot be assured solely through digital functions. Deliberate strategies should be implemented to address the potential risks of exclusion. Consequently, table 14 illuminates the challenges related to exclusion identified throughout the research process.

Challenge	Exclusion risk
Misalignment with organisational values	Rigid digital systems create exclusion by not catering to the unique values of organisations, which may revert to non-digital methods.
Overemphasis on environmental metrics	A focus on environmental metrics risks sidelining social and governance values.
Exclusion due to complexity	Complex digital functions exclude non-specialists, reducing holistic inclusion of ESG values.
Fragmentation of standards	Lack of interoperability in digital functions leads to exclusion of stakeholders unable to adapt, hindering collaboration and data sharing.
Digital divide and workforce adaptability	Excludes stakeholders with limited access or the resistance to adopt, potentially hindering the inclusion of certain ESG values.

Table 14 exclusion challenges (Author, 2024)

Findings proposition 3 The success of ESG-driven digital functions depends more on cultural and dynamic chain-oriented developments than technological developments.

Kane et al. (2015) and Wang (2023) highlighted the necessity for the move towards integrated and strategic applications of digital functions to enhance sustainability. Likewise, the digital functions within the real estate industry signifies a transformation of conventional practices and an improvement of activities related to real estate (Lee et al., 2024). Added to that, it was observed that while innovation and technology present significant potential, the industry is proceeding carefully in its adoption of digital functions (Tan & Miller, 2023; Wang, 2023), all the while integrating ESG values into its practices.

In turn, the final proposition implies that technology by itself is insufficient to ensure the effective integration of ESG. Instead, it necessitates a cultural transformation and a chain-oriented approach. A number of people interviewed highlighted the importance of collaboration and trust throughout the chain as essential for realising ESG values. This indicates that cultural factors, including the readiness to collaborate and assist one another, play a crucial role in upholding ESG values. One interviewee, a real estate developer, highlighted the particular supportive function of digital functions mainly in the areas of reporting and documentation.

"I think digitisation can start to help a lot in a piece of evidence and especially documenting" – *Real estate developer*[1]

Nonetheless, the interviewee declared that a chain-oriented approach is essential. Particularly when considering the long-term sustainability of real estate projects. It was emphasised that mutual trust is increasingly significant. Consequently, various advantages and disadvantages can be identified based on the results of the interviews (table 15 and 16).

Advantages	Elaboration	Relevant quote
Cultural importance	a culture that prioritises and responsibility can foster greater commitment among stakeholders. The core of ESG within organisations remains human-centric	*"Yeah, I don't think you can do it any other way either. You just have to feel this from your toes. Fortunately, more and more people do have that feeling."*
Collaboration and trust	when organisations foster a culture of cooperation, they are more likely to share best practices, resources, and insights, leading to more value	*"We try very hard to focus on our partners abroad who also want to join us. This is also a team effort, but it is not so that everyone at ... is so busy, and that is good with different rules for the change. But I feel that when we all work on a project together, we are all the more motivated to do something completely different. When the challenges are all there to*

		do something completely different, it is still too late. That is why we try so much more at the beginning, in the manner of the same people, and try to make it even better."
Long-term value	valuing long-term sustainability over short-term profits encourages businesses to integrate ESG values into their core strategies. Moreover, brand reputation also attracts socially conscious investors and customers.	*"You have to start holding hands there and trusting each other to programme, for example, just as I said, the plinth in such a way. That it is better for the project in the long run. Only then the end investor and the bank can also see that. That's where digitisation and data come in again to provide that bit of evidence towards those parties, that that extra value is really there. For that, you have to rely on each other". – Engineer 1*
Adaptability to change	dynamic chain-oriented developments allow organisations to be more responsive to changes in societal expectations and regulatory requirements.	
Human-centric approach	the success of ESG often relies on commitment and engagement of employees and stakeholders. A strong organisational culture that prioritises responsibility can motivate individuals to contribute actively for ESG values.	

Table 15 advantages (Author, 2024)

Disadvantages

Underestimation of technical importance	while cultural and dynamic factors are essential, underestimating the role of technology can be detrimental. Advanced technologies are crucial for data collection, analysis, and reporting, which are fundamental for measuring ESG performance and making informed decisions.
Cultural impact	Unlike technological advancements, which can be quantified and assessed, cultural and dynamic developments are often more subjective and challenging to measure. This can lead to difficulties in evaluating the effectiveness of ESG initiatives and making necessary adjustments.
Resistance to change	shifting organisational culture and dynamics can be met with resistance from employees and stakeholders who are accustomed to traditional practices. This resistance can hinder the implementation of ESG-driven digital functions and delay progress.
Misalignment	If cultural values do not align with technological capabilities, organisations may face challenges in executing their ESG strategies effectively. For instance, a strong commitment to sustainability may not translate into action if the necessary technological infrastructure is lacking.

Table 16 disadvantages (Author, 2024)

Discussion

The findings for proposition 3 emphasise that the success of ESG-driven digital functions hinges on the interconnection of stakeholders within the real estate value chain rather than technology. While technology provides enablers for collecting, tracking, storing, exchanging, visualising, and sharing, ESG values remain dependent on collaboration, trust, and shared accountability among stakeholders.

Stakeholder interconnection plays a role in enhancing the adaptability and long-term impact of ESG values. Through collaboration, stakeholders can respond dynamically to evolving societal expectations and regulatory frameworks, ensuring the relevance and effectiveness of their efforts. Furthermore, trust within the chain aligns long-term objectives, fostering an environment where short-term profits give way to sustained value creation. This alignment is

particularly vital in addressing investor and end-user demands for transparency and holistic ESG values.

However, while stakeholder/cultural interconnection is seen as an enabler for ESG values, technology must complement this dynamic as an enabler rather than the sole driver. Yet, overreliance on technology without addressing cultural resistance or fostering mutual accountability risks reducing ESG values to compliance exercises. The potential of digital functions may be realised in a collaborative ecosystem where cultural alignment and technology work in tandem. Hence, cultural interconnection surpasses technological advancement in driving ESG values within the real estate sector.

7.5 Concluding findings of propositions

The panel discussion aims to critically discuss and assess the propositions and interview outcomes with real estate developers as panellist to engage in an in-depth dialogue. The objective is to explore how the propositions are perceived based on real estate developments and professional experiences, while also addressing the research gaps that exist.

By bringing these panellist together in a cooperative setting, the discussion seeks to gain comprehensive insights. These insights gathered will contribute to a greater understanding of the interconnectedness between ESG values and digital functions, ultimately leading to sustainable and responsible practicalities.

Proposition 1

The proposition states that environmental values can only truly be considered sustainable when they are supported by S-values, focusing on the use and experience of the building. During the panel discussion, this proposition was put up for discussion. A critical question ties in well with this proposition: what is the concept of sustainability? A key point that emerged is that environmental values can exist in their own right and can be measured objectively, while social values are personal and remain difficult to quantify prior to the commissioning of a building. It was suggested that sustainability can be achieved by looking purely at the product, focusing only on environmental values. This raises the question to what extent sustainability can be truly integral if the social component is neglected.

Another point of criticism from the panellists was that the three ESG themes are not equivalent in hierarchy. Environmental values tend to get the most attention, mainly because of pressure from laws and regulations that explicitly require environmental performance. At the same time, lesser attention is paid to social values (e.g. comfort and liability of buildings) which can be evaluated post-completion. The panellists' argument emphasises that there should be a balance between environmental and social values, focusing on the eventual use and added value for the users. However, the hierarchy of each theme is questionable. The proposition strikes a chord with this, but instead calls for a balance and takes into account that not each theme might be considered equal.

Proposition 2

The second proposition highlighted the risk of excluding specific ESG values through the use of digital functions. While digital technologies offer potential for optimising processes and enhancing accessibility, concerns were raised about their potential to prioritise certain ESG values, such as environmental values, while sidelining others, like social and governance values.

A critical issue discussed was how the outputs of digital systems depend heavily on the quality of input data. If these inputs do not adequately reflect all relevant values, particularly social ones,

the effectiveness of digital functions in promoting ESG outcomes may be undermined. Incomplete or biased data can lead to a distorted representation of ESG performance, ultimately excluding important values from decision-making processes.

Additionally, the example of 'smart buildings' revealed that the focus on technological optimisation often prioritises efficiency over inclusivity, potentially neglecting lower-income groups and broader social considerations. This raises concerns about the unequal representation of ESG values within digital systems, where the emphasis on certain metrics could inadvertently undermine the broader goals of sustainability.

Overall, while digital functions offer opportunities for better ESG data integration, they also present risks of excluding essential social and governance values, reinforcing the need for digital systems that fully encompass the diverse range of ESG principles.

Proposition 3

The third proposition discusses that cultural and chain-oriented developments are more important for the success of ESG-driven digital functions than technological development itself. As a result, the panel discussion indicated that many laws and regulations have now been digitised. However, despite these technological advances, it remains challenging to implement ESG effectively if cultural aspects within the real estate chain are not addressed.

Moreover, it was noted during the discussion that technology is often only a means to comply with regulations. This implies that technological development is only a reaction to laws and regulations, and does not necessarily improve the culture of cooperation in the chain. The success of ESG driven digital functions depend on the extent to which organisations are able to change their culture and collaboration to focus on sustainable goals. This perspective supports the assertion that the cultural and chain-centric approach has a greater impact on achieving ESG goals than technology alone. It was also highlighted that the financial viability of such initiatives plays an important role, with the technology only being effective if the wider chain accepts and implements it.

Reflection

The panel discussion showed that real estate developers had several critical perspectives on the propositions. For proposition 1, it was highlighted that E-values often prevail due to their measurability and legal requirements, while S-values receive less attention. However, the sustainability of products is mainly determined by E-values. Moreover, proposition 2 highlighted that while digitisation can promote inclusion, it also carries risks of exclusion, especially for vulnerable groups. Moreover, it was stressed that the output of digital functions is only as good as the input. If the input is not complete or incorrect, the effectiveness of digital functions can be undermined. Thesis 3 indicated that technological advances alone are not enough to effectively implement ESG; cultural change within organisations and collaboration within the chain are essential. Without broad acceptance and adjustment of chain culture, the benefits of technology remain limited and the desired impact on sustainability cannot be realised.

Ultimately, the propositions show that sustainable development within the real estate industry is not only dependent on technological advancements and compliance with laws and regulations. To strike a balance between ESG values, where technology is supported seems important to promote cultural change and chain operations. This could ensure that sustainability is not only seen as a sum of environmental performances, but also a socially and culturally supported process in which the needs of all users are central.

8.
Conclusion

This chapter synthesises the answers to the research questions and contributes to the thesis, reflecting on the interconnectedness of ESG values and digital functions. It discusses practical and academic implications of the research, acknowledging research limitations and outlines potential directions for future research. The chapter also highlights how the research aligns the importance of the current and future real estate context and technological advancements for ESG.

As previously mentioned, the research focus group entails real estate developers. As a result, the conclusion will focus on the strategic development stage from the perspective of real estate developers to come up with practical solutions. In order to have a practical and meaningful solution for the main research question it is vital to assess the challenges as well as the opportunities for each sub-question. Therefore, the conclusion will look into both.

8.1 Addressing sub-questions

1. Which constellations of ESG values are prioritised during the strategic development stage?

The strategic development stage in real estate offers a critical opportunity to integrate ESG values from the outset, as noted by Phan and Boge (2023). While the prioritisation of these values varies depending on project-specific factors and stakeholders, the qualitative research findings highlight a clear hierarchy, with environmental values often taking precedence. This is largely due to their regulatory basis (e.g., Paris Proof, SDGs) and the ease with which environmental metrics can be quantified.

Theory and practical gap

A key finding from the research is the gap between theoretical frameworks and their practical application. While academic literature advocates for a balanced approach to ESG, in practice, environmental factors dominate due to compliance pressures. However, there is growing recognition that long-term sustainability requires integrating social and governance values. The strategic stage provides a unique opportunity to move beyond compliance-driven environmental metrics and adopt a more holistic, value-driven approach that considers all ESG dimensions.

Hybrid approaches to balance ESG values

To address this imbalance, findings from the study suggests hybrid methods that combine quantitative (environmental) values with qualitative (social) value values. To achieve this the strategic stage is pivotal in determining how these values can be operationalised and balanced from the outset of real estate developments, setting the foundation for long-term, sustainable outcomes.

In conclusion, based on the qualitative research, the list of values identified during the study (outlined in Table 17) provides a view of the prioritisation of ESG values during the strategic development stage. By adopting a hybrid value-driven approach, real estate developers can prioritise the multifaceted challenges of ESG values from the outset.

Theme	Value constellations	Values included
Environmental	Resource efficiency and circularity	Waste, circularity, re-use, biobased construction, disassembly, material passports, local production
	Carbon management	Carbon emissions, carbon footprint, embodied carbon, cooling and heating, Paris Proof, net-zero
	Biodiversity and ecology	Biodiversity, reforestation, vegetation, ecology, climate adaptation

	Water and sustainable infrastructure	Water, climate adaptation, local production
	Certifications and global goals	MPG (Environmental Performance Score), alignment with the UN Sustainable Development Goals (SDGs), Paris Proof, Net-zero, MPG
Social	Human-centric experience (or biological fundamentals)	Experience, comfort, health, daylight, home feeling, wellbeing, facilities and amenities, leisure features
	Equity and inclusion	Diversity, inclusion, ethics, social impact, affordability, vulnerable communities
	Community and interaction	Resident and user involvement, walkability and walk score, interaction, routing, liveability, location
	Work and employee Satisfaction	Work environment, employee satisfaction, human-centric environment
Governance	Accountability and transparency	Accountability, evidencing and proofing, transparency, certification, reporting, audits, compliance
	Regulation and compliance	Compliance with laws and regulations, CREMM (Carbon Risk Real Estate Monitor), CSRD (Corporate Sustainability Reporting Directive), ESG-related taxations, EU taxonomy, MVO, SFRD
	Organisational strategy and culture	Organisational ambition and objectives, organisational benchmarks, organisational influence, organisational responsibility, organisational culture, short- and long-term objectives
	Collaborative governance	Design team partners, organisational partners, political direction, social governance
	Impact and proof	Broad prosperity, societal impact, investor insights, socially responsible entrepreneurship (MVO), financing
	Ethics and integrity	Ethics, extended producer responsibility, autonomy, audits

Table 17 ESG value constellations (Author, 2024)

2. What digital functions are available and suitable for during the strategic development stage?

During the strategic development stage, digital functions suitable for embedding ESG values focus on data collection, analysis, and stakeholder collaboration. These functions enable stakeholders to make informed decisions by enhancing transparency, facilitating collaboration, and tracking ESG values from the outset. Functions like data visualisation, predictive modelling, and reporting platforms help assess environmental impact, manage resource efficiency, and ensure compliance. Functions for collecting and storing ESG data (e.g. Measurabl and Deepki) are supportive for centralising information across portfolios, enabling effective reporting and decision-making.

However, while these functions excel in supporting environmental goals, challenges remain for incorporating social and governance values. Digital functions like CitiesDAO and DigiGO, which enable data sharing and collaboration across stakeholders, can help address these challenges by fostering transparency and collective decision-making, though they require alignment with organisational and societal needs.

Despite their potential, digital functions at this stage face barriers (e.g. data reliability, integration issues, and high initial costs) which could exclude smaller organisations or those with limited technical capacity. The over-digitalisation risk, coupled with the marginalisation of intangible social values, calls for an hybrid approach that complements digital functions with human-centred methods to address social sustainability and governance concerns. Thus, while digital functions offer substantial potential in driving ESG values, their suitability depends on alignment with project's ESG values, scalability, and stakeholder values.

The available and suitable functions found during the study within the specific context, are outlined in table 18 and figure 13, building upon the list of digital functions presented in Table 13.

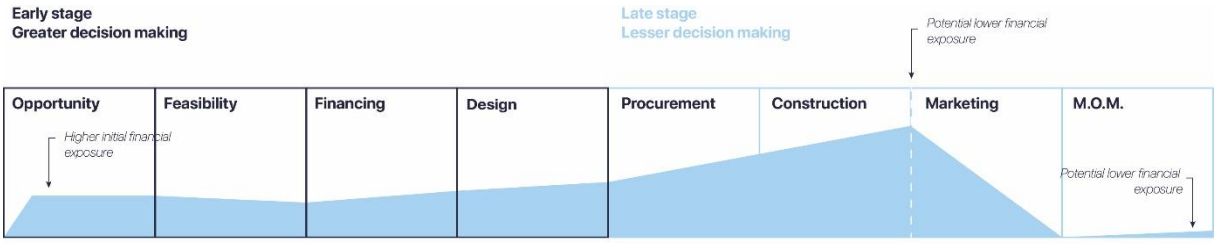

Figure 13. Available and suitable digital functions timeline (Author 24; based upon figure 1; Phan & Boge, 2023).

Digital function	Capabilities	Primary function	Operational scale
Scaler	Data visualising and analytics	ESG data collection and reporting for real estate decarbonisation	Portfolio or regional
Measurbl	Data storing and organising	ESG data management and reporting platform for real estate	Portfolio or regional
Deepki	Data visualising and analytics	ESG data intelligence and performance monitoring for real estate	Portfolio or regional
CitiesDAO	Data sharing and collaborating	Platform for collaboration and transparency ensuring that ESG values are incorporated from the outset	Local or neighbourhood
DigiGO	Data exchange and sharing	Platform for stakeholder engagement and market testing allowing developers to gauge ESG-driven values early in the process and communicate to a broader audience.	Portfolio or regional

Figure 18. Available and suitable digital functions timeline (Author, 2025)

3. What is the interconnection between ESG values and digital functions?

The interconnection between ESG values and digital functions is rooted in a few common grounds. Digital functions, with their capacity to process and analyse data, align well with ESG's reliance on measurable metrics, particularly in the environmental domain. While environmental values are easily operationalised through digital functions, social values pose challenges, as they are qualitative, context-dependent, and preconditional, rather than directly measurable. Similarly, governance values often focus on compliance, which limits their transformative potential within digital frameworks.

Both ESG values and digital functions aim to drive systemic change; ESG through sustainability and digital functions through improved efficiency and accuracy. However, challenges remain in interconnecting digital functions with social and governance values, as the former are difficult to quantify, and the latter often lack the depth needed for transformation.

The study revealed three key common grounds between ESG values and digital functions:

	ESG values	Digital functions
Data-driven nature	Rely on data/metrics	Excel in data/metric processing and analytics
Systemic impact	Aims to create systemic change through sustainability	Aims to create systemic change through efficiency

Stakeholder engagement	Requires a multi-stakeholder approach to succeed	Requires a multi-stakeholder approach to succeed

Table 19. Common grounds (Author, 2025)

As a result, the study reveals a strong interconnection (common grounds) between environmental values and digital functions, primarily due to the measurable and quantifiable nature of environmental metrics. Digital functions excel at processing and analysing data, enabling systems, providers, and stakeholders (both internal and external) to collaborate effectively and understand real-life environments. This interconnectedness supports alignment across the value chain, fostering collective accountability and reducing isolated efforts.

In contrast, social values present a more challenging interconnection with digital functions, as they are inherently qualitative, context-dependent, and often preconditional rather than directly measurable. The lack of standardised metrics for social values limits their integration into digital systems, highlighting the need for participatory, human-centric approaches to address this gap.

Ultimately, it can be argued that the strength of the interconnection lies in the ability of digital functions to link diverse stakeholders and systems, facilitating transparency, collaboration, and shared responsibility for ESG values. Without such integration, efforts risk becoming fragmented and less impactful.

4. How can ESG values and digital functions be integrated during the strategic development stage?

The integration of ESG values and digital functions during the strategic development stage is constrained by collaborative gaps, lack of standardisation, and ESG fragmentation. In order to come up with effective integration it requires consistent stakeholder engagement, unified data standards, and interoperability of platforms to align digital functions with ESG values from the outset of project developments.

Collaboration across the real estate chain was proven to be essential to align ESG values with stakeholders objectives. As the study showed that inconsistent stakeholder involvement limits holistic and collective impact. Additionally, standardisation remains a challenge, as fragmented data formats, certifications, and regulatory (European) frameworks create inefficiencies and discourage scalability. So without unified standards, developers could face higher costs, reduced transparency, and limited capacity to address ESG values from the aforementioned stage.

To conclude, prioritisation of unified (data) standards and adaptable digital functions could promote efficient and effective integration. To do this it is key to address the challenges to enhance scalability, efficiency, and long-term impact, ensuring ESG values are actionable, measurable, and aligned with market and societal standards.

8.2 Addressing main research questions

How can the interconnection between ESG values and digital functions be enhanced across the real estate industry chain during the strategic development stage?

In addition to the previous studies, the industry calls for an integrated and strategic integration of technology, rather than an uncontrolled implementation, to improve sustainability and efficiency (Kane et al., 2015; Wang, 2023). As mentioned in the introduction (chapter 1.5), the initial strategic development phases of development is relevant for this research, as it lays the foundation for developments, stakeholder alignment, roles and responsibilities, and the overall

project scope. Building upon this, the research findings also identified the strategic development stage as a key opportunity for enhancing the interconnection between ESG values and digital functions across the real estate industry chain, more specifically for real estate developers.

The research highlights a strong interconnection between environmental values and digital functions, driven by their shared reliance on measurable and quantifiable (data-driven) metrics. Digital functions enable the processing, tracking, and visualisation of environmental values, facilitating collaboration among internal and external stakeholders and fostering collective accountability and environmental sustainability. However, social values, being qualitative and context-dependent, require a more human-centric approach, while governance remains focused on compliance, lacking the depth needed for transformative integration.

Ultimately, ESG driven digital functions should not be mere enablers for tracking ESG metrics; they should enforce stakeholders to engage collaboratively, make informed decisions, and align ESG values across the real estate chain during real estate developments. By fostering stakeholder engagement, addressing practical and theoretical gaps in social and governance values, and ensuring data standardisation, digital functions can drive systemic change, scalability, and long-term sustainability. The proposed value-driven framework (table 20) provides real estate developers with actionable steps to bridge the gaps between ESG values and digital functions and make informed decisions about digital and non-digital actions for ESG values, promoting a more thoughtful and integrated approach to the interconnection between ESG values and digital functions.

To address the challenges, the study identifies thirteen steps for how to enhance the interconnection of ESG values and digital functions from the outset of real estate developments (table 20):

	Steps	Objective	Implementation	Relevance
1	**Strategic ESG baseline**	Establish the level of ESG maturity to guide actions	Identify strengths, gaps, and priorities for ESG values at the project or organisational level	Ensures values are context-specific and relevant to the project's needs
2	**Identify ESG values**	Recognise both tangible and intangible ESG values	Engage stakeholders in workshops or surveys to co-create a prioritised ESG value map that aligns with project objectives and regulatory frameworks	Ensures balanced consideration of all ESG values, avoiding an overemphasis on measurable metrics
3	**Map ESG interdependencies**	Highlight overlaps and dependencies between environmental, social, and governance values	Map how ESG values influence and depend on one another, ensuring system thinking	Avoids siloed implementation and promotes broader ESG integration
4	**Visibility bias**	Mitigate overemphasis on quantifiable metrics, particularly environmental values	Document ESG values alongside environmental goals	Prevents marginalisation of social and governance values, ensuring a balanced ESG strategy
5	**Evaluate necessity**	Assess whether digital functions are needed and aligned with specific ESG values	Identify tasks where digital functions add value and recognise areas requiring human-centric approaches	Avoids unnecessary digitalisation, ensuring efficient resource allocation
6	**Define operational scale**	Determine whether the main focus is on the building, local area, or portfolio level	**Building Level:** Granular focus on individual project impacts (e.g., energy efficiency). **Local Area:** Broader socio-environmental impacts (e.g., liveability). **Portfolio:** Strategic decision-making and benchmarking across multiple projects.	Tailors digital strategies to project-specific operational needs and objectives
7	**Select digital functions**	Select appropriate digital functions to operationalise ESG values effectively	**Measuring and collecting:** Ensure consistent and accurate ESG data. **Storing and organising:** Use scalable systems like data lakes. **Exchanging and sharing:** Foster interoperability through APIs. **Visualising and analytics:** Employ dashboards for performance insights. **Collaborating and sharing:** Enhance	Aligns digital functions with ESG values to drive scalability, efficiency, and impact.

			transparency through stakeholder platforms.	
8	**Foster stakeholder collaboration**	Promote engagement across the value chain to align ESG objectives	Facilitate shared decision making and data sharing among stakeholders	Builds collective accountability and reduces fragmentation of ESG values.
9	**Select data formats and standards**	Address inefficiencies caused by fragmented data standards and certifications	Advocate for unified data standards and interoperable platforms to enable stakeholder engagement	Enhances comparability, scalability, and transparency of ESG data across stakeholders
10	**Integrate feedback loops**	Establish mechanisms for continuous improvement and refinement of ESG-digital driven interconnection	Regularly review performance through stakeholder feedback, data insights, and iterative evaluations	Ensures the framework evolves to meet emerging challenges and opportunities
11	**Multi-stakeholder governance**	Develop governance mechanisms to coordinate collaboration and accountability	Establish advisory groups or governing bodies with representatives from all stakeholders to oversee ESG values and digital functions	Ensures equitable decision-making and shared ownership of ESG values
12	**Inclusive and equitable participation**	Avoid excluding smaller organisations or underrepresented stakeholders in ESG driven digital efforts	Provide training, accessible functions, and support systems to enable participation across all stakeholders, regardless of resource capacity	Promotes inclusivity
13	**Establish ESG accountability mechanism**	Build systems for tracking, reporting, and rewarding progress toward ESG values	Link digital functions with performance-based metrics, certifications, and financial incentives to drive compliance and continuous improvement	Encourages sustained commitment to ESG values

Table 20. Value-driven framework (Author, 2025)

9.
Reflection

This research examines the interconnection between ESG values and digital functions within real estate development, adopting a chain-oriented perspective to explore the interconnected roles of stakeholders. It provides a structured approach for relevant ESG values with digital strategies during the strategic phase of development, offering insights into both theoretical and practical dimensions of ESG values. However, while the findings contribute to a deeper understanding of ESG values, it also highlight significant limitations that shape the applicability and generalisability of the outcomes.

Academic contribution

The thesis enriches academic discourse by conceptualising ESG as values, emphasising their subjective and evaluative nature. This framing not only clarifies ESG's values in decision-making but also aligns it with the dynamic and context-specific requirements of sustainable real estate development. By introducing this nuanced perspective, the research expands the theoretical foundations of ESG and offers more adaptable ideas for its analysis.

From a methodological standpoint, the research has demonstrated the strength of qualitative approaches, particularly through interviews and expert panel discussions. However, it also shows the complexity of ESG values, as the reliance of real estate developers on other stakeholders adds challenges in isolating actionable roles. This observation underscores the need for further academic exploration into the interdependencies within the real estate chain, particularly regarding ESG values and digital. Additionally, who play an important role within the interconnection of ESG values and digital functions in order to have practical impact.

Practical Contribution

Practically, the research provides actionable insights for integrating ESG values and digital functions into real estate developments. The proposed ideas and functions aim to enhance sustainability outcomes and stakeholder collaboration. However, these contributions are limited in scope, as the findings predominantly reflect the perspectives of larger organisations, with smaller firms and trade associations underrepresented. This imbalance constrains the applicability of the research across the broader spectrum of real estate stakeholders and limits its use for addressing systemic challenges in the industry.

Limitations

The studies focus on larger organisations overlooks the challenges faced by smaller firms, such as resource constraints and limited expertise in ESG values and digital functions. On top of that exclusion is a major risk based upon the research. This omission reduces the relevance of the findings for a significant part of the industry, particularly those stakeholders who might benefit the most from targeted research.

By excluding trade associations, the research fails to capture collective, sector-level perspectives. After all, trade associations serve as critical platforms for collaboration and standard-setting, and their absence limits the exploration of systemic strategies for ESG values and digital functions.

The reliance on thematic coding introduces challenges in evaluating the depth and relevance of insights. While coding facilitated the identification of themes, the qualitative nature of the data and subjective interpretations may have impacted the accuracy and bias of the analysis. This issue underscores the need for critical and rigorous coding techniques in future research.

The dependency of real estate developers on other stakeholders, such as contractors, investors, and public bodies, complicates the identification of developer-specific actions. The interconnectedness highlights the systemic nature of ESG values and underscores the importance of collaborative dynamics, which were only partially explored in this study.

The involvement of Boelens de Gruyter introduces another bias that shaped the practical insights and interpretations of the developers role. This organisational perspective, while valuable and practical, may not reflect the wider range of real estate developer experiences or roles in within the dynamics of real estate development.

Methods

Initially, the propositions laid a solid foundation for the discussion and research, serving as a starting point for diving into the research aims. Nonetheless, developing propositions that deeply covered the complete research aim laid out challenges, constraining their capacity to adequately support the research methods and results. The qualitative methods successfully formed stakeholders perspectives and offered important insights into the context of the real estate industry. Nonetheless, challenges emerged in concentrating on the particular stage of strategic development, given that not all interviewees were directly engaged during this phase. Furthermore, the differing degrees of knowledge and understanding of the subject in question among participants underscored a notable limitation.

In light of these challenges, the semi-structured interview method provided an extent of adaptability, allowing the interviews to stay relevant and investigating. The panel discussions held with the expert panel contributed a practical and critical aspect to the interview findings and propositions, providing more profound insights. Nonetheless, these discussions were fundamentally subjective, significantly shaped by the individual experiences and biases of the experts, which added another layer of limitation.

Ultimately, while the research aimed to explore the interconnection between social (S) and governance (G) values with digital functions, this relationship was not sufficiently captured by the chosen methodology. Although it is possible that such an interconnection exists, the approach did not provide the depth needed to fully uncover how digital functions can effectively support or enhance these values. Social values, often characterised by their qualitative and context-dependent nature, may be more challenging to quantify and integrate within digital frameworks, particularly when compared to environmental values. Similarly, governance values, which are deeply tied to decision-making processes and stakeholder engagement, may require more complex digital tools for alignment. The current method, with its focus on data-driven insights, was unable to capture these nuanced interactions in full. Future research should therefore refine the approach to explore how digital functions can facilitate the integration of social and governance values, providing a more comprehensive understanding of their interconnection in the context of real estate development.

Future research

To address the identified limitations and enhance the relevance and impact of future studies, the following research directions are recommended:

1. Inclusion of smaller organisations
2. Engagement with trade associations
3. Refinement of coding methodologies
4. Focus on collaborative dynamics
5. Quantitative analysis of stakeholder dependencies
6. Interconnection of social and governance values with digital functions

Concluding reflection

Ultimately, the thesis represents a step forward in understanding the interconnection of ESG values and digital functions within the real estate development context. It highlights the importance of adopting a chain-oriented perspective and contributes both academically and practically to the field. However, the critical limitations identified suggest that this work is part of an ongoing dialogue, and there remains substantial scope for future research to build upon and refine these findings. By addressing these limitations, future studies can offer more comprehensive, inclusive, and actionable insights, ensuring that ESG values and digital functions become more interconnected components of a more sustainable real estate industry.

10.

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Figure list

1. Phan, T. N., & Boge, K. (2023b, mei 1). The Norwegian proptech market – an incubator for game changers. IOP Conference Series. Earth And Environmental Science (Online). https://doi.org/10.1088/1755-1315/1176/1/012002

11.

Appendix

11.1 panel discussion protocol

ESG propositions and interview outcomes

Objective: to come up with an insightful and critical discussion among real estate developers about the propositions and findings of the interviews, focusing on ESG values during real estate developments, digital functions, and the interconnection between ESG and digital functions.

Number of panellist: 8 real estate developers attended as panellist

Duration: 1,5 hours

Structure

1. **Introduction** (5 minutes)
    a. Welcome and setting the scene: moderator introduces the purpose of the research (including research framework) and panel, focusing on the importance of ESG values

and digital functions in real estate development. Explain the objective of the discussion: to critically examine the propositions and findings of the study for practical and realistic insights.

2. **Opening** remarks and propositions (10 minutes)
    a. Moderator presents three propositions
        i. Proposition 1: Environmental values are only sustainable when social values are sustained.
        ii. Proposition 2: Digital functions may promote inclusion but risks excluding (digital vs non-digital).
        iii. Proposition 3: The success of ESG-driven digital functions depends more on cultural and dynamic chain-oriented developments than technological advancements.
3. Panel **discussion** (60 minutes)
    a. Proposition 1: Environmental values are only sustainable when social values are sustained.
    b. Proposition 2: Digital functions may promote inclusion but risks excluding (digital vs non-digital).
    c. Proposition 3: The success of ESG-driven digital functions depends more on cultural and dynamic chain-oriented developments than technological advancements.
    d. Briefly summarise the findings from the interviews and contextualise each proposition after discussion
4. **Wrap-up** and final remarks (15 minutes)

11.2 Interview protocol

Doel	Exploratief en reflectief interview
Structuur	Semi-gestructureerde aanpak met open vragen met ruimte voor persoonlijke reflectie van de geïnterviewde.
Start	filter vragen
Belangrijke onderwerpen	Focus op ESG (waarden) en digitale functies
	Vraag naar reflecties op uitdagingen en kansen
	Vraag naar strategieën of technieken
Vermijd	Het geven van te veel voorbeelden
	> Laat de geïnterviewde zelf reflecteren.
Afsluiten	Vraag naar hun huidige scenario en hoe ze het gewenste scenario zien in de toekomst.
	Duidelijkheid in terminologie
	Het is belangrijk om termen zoals "digital functions" en "ESG values" duidelijk te definiëren en goed uit te leggen aan de geïnterviewden. Dit voorkomt misinterpretaties.
	Vermijd voorbeelden, zodat geïnterviewden niet vast blijven hangen aan specifieke ideeën.
	Starten met (ESG) waarden
	Begin het interview met vragen over waarden (values). Vraag naar hoe deze waarden worden bewaakt en geïmplementeerd in hun werkprocessen.
	Structuur van vragen
	De feedback benadrukt een semi-gestructureerde aanpak. Dit betekent dat ik flexibel kan inspelen op de antwoorden, terwijl ik toch de kern van mijn onderzoek behandel\.
	Maak gebruik van open vragen om brede reflecties te stimuleren.
	Focus op verbeteringen en processen
	Vraag naar hoe processen verlopen en wanneer ze als ‘verbeterd’ worden beschouwd. Het is belangrijk om hierop door te vragen, vooral over hun interpretatie van verbetering.
	Vragen over de balans tussen digitale en niet-digitale processen kunnen helpen bij het begrijpen van verwachtingen en ervaringen.
	Minimale vraagstelling
	Begin met drie open vragen om het gesprek te starten, zoals “Wie ben je?”, “Wat zijn je verantwoordelijkheden?” en “Kun je je verhaal vertellen over…?” Dit geeft ruimte voor een natuurlijk gesprek waarin de geïnterviewde vrij kan reflecteren.

Pre-Interview Preparations
1. Contact interviewees:
Call and email the interviewees in advance to ask for participation and provide context about the interview's purpose.
Share key background information about the research and the research objectives.
2. Send nterview invitation:
Include the formal invitation by email, detailing the interview purpose, duration, and expectations.
Attach the consent form and request that it be reviewed and signed before the interview.
Provide clear time and location details (including a Microsoft Teams link if applicable).
3. Prepare recording equipment:
Ensure that the primary and backup recording devices (Teams, audio recorders) are functioning.
Test equipment or software (e.g., Teams) beforehand to ensure everything runs smoothly.
4. Prepare questions and supporting materials:
Review and finalize the list of questions tailored to each interviewee.
Gather any reference materials (if relevant) that might help guide the discussion.

Start of the Interview
1. Welcome and introduction:
Thank the interviewee for their time and participation.
Introduce myself and give a brief overview of the study, including the specific research area.
2. Confirm informed consent:
Verify that the interviewee has signed and returned the consent form.
Request verbal consent at the start of the recording, confirming their willingness to participate in the recorded interview.
3. Explain the recording process:
Mention that the interview will be recorded for transcription and analysis purposes.
Reassure the interviewee that their data will be handled confidentially.
Start the Teams session and ensure backup recording is also functioning.

4. Set interview expectations:
Briefly outline the structure of the interview, how long it will take, and the topics to be covered.

Post-Interview checklist
1. Wrap-up and additional comments:
Ask if the interviewee has any additional comments or questions.
Thank the interviewee once again for their participation.
2. Explain next steps:
Outline the validation process (e.g., how the interviewee will have an opportunity to review the transcript or findings).
Inform them that the final thesis can be shared with them upon request.
3. Follow-up procedures:
Send a thank-you email within 24–48 hours, including the interview transcript for review (if applicable).
Provide a follow-up date or timeframe for the subsequent interview with Boelens de Gruyter
4. Data storage and confidentiality:
Ensure that recordings and transcripts are securely stored in line with confidentiality agreements.
Additional
Data Privacy & Anonymization: In my communication, ensure the interviewee knows how their data will be anonymized if applicable.
Tailored Questions: Review any specific context about the interviewee to tailor questions better to their background and area of expertise.
Feedback Loop: Consider asking for feedback on the interview process itself, to improve future sessions.

11.3 ESG focused interview

Semi-structured **interview opzet**

Filter vragen
Betrokkenheid en rol bij ESG
1.1 Zou je kort willen toelichten wie je bent en wat jouw rol/functie binnen [...] is?

Algemene- en filtervragen
2.1 Hoe zou je ESG-waarden definiëren?
2.3 Wat beschouwt de organisatie als belangrijkste langetermijnwaarde?

Focus vragen
ESG in de organisatie
3.1 Zijn er ESG-waarden die centraal staan bij [...]?
3.2 Kun je mij meenemen door een specifiek project en uitleggen hoe ESG-waarden daarin worden geïntegreerd?
3.3 Hoe worden ESG-waarden binnen de organisatie ondersteund, zowel bottom-up als top-down?
3.4 Vanaf welke fase in ontwikkelingen zijn jullie betrokken v.w.b. ESG?

Uitdagingen bij ESG
4.1 Welke uitdagingen komen jullie tegen bij ESG?
4.2 Verschillen deze uitdagingen per type project of regio?

Meten en evalueren
5.1 Hoe meten jullie ESG binnen de organisatie?
5.2 Hoe meet je dit in je projecten, leningen en/of investeringen?
5.3 Welke digitale tools worden overwogen voor ESG?
5.4 Hoe zie je de verbinding tussen ESG en digitalisatie?
5.5 Hoe rapporteren jullie ESG?

Samenwerking met partners
6.1 Hoe zie je de samenwerking met externe om ESG-doelen te behalen?
6.2 Welke rol speelt [...] binnen de vastgoedketen v.w.b. ESG?
6.3 Welke partners beschouw je als cruciaal voor ESG-doelen, en waarom?

11.4 ESG focused interview

Interview opzet (semi-structured)

Filter vragen

Betrokkenheid en rol bij ESG

1.1 Kun je kort je functie en rol toelichten?

Algemene- en filtervragen

2.1 Hoe zou jij ESG omschrijven?

2.2 Hoe kunnen we de projecten van [...] het beste omschrijven?

Focus vragen

ESG en digitalisatie

3.1 Welke ESG-waarden zien jullie als het meest cruciaal?

3.2 Hoe ziet [...] de rol van digitalisatie in het ondersteunen en versterken van ESG?

3.3 Zien jullie verschillen in ESG-waarden per type project?

3.4 Kun je een typisch [...] project beschrijven m.b.t. ESG?

Uitdagingen

4.1 Welke uitdagingen ervaart [...] bij het verbinden van ESG en digitalisatie?

4.2 Verschillen deze uitdagingen per type project, organisatie, regio, of technologie?

Meten en evalueren

5.1 Hoe meet [...] de impact en voortgang van ESG-waarden?

5.2 Welke KPI's of metrics worden specifiek gebruikt voor het meten van ESG?

Samenwerkinging

6.1 Hoe ziet [...] de samenwerking met externe partijen om ESG-doelen te bereiken?

6.2 Welke rol speelt [...] binnen de keten met betrekking tot ESG en digitalisatie?

6.3 Welke partners beschouwt [...] als cruciaal voor het behalen van ESG-doelen??