GENERATIVE AI FOR DELIBERATION IN DESIGN TEAMS

Management in the Built Environment, Delft University of Technology

Theme 4: Gamechangers in Transitions

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Preface

Dear reader,

It is both exciting and surreal to realise that this thesis marks the closing chapter of my time at the Faculty of Architecture and the Built Environment at TU Delft. What began as a curiosity about artificial intelligence and innovation has grown into a research journey that challenged me both academically and personally.

This graduation project was conducted as part of the Management in the Built Environment master's programme and took place within the Gamechangers in Transitions graduation lab. Over the past months, I had the privilege to explore how generative AI could support stakeholder deliberation in design teams, an area that sits at the intersection of technology, collaboration, and real estate development.

This thesis was far from an individual effort. From the early formulation of the research questions to the final structure and outcomes, the project was co-developed in close collaboration with my academic supervisors, Dr. Aksel Ersoy and Professor Dr. Paul Chan. Their critical insights, thoughtful guidance, and continued support shaped every stage of the process. These materials may also be used by my supervisors for academic or educational purposes.

I also want to thank NEOO, my host organisation, for welcoming me into their forward-thinking team. In particular, I am grateful to my mentor Linda van Dam, whose practical perspective, trust, and encouragement helped connect academic thinking to real-world development practice. Working within NEOO's inspiring environment has taught me more than I could have imagined and grounded my research in daily practice.

I am proud of the final result, not only for what it delivers, but for what it represents: a collaborative, iterative process of inquiry, design, and reflection. This project has shown me the importance of critical thinking, adaptability, and the courage to work with complexity. It has helped me grow into someone who is ready to contribute to innovation in the built environment, not only as a researcher but also as a future gamechanger.

Enjoy reading,

Annefloor Pluut

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Abstract

Generative Artificial Intelligence (AI) is increasingly recognised as a transformative force across industries, yet its integration into real estate development remains tentative and largely exploratory. This research investigates how generative AI can support stakeholder deliberation within multidisciplinary design teams in real estate development projects. Deliberation is understood as a structured, inclusive, and reflective process of mutual reasoning and knowledge integration, distinct from decision-making or negotiation.

Employing an exploratory mixed-methods approach, the study combines a literature review, semi-structured interviews, a survey, and a validation phase including a workshop and expert panels. Conducted in collaboration with the Dutch real estate development firm NEOO, the research focuses on design-phase deliberation and investigates how AI tools can facilitate more effective collaboration. Three research phases guide the study: (1) mapping the nature and phases of deliberation in design teams, (2) evaluating the challenges and potentials of generative AI tools, and (3) developing and validating a framework and implementation strategy for AI-supported deliberation.

The research identifies three deliberative modes, namely exploratory, convergent, and operational, each aligned with specific phases of the design trajectory. Five AI support themes emerge: facilitation, augmentation, efficiency, inclusivity and coordination. Together, these inform a framework and roadmap for practice. The study finds that generative AI can enhance structured dialogue, support inclusive engagement, and augment creative reasoning, provided that its implementation is sensitive to organisational dynamics, professional trust, and reflective learning processes.

This thesis contributes to both academic theory and industry practice by offering conceptual clarity on deliberation and practical guidance on integrating AI into design team deliberation workflows. It is intended for scholars, practitioners, and developers seeking to leverage digital innovation for more effective and inclusive collaboration in the built environment.

Keywords: generative AI, stakeholder deliberation, design teams, real estate development, collaboration, AI integration.

Summary

This summary is intended for professionals in real estate development who are curious about how generative AI can contribute to improved deliberation in design teams.

In real estate development, projects are becoming increasingly complex, bringing together diverse interests and perspectives within multidisciplinary design teams. One essential, yet often overlooked, aspect of this collaboration is deliberation: the structured and reflective exchange in which design options are explored, viewpoints are shared, and collective direction is determined. In practice, however, this deliberative process often unfolds in a fragmented and unstructured way, leading to misunderstandings, inefficiencies, and missed opportunities.

At the same time, generative Artificial Intelligence (AI) offers new opportunities to support this type of collaboration. AI tools are increasingly used to organise information, generate ideas, and streamline decision-making processes. Yet little is known about how this technology actually contributes to deliberation in design teams within the field of real estate development. The central question of this research therefore was: How can generative AI support stakeholder deliberation within design teams in real estate development?

This question was explored within the context of NEOO, an innovative development company actively seeking ways to integrate innovation into its daily operations. The research followed a phased, exploratory design, combining literature review with a survey, semi-structured interviews, and validation through a workshop and expert panels. In the first phase, the concept of deliberation was examined in depth and the current uses of AI were mapped. Next, practical insights were gathered and analysed, leading to the development of a framework and implementation strategy. These were validated and refined in the final phase based on feedback from professionals and academics.

The study shows that deliberation in real estate development is not a fixed method, but an iterative process that varies across phases and contexts. Three deliberative modes were identified: an exploratory mode in which ideas emerge, a convergent mode in which choices are weighed, and an operational mode in which execution is coordinated. In each of these modes, deliberation plays a different role, and AI can provide support in distinct ways.

Based on these insights, an AI-supported deliberation framework was developed to help design teams use generative AI in a targeted and responsible manner. The framework connects the three deliberative modes to project phases and shows how AI tools can strengthen various deliberative functions at different moments. An accompanying implementation strategy was also developed to support organisations in integrating generative AI into their professional workflows.

For professionals, this research provides concrete insights into how generative AI can be responsibly applied within design teams. It helps teams organise deliberation more consciously, use technological tools more strategically, and simultaneously maintain the central role of human judgment.

For further elaboration, justification, and reflection, I kindly refer to the full thesis. I invite readers to join the conversation, apply the insights from this research, and explore how generative AI can contribute to better deliberation in design teams.

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1. Introduction

This chapter provides the background, context, and scope of the research. It outlines the problem statement, defines key concepts, and presents the research questions, objectives, and relevance to both academic and practical domains.

1.1 Problem statement

The real estate development sector increasingly relies on multidisciplinary design teams to address the complex demands of modern projects. These teams typically include architects, engineers, project managers, and urban planners, each contributing specific knowledge and distinct viewpoints to deliver integrated solutions (Elforgani, 2010; Svalestuen et al., 2015). While this diversity creates opportunities for creativity and innovation, it also introduces considerable challenges in communication and coordination. Fragmentation of expertise, conflicting priorities, and inconsistent workflows often result in inefficiencies, misalignment, and delayed or suboptimal outcomes (Forgues & Koskela, 2009; Ren et al., 2011).

A particularly underdeveloped yet essential aspect of this collaboration is the practice of deliberation. Deliberation refers to the structured and reflective exchange of perspectives through which professionals engage in mutual reasoning, explore alternatives, and work toward shared understanding. Unlike negotiation or informal discussion, deliberation prioritises inclusivity, critical reflection, and the thoughtful evaluation of multiple perspectives (Barabas, 2004; Gollagher & Hartz-Karp, 2013). In real estate design contexts, this process is critical for integrating technical, spatial, regulatory, financial, and sustainability considerations into a coherent project strategy (Den Otter & Emmitt, 2008; Forester, 2006). However, in practice, deliberation often remains unstructured and fragmented, which undermines transparency and contributes to unresolved conflicts within design teams (Geiser et al., 2024; Stefaniak & Moore, 2024).

Generative Artificial Intelligence (AI) offers a promising opportunity to support more structured forms of deliberation. These technologies are increasingly used to structure information, simulate alternatives, and provide cognitive support in complex settings. When thoughtfully implemented, these tools can support more transparent and inclusive dialogue, helping teams engage with difficult trade-offs and reflect on complex scenarios (Feuerriegel et al., 2023; Han et al., 2024).

However, most research on AI in the built environment focuses on automation and predictive modelling rather than on the potential of artificial intelligence to influence deliberative processes within teams. Recent studies on the use of AI in professional learning and collaboration (Durgungoz and McLaughlin, 2025) suggest that generative tools can shape not only the content of discussions but also the ways in which professionals interact. They can influence authority, trust, and participation within teams. A recent literature review also shows that the presence of AI in team settings alters communication patterns, perceived autonomy, and power relations (Zercher et al., 2023). These insights highlight the need to understand AI not just as a technical instrument, but as a participant that affects how collaboration unfolds.

To respond to this gap, the research focuses on how generative AI can support stakeholder deliberation in design teams. It does not investigate AI as a tool for technical optimisation in the built environment, but as a means to improve how professionals think and work together. Introducing generative tools into design practice requires more than technical implementation. It calls for a transformation in how professionals collaborate, interpret complexity, and structure their collective reasoning. This change disrupts existing routines, relationships, and communication patterns, and demands a thoughtful approach to organisational learning.

One interviewee in this study captured the current situation with a striking metaphor: *"I was faster on a bike than in a car before I had a driver's license."* This reflects the current gap between the potential of generative AI and its practical use for deliberation in design teams. The technology is not limited by its capabilities, but rather by the absence of structure, adequate knowledge, and practical guidance. This research seeks to address that gap by adopting the role of a driving instructor, offering structured support and direction for design teams in real estate development to work with generative AI in a purposeful and reflective manner.

1.2 Practical context & illustrative scenario's

This research is conducted as part of a graduation internship at NEOO, a real estate developer specialising in complex, mixed-use urban projects. NEOO's multidisciplinary design teams routinely engage in deliberation involving architects, engineers, sustainability consultants, and investors. These teams must critically evaluate and iteratively refine design propositions across a range of dimensions. The following scenarios illustrate how deliberation unfolds in this context, highlighting structural inefficiencies, cognitive barriers, and coordination challenges that could potentially be addressed using AI-supported tools.

Scenario 1: Deliberation on sustainability and technical feasibility in a casco delivery

In casco delivery projects, sustainability consultants may propose high-performance energy systems to meet long-term environmental goals. Project managers, in contrast, often raise concerns about upfront investment costs, technical feasibility, and delivery risks. Meanwhile, architects and engineers must account for dependencies on local grid capacity and infrastructure limitations, further complicating the discussion. Deliberation in this context requires more than technical negotiation. It involves each stakeholder articulating their reasoning, understanding others' concerns, and working toward a shared solution despite divergent priorities. Without clear structure, these conversations risk being dominated by assertive voices or reduced to siloed exchanges. Generative AI could support the process by visualising long-term impacts, mapping trade-offs, and helping teams engage in more transparent and inclusive dialogue.

Scenario 2: Deliberation on spatial and functional flexibility in mixed-use developments

In mixed-use developments, design teams must negotiate spatial configurations that accommodate diverse user needs. Architects may advocate for open, flexible layouts that support retail or hospitality functions, while leasing managers and investors often prefer defined divisions that ensure commercial predictability. Engineers and planners also consider structural constraints, technical feasibility, and compliance requirements. Practical deliberation in this setting allows team members to express priorities, understand the implications of various spatial strategies, and converge on mutually acceptable outcomes. However, this process is often hindered by fragmented communication and a lack of shared understanding. Generative AI could help facilitate more reflective dialogue by simulating user flows, visualising spatial alternatives, and surfacing the implications of different configurations across stakeholder interests.

1.3 Research gap

Although deliberation has the potential to support the integration of diverse expertise in real estate design teams, it is often unstructured, fragmented, and vulnerable to misalignment and inefficiency (Geiser et al., 2024; Stefaniak and Moore, 2024). While previous research has explored deliberation in public governance and participatory planning (Barabas, 2004; Gollagher and Hartz-Karp, 2013), there is limited insight into how this process unfolds within interdisciplinary design environments that must reconcile spatial, technical, regulatory, and financial priorities (Den Otter and Emmitt, 2008).

At the same time, most studies on generative AI in the built environment have focused on automation, optimisation, and predictive modelling (Kalampokis et al., 2024), offering limited insight into how AI might shape collaborative reasoning and communication within professional teams. Recent work suggests that generative AI has the capacity to influence not only decision outcomes but also team dynamics, including trust, participation, and power relations (Durgungoz and McLaughlin, 2025; Zercher et al., 2023). Yet these findings have not been translated into practical strategies for design teams navigating complex deliberative processes.

This research addresses that gap by focusing on how generative AI can support stakeholder deliberation within design teams in real estate development. In particular, it explores how AI can act as a facilitator of structured dialogue and reflective exchange, rather than merely a technical solution. Especially in practice-based settings like NEOO, where deliberation is recognised as essential yet inconsistently applied, there is a pressing need for actionable guidance that integrates technological and organisational dimensions to improve collaboration in early design phases.

1.4 Goals & objectives

The primary goal of this research is to explore how generative AI can support stakeholder deliberation within real estate design teams. This goal is pursued through the following objectives:

- To conceptualize stakeholder deliberation within the context of multidisciplinary design teams in real estate development
- To explore generative AI tools and their potential applications in deliberative processes
- To design and develop a practical and iterative roadmap for integrating generative AI tools into deliberation workflows
- To validate the proposed roadmap through expert consultation to ensure its relevance and applicability

1.5 Research questions

The identified research gap highlights the absence of structured methods for integrating generative AI into stakeholder deliberation processes within real estate design teams. To address this gap, the following main research question is proposed:

<u>How can generative AI support deliberation within design teams of real estate development?</u>

To answer this main research question, the study is guided by three sub-questions:

1. What is meant by deliberation in the context of design teams in real estate development, and at which stages is it most essential?
   This sub-question aims to define deliberation within multidisciplinary design teams, identifying its critical components and the key phases of the design process where it plays the most significant role.

2. Which generative AI tools are currently used to facilitate deliberation?
   This sub-question investigates existing generative AI tools and their potential to support structured stakeholder engagement. It seeks to identify tools that are most effective in improving dialogue, collaboration, and inclusivity in real estate design contexts.

3. How can the main challenges and advantages of implementing generative AI tools be incorporated into the deliberation process within design teams?
   This sub-question focuses on the development of a practical roadmap for integrating generative AI into design team deliberation. It addresses the key enablers and barriers of implementation and outlines strategies for effective adoption.

1.6 Concepts

Generative AI

Generative AI refers to advanced algorithms and computer systems that create new content based on input data and prompts, such as text, images, and simulations. Unlike predictive AI, which analyses historical data to forecast outcomes, generative AI creates new and original content by identifying and replicating patterns from existing data (Caballar, 2024). It can design complex scenarios, visualize design alternatives, and provide predictive insights that support collaborative planning (Geiser et al., 2024). In real estate development, generative AI allows design teams to explore various options by generating predictive scenarios and visualizations. These tools make it easier for team members to understand the potential outcomes of different approaches, enabling inclusivity and communication within design teams (Karacapilidis et al., 2024).

To me, generative AI is a powerful enabler of creativity and efficiency in complex processes. It is more than a tool for automation; it is a collaborator that bridges the gap between abstract ideas and tangible solutions.

Deliberation

Deliberation within design teams refers to a structured, collaborative process where team members come together to discuss and find common ground on project goals and design challenges. Academically, it is defined as sharing perspectives, considering trade-offs, and working toward cohesive solutions. Unlike basic decision-making, practical deliberation builds mutual understanding and alignment within the team. Deliberation requires inclusivity, structured interaction, and mutual respect among stakeholders (Garard et al., 2018).

For me, deliberation is about creating a space where everyone can share their thoughts and be heard. It is not about the decision itself but rather the path toward it. It is the moment when discussions occur, and all team members are actively involved. Deliberation allows for a rich exchange of ideas, enabling a deeper understanding of different perspectives and ensuring that decisions are grounded in thoughtful, inclusive conversations. This process plays a vital role in addressing complex challenges, fostering collaborative problem-solving, and ensuring that project outcomes reflect the collective input of the team.

Design team

As the context for this research, design teams provide the real-world environment in which deliberation and generative AI are explored. Design teams in real estate development consist of multidisciplinary professionals, including architects, engineers, project managers, and urban planners, working together to translate concepts into viable projects (Elforgani, 2010). Collaboration in these teams requires integrating diverse expertise and navigating complex project phases, from concept design to construction preparation. Clear communication, trust, and structured deliberation are critical for building a productive team dynamic.

Personally, I see a design team as a microcosm of diverse expertise and interests, where collaboration thrives not by erasing differences but by leveraging them. The development process's heart is where technical knowledge and creative vision converge to create innovative and well-rounded outcomes. A design team's strength is integrating varied perspectives, fostering a holistic approach to solving design challenges and achieving project objectives.

1.7 Assumptions

This study is based on several key assumptions that inform its research design and methodological choices.

First, it is assumed that stakeholder deliberation varies across the different phases of real estate design. The dynamics, timing, and intensity of deliberation are expected to differ depending on the specific phase, reflecting variations in decision scope, stakeholder involvement, and project constraints.

Second, the study assumes that generative AI tools are already being adopted to some extent by design teams, albeit inconsistently and often without formalised processes. While the level of use and the perceived effectiveness of these tools may vary across teams and organisations, their presence indicates a growing interest in leveraging AI to support collaboration and address complexity in multidisciplinary environments.

Third, it is assumed that the integration of generative AI into deliberation processes brings both challenges and opportunities. Anticipated challenges include resistance to change, concerns about data privacy, and gaps in technical expertise. However, these are balanced by potential advantages such as improved information structuring, enhanced visualisation of alternatives, and more inclusive engagement. It is further assumed that these challenges can be mitigated through the development of a well-structured roadmap that aligns AI integration with the deliberative practices and workflow realities of real estate design teams.

1.8 Relevance

This research aligns closely with the ambitions of the Gamechangers in Transitions Lab by exploring how generative AI can serve as a catalyst for structural change in complex societal settings. By examining the role of AI in supporting stakeholder deliberation, the study contributes to the lab's mission to identify emerging technologies that can facilitate purposeful and transformative change in urban development processes. In this context, generative AI is not viewed solely as a technical tool, but as a mechanism for improving how professionals engage in shared reasoning, reflect on diverse perspectives, and work toward integrated solutions in design practice.

From a scientific perspective, this research extends existing knowledge on the application of technology in collaborative processes. While much of the literature focuses on AI's ability to automate tasks, optimise workflows, or predict outcomes, this study shifts attention to its potential for fostering inclusive communication, clarifying team roles, and supporting interdisciplinary engagement in real estate design teams. It contributes to theoretical understandings of how technology influences team dynamics and co-creation within complex environments. Societally, improved deliberation processes can lead to real estate projects that are more responsive to community needs and better equipped to address environmental, spatial, and social challenges. By encouraging open dialogue and reducing the social pressures that often marginalise minority viewpoints, this research promotes a more democratic and inclusive approach to urban planning, one that fosters trust and ensures that a wide range of perspectives are reflected in the built environment.

1.9 Audiences and dissemination

This research is intended for professionals working in real estate development, particularly multidisciplinary design teams, project managers, and developers seeking to integrate generative AI into deliberative workflows. For NEOO, the findings provide practical guidance to support AI adoption in internal deliberative processes.

The study is also relevant to academic audiences in the fields of urban design, human–AI interaction, and collaborative planning. Its outcomes will be shared through a framework and

implementation strategy, a presentation to project partners, and, where possible, through professional and academic platforms to encourage broader reflection and application.

1.10 Personal study targets

Through this research project, I aim to achieve several personal and professional development goals that align with my aspirations in the built environment sector. My central objective is to deepen my understanding of generative AI technologies and their potential applications within real estate development. I hope to contribute insights that bridge the gap between theoretical knowledge and industry practice by exploring how these tools can support stakeholder deliberation.

A key component of this journey is my internship at NEOO, where I am gaining firsthand experience in a professional environment. This opportunity allows me to observe and participate in the inner workings of a real estate development company, including team collaboration, project workflows, and deliberation processes. I look forward to learning how generative AI can be integrated into these workflows and to understanding the challenges and opportunities that arise during implementation. This experience also helps prepare me for future professional roles by offering a practical understanding of working in a dynamic corporate setting.

While I enjoy the academic side of this research, I am also striving to develop my ability to express a clear personal perspective. Feedback from my supervisors has highlighted the importance of moving beyond academic rigour alone to incorporate critical analysis and interpretation. I see this as an opportunity to grow as a researcher who not only builds on existing theories but also contributes an original and thoughtful voice.

Working with NEOO, academic supervisors, and industry experts has also helped me develop my communication and interpersonal skills. Engaging with different stakeholders allows me to present complex ideas clearly and meaningfully, while also enriching the research through diverse perspectives.

Ultimately, this research supports both academic learning and the production of a practical deliverable, such as a roadmap for integrating generative AI into design teams. I am excited to explore how this can contribute to industry practice while also shaping my own growth and professional readiness.

1.11 Disclaimer

Given the rapid evolution of generative AI, this research acknowledges that emerging technologies may outpace its findings. The findings should therefore be understood within the technological and organisational context available at the time of the study.

2. Theoretical orientation

This chapter presents the theoretical foundations relevant to the topics explored in this study. It reviews key literature on generative AI, the practice of deliberation, and the structure and dynamics of design teams. The chapter outlines how each domain contributes to the broader theoretical landscape in which this research is situated.

2.1 Generative AI tools

Generative AI represents a groundbreaking advancement in artificial intelligence, providing innovative tools that enhance decision-making and collaboration in the design process (Stefaniak & Moore, 2024). At its core, generative AI creates new and original content by identifying and replicating patterns from existing data, offering flexible and creative solutions beyond the capabilities of traditional predictive methods (Caballar, 2024).

The evolution of generative AI spans decades, beginning in the 1950s with models like Hidden Markov Models (HMMs) and Gaussian Mixture Models (GMMs), which were primarily used to generate sequential data such as speech. These early developments laid the groundwork for more sophisticated techniques, including recurrent neural networks (RNNs) and Long Short-Term Memory (LSTM) networks, which improved natural language generation. A major leap occurred in 2014 with the introduction of Generative Adversarial Networks (GANs), which enabled the creation of high-quality images. This innovation paved the way for tools like Variational Autoencoders (VAEs) and diffusion models, significantly expanding the applications of generative AI. Today, Large Language Models (LLMs) such as ChatGPT have revolutionised content creation, leveraging vast datasets and advanced architectures to produce coherent and contextually relevant outputs, further enhancing the practical capabilities of generative AI (Cao et al., 2023).

A key distinction exists between predictive AI and generative AI, as the two serve fundamentally different purposes. Predictive AI analyses historical data to forecast outcomes, such as estimating future housing prices based on market trends or demographic information. In contrast, generative AI creates new outputs, such as designs, concepts, or text, that may not exist in the training data. Predictive AI answers specific questions, like estimating the impact of policy changes, while generative AI proposes creative solutions and alternatives (Feuerriegel et al., 2023). This research will focus exclusively on generative AI.

Generative AI models operate using advanced systems that can produce clear and meaningful outputs across various formats. For instance, Generative Adversarial Networks (GANs) are widely used to create realistic images, such as hyper-realistic renderings of urban landscapes, by combining two systems that work together: one generates potential outputs. At the same time, the other refines them to ensure quality (Feuerriegel et al., 2023). These capabilities make GANs valuable for visualizing complex architectural designs or generating variations of urban layouts. Similarly, transformer-based models like GPT use contextual understanding to generate clear and coherent text, supporting tasks such as summarizing discussions, drafting reports, or synthesizing stakeholder feedback in real estate design processes (Brown et al., 2020). Diffusion models specialise in generating highly detailed and controllable visual outputs, enabling realistic conceptual designs and scenario simulations by refining images through a stepwise noise removal process (Ho et al., 2020).

I believe that generative AI's ability to create new content, visualise complex ideas, and explore diverse alternatives makes it a transformative collaborator in deliberative contexts. Bridging gaps in understanding fosters more inclusive and informed conversations where different voices and perspectives can be heard. This potential is especially valuable in design teams, where generative

AI can support stakeholders in exploring scenarios, reaching mutual understanding, and working toward shared agreements.

2.1.1 Capabilities of generative AI tools

Generative AI tools offer a wide range of technical capabilities that make them highly valuable in collaborative environments. One of their core strengths lies in visualising complex and abstract information, enabling stakeholders to better understand and engage with scenarios that might otherwise remain inaccessible. For instance, tools such as UrbanGenAI apply generative AI models like SDXL to produce visual representations of urban layouts or architectural design alternatives (Kapsalis, 2024). These visualisations allow design teams to evaluate trade-offs and assess feasibility in early planning stages.

In addition to static visualisations, generative AI tools support dynamic scenario modelling, where teams can explore the outcomes of different decisions based on environmental, economic, or spatial variables. This helps anticipate potential challenges and supports data-informed planning (Feuerriegel et al., 2023). Scenario modelling enhances design deliberation by making complexity visible and enabling more strategic exploration of "what-if" scenarios.

Furthermore, Large Language Models (LLMs), such as GPT-4, provide valuable communication support. These tools generate text in natural language, allowing them to summarise meetings, synthesise stakeholder inputs, or draft stakeholder communications with clarity and consistency (Karacapilidis et al., 2024). This capacity helps maintain shared understanding in multidisciplinary teams and reduces the administrative burden associated with documentation.

A final capability lies in the personalisation of output. Generative AI can tailor content to specific audiences or decision-making contexts, enabling more relevant and accessible communication. For example, AI-generated outputs can be adapted to align with stakeholders' roles, backgrounds, or knowledge levels, ensuring that each participant receives information in a format that supports their engagement (Feuerriegel et al., 2023). This level of customisation helps foster inclusive dialogue and increases the relevance of deliberative interactions.

From my perspective, these technical capabilities make generative AI a powerful enabler of more inclusive, informed, and responsive collaboration. By transforming complex data into understandable formats, facilitating scenario thinking, and tailoring communication to diverse audiences, generative AI tools support clearer dialogue and more equitable engagement. Especially in multidisciplinary design teams, these functions can help bridge knowledge gaps, reduce miscommunication, and enhance the overall quality of deliberation.

2.1.2 Opportunities of generative AI tools in deliberation

The application of generative AI in deliberative processes presents significant opportunities to improve how multidisciplinary teams collaborate. A major advantage is its ability to make deliberation more inclusive. By generating accessible and multimodal outputs, such as visual, textual, or simulated content, generative AI helps close the gap between experts and non-experts, allowing all stakeholders to meaningfully participate in discussions (Karacapilidis et al., 2024; Zhang et al., 2023). This is particularly valuable in real estate development, where complex spatial, technical, and financial issues intersect.

Generative AI also contributes to efficiency and clarity by automating time-consuming tasks such as drafting reports, structuring meeting summaries, or organising key discussion points. These automated functions enable participants to focus more on creative thinking and strategic deliberation rather than routine documentation (Karacapilidis et al., 2024).

Another opportunity lies in real-time collaboration and adaptability. AI-powered simulations and live scenario tools enable teams to dynamically adjust parameters, visualise consequences, and iterate on designs collectively. These features support deeper engagement, as stakeholders can see the effects of proposed changes immediately and adjust their reasoning accordingly (Landemore, 2022; Kapsalis, 2024).

Moreover, generative AI enhances reflective learning within teams. By interacting with AI-generated insights, participants can revisit previous decisions, identify recurring biases, and refine shared values. These capabilities strengthen transparency and accountability, while also enabling long-term improvement of deliberative practices (Zhang et al., 2023).

From my perspective, the opportunities offered by generative AI tools hold great promise for strengthening deliberative processes. Their capacity to visualise complex ideas, support real-time scenario exploration, and personalise communication can enhance inclusivity, responsiveness, and mutual understanding in multidisciplinary teams. These features do not merely streamline collaboration but open new pathways for deeper engagement, allowing participants to think together in more creative, reflective, and equitable ways.

2.1.3 Organisational requirements for implementation of AI in deliberation

Despite the promising capabilities and opportunities of generative AI, its successful implementation depends heavily on organisational preparedness. Generative AI cannot be considered a plug-and-play solution. Instead, its integration into design workflows must be viewed as both a technological and organisational change process.

First, practical considerations must be addressed to build trust in AI-supported processes. Issues such as data quality, output transparency, and the potential for biased or misleading content, so-called “hallucinations”, require explicit attention (Feuerriegel et al., 2023). Ensuring the explainability of AI outputs is critical for maintaining confidence among stakeholders, particularly when AI contributes to high-impact decisions.

In addition, the change management literature underlines the importance of structural and cultural readiness. Successful adoption of AI in the AEC sector depends on an organisation’s capacity to adapt workflows, redefine roles, and support behavioural change among professionals (Maali, 2019; Karlsson, 2020). This includes setting up leadership structures, developing internal champions, and offering ongoing training and guidance to support adoption over time.

Furthermore, organisational conditions such as open communication, psychological safety, and a willingness to experiment play a decisive role in determining whether generative AI tools will be used effectively or remain underutilised (Karlsson, 2020). Without this foundation, even well-designed tools risk becoming symbolic innovations with limited practical impact.

From my view, this means that the real potential of generative AI unfolds not simply through tool availability, but through the ecosystem that surrounds its use. Implementation strategies must therefore account for organisational culture, stakeholder readiness, and the capacity to iterate and adapt tools in practice. Only under these conditions can generative AI realise its full potential in supporting dynamic, inclusive, and future-oriented deliberation.

2.1.4 Challenges of generative AI tools in deliberation

While generative AI holds transformative potential for improving deliberation, it is crucial to carefully manage the associated risks to ensure transparency, trustworthiness, and the overall quality of the

deliberative processes (Kalampokis et al., 2024). If unaddressed, these risks could undermine the inclusivity and innovation that generative AI seeks to promote.

A primary concern is the potential for generative AI to produce factually incorrect information or "hallucinations" resulting from flawed training data or reasoning errors. For instance, a generative model summarising complex urban planning proposals might generate misleading or incorrect summaries, leading to stakeholder misunderstandings. Such inaccuracies necessitate robust quality control mechanisms to filter out irrelevant or inappropriate content and ensure the reliability of deliberative processes (Karacapilidis et al., 2024). Furthermore, the transparency and explainability of AI models are critical for fostering trust among participants. To maintain confidence in the system, stakeholders must understand the rationale behind AI-generated outputs, especially in tasks like scenario simulations or decision-support tools (Kalampokis et al., 2024).

Another significant risk is the possibility of generative AI perpetuating biases inherent in its training data. These biases can result in outputs reinforcing systemic inequities, potentially marginalising certain groups or distorting deliberative inclusivity (Zhang et al., 2023). For example, if training data disproportionately reflects the preferences of specific demographics, the AI might favour solutions that exclude minority perspectives. Generative AI tools also present the challenge of over-standardization. By relying heavily on existing patterns and biases, these systems may constrain creativity and limit the exploration of unconventional ideas. While efficiency is a notable advantage, it must not come at the expense of diverse and innovative solutions. Striking a balance between generating familiar, coherent content and fostering creativity is essential to avoid outputs that lack originality and fail to provoke new ideas (Mukherjee & Chang, 2023).

Additionally, generative AI systems can inadvertently generate toxic or offensive language influenced by biases in the data on which they were trained. This risk is particularly concerning in contexts involving public deliberation or sensitive topics, where maintaining respectful communication is essential. Implementing AI-driven fact-checking tools and toxicity filters is critical to preserving the integrity of deliberative discussions (Karacapilidis et al., 2024). Beyond these risks, privacy concerns also present a significant challenge. Using sensitive or proprietary data to train generative models can lead to risks such as unauthorised data use, lack of transparency, and challenges obtaining or modifying stakeholder consent (Zhang et al., 2024). In deliberative contexts, where sensitive stakeholder data or proprietary designs are often used, addressing privacy issues is essential to maintaining trust and transparency.

From my perspective, while generative AI offers transformative potential, it introduces risks such as over-standardization, biases in training data, hallucinations, and the misuse of tools due to limited stakeholder expertise. These challenges can hinder creativity, perpetuate inequalities, and lead to over-reliance on AI outputs, potentially undermining inclusivity and trust in deliberative processes. Addressing these risks requires a balanced approach that combines technical oversight, stakeholder education, and ethical safeguards. In the context of deliberation, such measures are essential to ensure that AI supports open dialogue, mutual understanding, and equitable participation rather than constraining or distorting them.

2.1.5 Industry adoption and insights

Practical insights from a generative AI masterclass at NEOO and the industry conference "Versnellen door AI & Digitalisering in de Bouw en Vastgoed" (2025) confirm that the integration of generative AI is gaining momentum in the real estate and construction sectors. These events emphasised AI's potential to support scenario modelling, streamline workflows, and facilitate inclusive dialogue in design teams. At the same time, both highlighted organisational barriers, such as change resistance, skills gaps, and regulatory challenges, that must be addressed to realise this

potential. These findings support the theoretical assumptions of this research and underline the need for a structured, practice-oriented framework for AI adoption in deliberative processes. A complete account of these industry insights is provided in Appendix A.

2.2 Deliberation

Deliberation refers to a structured process of collective reflection in which participants exchange perspectives, consider different viewpoints, and work toward mutual understanding and informed judgment. Rather than defending fixed positions, deliberation encourages participants to remain open to new information and to adapt their views based on reasoned argumentation and the claims made by others (Garard et al., 2018). This process plays a critical role in design teams within real estate development, enabling the integration of diverse viewpoints. Unlike negotiation or debate, deliberation emphasises mutual understanding and critical engagement rather than defending positions or seeking compromise (Forester, 2006).

In collaborative design practices, deliberation is not merely about concluding. It is a social process where design representations are negotiated among team members, ensuring that agreements are informed and reflective of diverse perspectives. This thoughtful exchange of knowledge and beliefs is essential for effective collaboration (Rapanta & Blair, 2011).

Deliberation is also characterised as a process that encourages input and participation from all group members, allowing them to discuss and reflect on decisions that impact them. It combines public deliberation and internal reflections to support more profound, intentional conversations that lead to inclusive and thoughtful agreements (Zhang et al., 2023). This process aligns with the principles of transparency, accountability, and inclusivity, involving diverse stakeholders such as civil society, media, and corporate actors in exploring and evaluating complex issues like the implications of AI technologies (Buhmann & Fieseler, 2021).

A key distinction exists between deliberation, negotiation, and debate, each serving different purposes and dynamics. Deliberation emphasizes collective reflection and inclusivity, fostering thoughtful dialogue where participants collaboratively explore diverse perspectives to reach informed agreements (Zhang et al., 2023). In contrast, negotiation adopts a more competitive approach, focusing on achieving mutually beneficial agreements through bargaining and compromise, often shaped by psychological factors, social contexts, and participants' subjective understanding of the negotiation process (Bazerman et al., 2000). Debate, meanwhile, is a structured exchange where participants present and defend opposing viewpoints on a specific topic, aimed at developing critical thinking and supporting decision-making, particularly in educational or formal settings (Lopez Garcia et al., 2016). For this research, deliberation will be the primary focus.

From my perspective, deliberation is an indispensable process for design teams. It offers a structured approach to thoughtful collaboration, inclusivity, and mutual respect. By engaging diverse stakeholders in reflective dialogue, deliberation enables teams to navigate complex challenges, explore innovative ideas, and arrive at informed and equitable agreements.

2.2.1 Key elements of deliberation

One central element of deliberation is inclusivity, which emphasizes the importance of involving diverse stakeholders to ensure all voices are heard. This approach allows for a broader range of perspectives, enriching discussions and fostering shared understanding, particularly when addressing complex issues or marginalized viewpoints (Buhmann & Fieseler, 2021; Zhang et al., 2023). Thoughtful exchange is another critical component, encouraging participants to engage

reflectively, consider alternative viewpoints, and weigh options carefully before agreeing (Forester, 2006).

Structured interaction provides a framework to navigate complex discussions, ensuring focus on objectives while facilitating meaningful dialogue. This structure often includes techniques such as facilitation, where a moderator ensures equitable participation and transparency to build participant trust (Caluwaerts et al., 2023; Garard et al., 2018). Mutual respect underpins the process, fostering constructive engagement with different viewpoints and promoting a culture of understanding rather than confrontation (Zhang et al., 2023).

Additionally, deliberation is characterised by critical engagement and reflection, where participants assess arguments and explore agreements' social, ethical, and practical implications. This approach enables collective exploration and negotiation of meanings, resolving differing understandings and interests (Rapanta & Blair, 2011). The iterative nature of deliberation also allows for revisiting and refining ideas, which ensures agreements are robust and aligned with shared goals (Rapanta & Blair, 2011).

From my perspective, deliberation is not merely a discussion mechanism but a thoughtful, inclusive, and iterative process. By integrating these elements, deliberation supports collaborative innovation, ensures transparency and accountability, and aligns agreements with societal values. Its structured yet flexible nature makes it a powerful tool for navigating complexity and achieving consensus in design teams and beyond.

2.2.2 Challenges of deliberation

While deliberation is a valuable tool, it is fraught with challenges that can hinder its effectiveness, particularly in design contexts. These challenges span technical, social, and structural dimensions, highlighting the need for careful facilitation and thoughtful design to achieve meaningful and inclusive outcomes.

One significant challenge is participant diversity. While including diverse perspectives enriches deliberation, it can complicate discussions, particularly when participants have conflicting values or goals. Balancing these differing viewpoints often requires effective communication and conflict resolution, as unresolved tensions may derail the process (Garard et al., 2018; Rapanta & Blair, 2011). Power dynamics further exacerbate these issues, as imbalances can marginalize certain voices, particularly those from less organized or weaker groups, thereby undermining inclusivity (Buhmann & Fieseler, 2021).

Technical opacity is another barrier, especially in contexts involving complex technologies like AI and machine learning. Stakeholders often struggle to engage meaningfully due to their limited understanding of these systems, challenging informed participation (Zhang et al., 2023). Access to information compounds this challenge, as participants require comprehensive and transparent data to fully comprehend the implications of deliberative agreements (Buhmann & Fieseler, 2021). Without adequate support, non-expert stakeholders may feel excluded, reducing the effectiveness of the process.

The balance between reflection and deliberation is further complex, as individual contemplation and group discussion are essential for effective outcomes. However, integrating these elements seamlessly is difficult, as group-level insights may overshadow individual reflections or vice versa (Zhang et al., 2023). Similarly, the iterative nature of design problems often leads to frequent shifts in focus, disrupting deliberative coherence and making it difficult to maintain momentum (Rapanta & Blair, 2011).

Resource constraints also play a critical role, limiting the ability to employ skilled facilitators, hold multiple workshops, or provide the necessary tools for successful deliberation. This can impact trust-building and the quality of dialogue (Garard et al., 2018). Furthermore, structural challenges in organizing deliberation, such as setting clear roles, maintaining transparency, and ensuring actionable outcomes, require meticulous planning. Ambiguities in participation and competing claims among stakeholders often result in misunderstandings and hinder consensus-building (Forester, 2006).

Finally, biases and fairness present persistent challenges. Historical data and decision-making practices often carry inherent biases, which deliberation processes may inadvertently perpetuate. Addressing these biases requires deliberate efforts to ensure fairness, equitable participation, and prioritising marginalised perspectives (Zhang et al., 2023).

From my perspective, these challenges show the complexities of deliberation and the importance of thoughtful facilitation, inclusive design, and ongoing reflection. While deliberation has immense potential to drive informed and collaborative dialogue, addressing these barriers is essential to ensure its effectiveness, equity, and long-term impact.

2.3 Design teams

Design teams serve as the practical context in which the core concepts of this research, generative AI and deliberation, are applied and explored. While generative AI offers technological advancements and deliberation forms a component of collaborative work, design teams represent the real-world setting in which these concepts can be explored, particularly within the multidisciplinary workflows of real estate development.

A design team in the context of construction projects refers to a multidisciplinary group of professionals who collaborate to create architectural and engineering solutions. These teams typically consist of specialists such as architects, project managers, structural engineers, mechanical and electrical engineers, and quantity surveyors, whose collective expertise is vital for translating client requirements into practical and innovative design outcomes (Elforgani, 2010).

Design teams are characterized by their collaborative structure, where members from various disciplines share complementary knowledge and skills. This collaboration fosters a mutual commitment to a shared purpose, defined performance goals, and joint accountability for project results (Svalestuen et al., 2015). A design team's success is intrinsically linked to its ability to integrate diverse perspectives, coordinate efforts, and deliver efficient, constructible designs.

From my perspective, design teams are more than a collection of individuals; they represent a cohesive and purpose-driven unit capable of addressing the complexities of construction projects. Their multidisciplinary nature and collaborative approach ensure that diverse expertise is harnessed effectively to meet client needs and achieve optimal outcomes.

2.3.1 Collaboration dynamics of the design team

Collaboration within design teams is a cornerstone of successful project outcomes, particularly in the architecture, engineering, and construction (AEC) industry, where multidisciplinary expertise is essential. Design collaboration involves integrating diverse perspectives, coordinating tasks, and resolving conflicts to achieve balanced outcomes that address competing objectives such as safety, reliability, performance, and cost (Ren et al., 2011). Effective collaboration is especially critical in modern building design, where complexity necessitates dynamic communication and advanced approaches to teamwork.

Design teams often adopt collaborative frameworks that promote interaction among members with varying specializations. These frameworks range from traditional face-to-face meetings to innovative methods (Ren et al., 2011). In integrated design processes, teams rely on shared approaches to facilitate real-time collaboration, reducing errors and improving constructability. This shared approach enhances performance by fostering trust, improving communication, and allowing for the seamless integration of design services (Eastman et al., 2008). Trust among team members is particularly vital, as it encourages open dialogue, promotes collaborative problem-solving, and ensures that individual contributions align with the team's goals (Svalestuen et al., 2015).

Collaboration in design teams is not without challenges. Issues such as reluctance to share models due to liability and intellectual property concerns can hinder the free flow of information, limiting the potential for collaboration. Overcoming this requires building trust and fostering strong relationships among team members, particularly between designers and other stakeholders (Smith, 2016). Additionally, the fragmented nature of traditional project delivery and diverse organizational cultures within integrated teams can create barriers to effective collaboration, which must be addressed through relational contracting and clear communication protocols (Forgues & Koskela, 2009).

Advancements in technology have transformed collaboration dynamics, introducing tools for synchronous and asynchronous communication that enable real-time interactions and iterative design processes. For instance, Building Information Modeling (BIM) environments facilitate data integration and improve design decision-making by providing a centralized platform for coordination (Chong et al., 2016). Similarly, computer-mediated tools, such as shared drawing environments and video conferencing, enhance synchronous collaboration and allow teams to navigate complex design challenges more effectively (Gross et al., 1998).

From my perspective, collaboration in design teams is both an art and a science. Trust, technology, and effective communication form the foundation for successful teamwork. By integrating diverse perspectives and leveraging advanced tools, design teams can overcome traditional barriers and achieve innovative, cohesive, and efficient outcomes. Collaboration is not merely about task division but creating an environment where collective expertise drives the project toward shared success.

2.3.2 Design phases in the Netherlands

The design phases in the Netherlands provide a structured approach for real estate development projects and define the specific stages where deliberation occurs within design teams. This explanation is informed by academic literature and industry conventions observed during my time at NEOO. These phases serve as the context for exploring how generative AI can support deliberation by addressing challenges unique to each stage.

In the Netherlands, the design process for real estate development follows a structured progression through five main phases: Sketch Design (Schetsontwerp, SO), Concept Design (Voorlopig Ontwerp, VO), Definitive Design (Definitief Ontwerp, DO), Technical Design (Technisch Ontwerp, TO), and Construction-ready Design (Uitvoeringsgereed Ontwerp, UO). These phases systematically translate abstract concepts into actionable plans, ensuring compliance with functional, regulatory, and aesthetic requirements. This structure facilitates collaboration among stakeholders, iterative refinement of designs, and risk management, forming a cornerstone of effective project delivery.

The design process begins with the Sketch Design (SO) phase, where the project's scope, objectives, and constraints are defined. High-level project briefs and feasibility studies serve as the foundation for subsequent phases. This early stage is crucial for aligning diverse stakeholder visions and addressing uncertainties, as decisions made here significantly influence the project's trajectory. Elforgani (2010) noted that early design phases like these are particularly impactful because they shape the project's sustainability, feasibility, and effectiveness at minimal cost.

During the Concept Design (VO) phase, architects and planners develop schematic designs that balance functionality, aesthetics, and environmental considerations. Preliminary drawings, rough cost estimates, and stakeholder feedback are integral to this phase, where clear communication is critical to refining concepts and avoiding misalignment among team members. Smith (2016) highlights how information needs to evolve at this stage, requiring flexibility to address changing priorities and emerging feedback.

The Definitive Design (DO) phase involves translating refined concepts into coordinated and technically sound plans. Structural, mechanical, and electrical engineers contribute to aligning design intent with technical feasibility, ensuring that systems are well integrated. This phase results in detailed design documents that serve as the basis for further technical elaboration, including preliminary specifications and cost estimates. However, reconciling design ambitions with engineering constraints and budget limitations remains a challenge, as Ren et al. (2011) note in their analysis of interdisciplinary collaboration during advanced design phases.

The Technical Design (TO) phase focuses on the technical elaboration of the design, developing the practical documentation required for execution, such as blueprints, procurement plans, and detailed schedules. Close collaboration with contractors ensures the design is constructible and aligns with on-site realities. Eastman et al. (2008) stress the importance of this collaboration in reducing errors and conflicts during construction, which are often identified and resolved in this preparatory stage.

The final phase, Construction-ready Design (UO), marks the transition from design to building. This phase involves completing and distributing the construction-ready drawings and specifications required for execution. All necessary regulatory approvals are secured at this stage. Coordination among the design team, contractors, and other stakeholders ensures a seamless transition into the construction phase. Effective communication remains critical to resolve any remaining ambiguities and ensure all parties are aligned before physical construction begins.

From my perspective, this phased approach provides a clear structure for managing the technical, functional, and aesthetic aspects of real estate development. Understanding the different design phases is essential for my research because the nature of deliberation changes throughout the process. Each phase involves different stakeholders, whose roles and priorities influence the dynamics of collaboration and collective exploration of ideas and solutions. By examining these variations, my research can better address how generative AI tools support deliberation across the project lifecycle.

2.3.3 Opportunities for collaboration in the design team

Collaboration within design teams presents numerous opportunities to enhance project outcomes, foster innovation, and improve efficiency. Effective collaboration allows design teams to leverage the collective expertise of multidisciplinary professionals, achieving results that surpass individual efforts. By integrating diverse perspectives and fostering an environment of trust and mutual respect, design teams can optimize functions, minimize costs, and reduce errors throughout the design process (Kvan, 2000; Ren et al., 2011).

One key opportunity lies in the potential for collaboration to drive innovation. Integrating diverse skill sets and viewpoints creates fertile ground for creative solutions addressing complex design challenges. For instance, multidisciplinary team composition, as seen in educational settings, demonstrates how architects, engineers, and project managers can collectively produce more comprehensive and innovative outcomes (O'Brien et al., 2003).

Collaboration also enhances the efficiency of the design process using advanced tools and methods. Computer-mediated technologies, such as synchronous collaboration platforms and shared digital environments, enable geographically dispersed teams to engage in real-time discussions and share design iterations interactively. These tools streamline communication and facilitate better coordination and alignment among team members (Gross et al., 1998).

Furthermore, integrated design teams benefit from iterative processes, where continuous feedback and refinement lead to improved problem-solving and adaptability throughout the project lifecycle (Forgues & Koskela, 2009).

Another significant opportunity lies in collaborative design workshops, such as design charrettes. These intensive sessions bring together a wide range of expertise to address design challenges early in the process. By involving all relevant stakeholders, design charrettes facilitate faster decision-making, conserve resources, and mitigate potential conflicts, ultimately leading to more streamlined and effective project delivery (Elforgani, 2010).

Collaboration also fosters more substantial commitment and belonging within the team. Creating an inclusive and engaging project environment encourages team members to actively contribute while involving them in planning enhances accountability and alignment with project goals. Techniques like brainstorming sessions and participatory scheduling reinforce collaboration and ensure that all disciplines are committed to the project timeline (Svalestuen et al., 2015).

From my perspective, collaboration within design teams provides a crucial foundation for effective deliberation. Integrating diverse expertise, open communication, and shared ownership over the design process creates the conditions for meaningful dialogue and joint exploration of ideas. Understanding these collaborative dynamics is essential for this research, as it sheds light on where and how generative AI could support deliberative practices.

2.3.4 Challenges of collaboration in the design team

Collaboration in design teams, while essential for achieving effective and innovative outcomes, is fraught with challenges that can hinder its success. A significant challenge lies in the misconception that effective teamwork is a true collaboration. Many teams operate cooperatively or compromise without fully leveraging the potential of collaborative efforts, leading to suboptimal outcomes (Kvan, 2000). This is exacerbated by the demanding nature of collaboration, which requires a higher level of commitment, trust, and relationship-building among team members. These attributes often take time to develop, particularly in short-term project environments (Svalestuen et al., 2015).

The diverse and fragmented nature of design disciplines further complicates collaboration. Professionals from various fields, such as architecture, engineering, and quantity surveying, often have a limited understanding of each other's requirements and constraints, leading to miscommunication and task misalignment (Ren et al., 2011). This lack of shared knowledge is particularly evident in multidisciplinary projects where balancing competing objectives, such as cost, functionality, and aesthetics, requires the effective integration of diverse perspectives.

Technological and logistical barriers also pose significant challenges. Traditional collaboration methods, such as face-to-face meetings, often face scheduling conflicts and technical difficulties, including incompatible file formats and inefficient data management systems (Gross et al., 1998b). While digital tools offer potential solutions, their adoption is not without issues. For instance, reliance on technology for communication can sometimes result in misunderstandings or delays, and the lack of explicit agreements on communication protocols and decision-making rules can further hinder alignment among team members (Forgues & Koskela, 2009).

Power dynamics within teams present another challenge, as imbalances can marginalize certain voices and impede equitable participation. In integrated teams, the temporary nature of collaborations and the absence of established working relationships can exacerbate these issues, leading to socio-cognitive barriers and a lack of trust among team members (Forgues & Koskela, 2009).

In my view, understanding these challenges is critical, as they directly shape the quality and inclusivity of deliberation within design teams. Issues such as fragmented expertise, communication breakdowns, and unequal participation can limit the open exchange of perspectives and hinder the ability of teams to arrive at well-informed, collectively supported outcomes. These barriers also reveal concrete entry points where generative AI may offer added value, for instance, by supporting more transparent communication through visualisations or real-time translation, enhancing inclusivity through objective synthesis of inputs, and reducing misunderstandings via scenario exploration and predictive feedback.

2.3.5 The Double Diamond Model

Initially developed by the UK Design Council in 2004, the Double Diamond model is a widely recognised framework for structuring design processes. It divides the design journey into four phases: Discover, Define, Develop, and Deliver, which are organised within two diamonds representing cycles of divergent and convergent thinking. The first diamond focuses on “doing the right things” by identifying and framing the problem, while the second emphasises “doing things right” through the development and delivery of practical solutions (Gustafsson, 2019; Wang et al., 2023).

This model has become popular for guiding practical design work and as a reflective tool to understand the design process. Although the original model presents a standardized structure, scholars and practitioners acknowledge the value of customizing it to project-specific needs, especially in complex and interdisciplinary contexts such as real estate development (Gustafsson, 2019).

Within design teams, the Double Diamond model offers more than a linear progression; it represents a flexible and iterative structure that accommodates uncertainty, collaboration, and adaptation. Its phases naturally align with key moments of deliberation, which in this context are understood as inclusive dialogue, critical reflection, the exchange of multiple viewpoints, and the pursuit of shared understanding. For example, the Discover phase invites broad input and open-ended exploration, often requiring teams to make sense of diverse stakeholder needs. The Define phase involves narrowing down and collectively agreeing on a problem scope. The Develop and Deliver phases build on this shared understanding to test ideas, weigh trade-offs, and implement agreed-upon directions.

Notably, the Double Diamond model also serves as an analytical lens for this research. It enables a structured examination of where and how deliberation unfolds in practice and where generative AI could offer meaningful support. For instance, AI tools help synthesise stakeholder input during the

Discover phase, visualise design alternatives in Develop, or simulate outcomes to support trade-off discussions in Define and Deliver. By linking AI capabilities to distinct phases of the model, this research aims to map both AI's current and potential roles in supporting deliberative processes in real estate design teams.

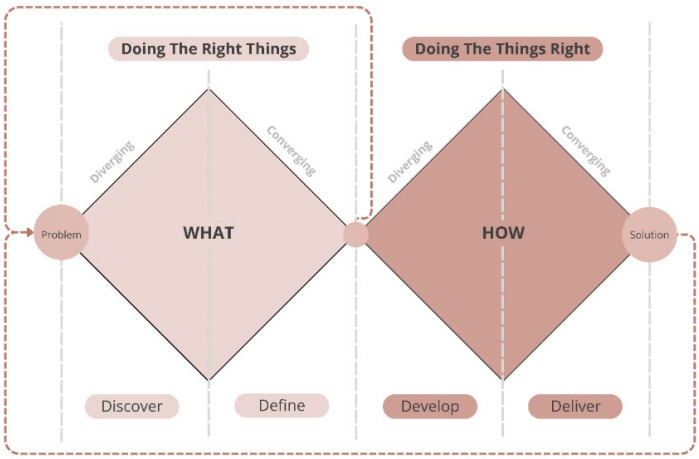

Figure 1: Double Diamond Model (Based on UK Design Council, 2005)

2.3.6 BOB-model

The BOB model, *Beeldvorming*, *Oordeelsvorming*, and *Besluitvorming* (Situation assessment, Judgment formation, and decision-making), offers a structured yet dynamic approach to collective decision-making. Originally developed in the Dutch crisis management domain, it is increasingly relevant to complex, multidisciplinary processes such as real estate design.

The model guides teams through three interconnected phases: developing a shared understanding of the situation, evaluating challenges, generating solutions, and making informed decisions. Rather than a linear sequence, BOB is a cyclical process that allows teams to revisit earlier stages as new information emerges
(Schraagen et al., 2015).

This research uses the BOB model to analyse how different forms of deliberation unfold during real estate design processes, and to structure the empirical findings on stakeholder interactions across distinct phases of reasoning. By aligning interview insights with the BOB phases, namely Beeldvorming, Oordeelsvorming, and Besluitvorming, the model provides a lens for understanding how generative AI can support teams in navigating complex decisions through structured yet iterative deliberation.

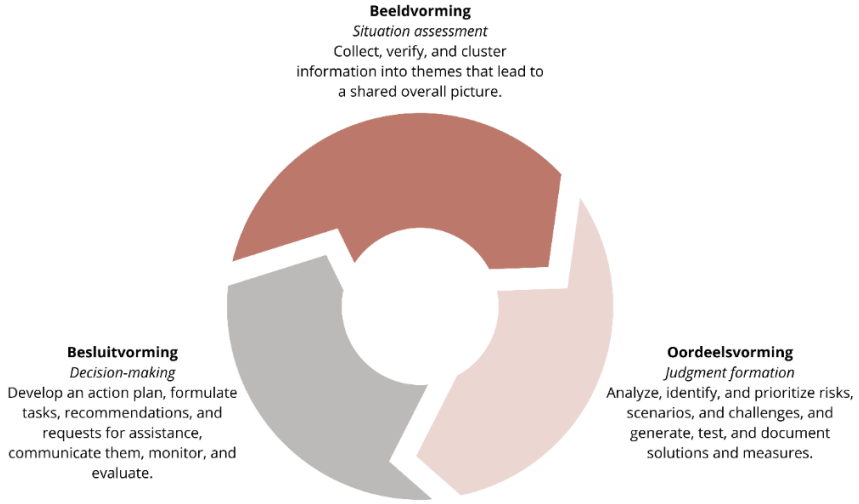

Figure 2: BOB-model (based on Schraagen et al., 2015)

2.4 Deliberation within the design team

Deliberation within multidisciplinary design teams refers to a structured and reflective process in which professionals collaboratively evaluate spatial, technical, regulatory, and commercial considerations before making final design decisions. These discussions involve multiple disciplines such as architecture, engineering, and project management, each contributing specialised knowledge and distinct perspectives. In this context, deliberation is essential for shaping well-informed and coherent design outcomes (Den Otter & Emmitt, 2008).

Typical deliberative topics in real estate design teams include the integration of technical and aesthetic requirements, trade-offs between sustainability and feasibility, adaptability for future tenants, and compliance with legal frameworks. These exchanges are not about defending fixed positions but about constructing shared reasoning through critical engagement and structured argumentation (Forester, 2006). The internal deliberation process enables design teams to refine proposals collaboratively before involving external stakeholders such as municipalities, financiers, or future users.

It is important to distinguish between deliberation and decision making, as they serve different purposes. Deliberation is an exploratory phase, focused on weighing perspectives, evaluating options, and building mutual understanding. It is a process rooted in justification, reflection, and critical dialogue (Barabas, 2004). In contrast, decision making marks the moment when a choice is finalised, which may happen through consensus, by hierarchical authority, or by relying on algorithmic recommendation systems (Auliya et al., 2024). In real estate design teams, for example, deliberation might take place when team members evaluate multiple material options, while the actual selection might be made unilaterally by the project manager.

The need for deliberation is especially strong in real estate development due to the interdependent nature of design choices. Unlike linear decision-making processes, where individual decisions can be treated in isolation, real estate design involves a continuous negotiation of priorities across disciplines. A change in one area, such as façade materials, may have implications for structural engineering, sustainability ratings, cost estimates, or delivery timelines (Geiser et al., 2024). Without structured deliberation, these interconnections are often overlooked, resulting in fragmented decision making, project delays, and costly redesigns (Stefaniak and Moore, 2024). Structured deliberation helps ensure that technical feasibility, regulatory constraints, sustainability ambitions, and stakeholder visions are considered in an integrated and timely manner.

This research focuses specifically on deliberation within the design team, as this is the primary setting where interdisciplinary expertise is integrated and where fundamental design refinements occur. This internal process is a subset of the broader design deliberation that may include external actors such as urban planners, investors, and user groups. While external deliberation is important for project legitimacy and alignment with broader societal goals, internal deliberation is crucial for developing technically sound and strategically aligned proposals that can be brought to these wider discussions.

It should be acknowledged that not all project decisions require deliberation. Some choices are made through hierarchical command structures, particularly under time pressure or when technical expertise is concentrated in a single role. Others may be delegated to algorithmic systems that optimise decisions based on quantitative models (Auliya et al., 2024). Additionally, some decisions are strictly regulated by building codes or legal constraints, leaving little room for deliberation. Although these alternative approaches can enhance efficiency, they lack the critical engagement, shared reflection, and creative negotiation that deliberation offers. Therefore,

deliberation is particularly valuable in situations where trade-offs must be evaluated, conflicting priorities must be reconciled, or long-term implications must be considered.

2.5 Conclusion theoretical orientation

This chapter has presented the theoretical foundation of the research by exploring generative AI, deliberation, and design teams. It has shown how each concept contributes to the research context and how their integration offers new opportunities for supporting deliberative practices in the built environment.

Generative AI brings substantial opportunities for enhancing collaboration and reflection within multidisciplinary teams. It supports visualisation of complex information, facilitates inclusive communication, and automates repetitive tasks, all of which help design teams to focus on meaningful engagement. These technical capacities become especially relevant in deliberative processes, where the aim is to generate shared understanding through critical and inclusive dialogue.

At the same time, implementing generative AI in real-world settings requires careful consideration. Organisational structures must be adapted, team members need time to build trust in new technologies, and ethical challenges such as bias and transparency must be actively addressed. Without these conditions in place, the risk is that AI becomes a superficial addition rather than a transformative support for collaboration and reflection.

The literature on deliberation clarifies that it differs from other forms of interaction, such as negotiation or decision-making. Deliberation focuses on collective reflection and the exchange of arguments, rather than on defending individual interests or reaching a quick conclusion. In the context of real estate development, deliberation within the design team plays a vital role in integrating different viewpoints and navigating trade-offs between technical, aesthetic, and regulatory demands.

Design teams form the operational setting of this research. They are more than groups of individuals working toward a shared goal. They are spaces in which collaboration, reflection, and decision-making unfold. Although collaboration and deliberation are distinct concepts, they are closely related. Collaboration refers to the process of working together to complete tasks, while deliberation concerns the quality of the dialogue and reasoning that underpins decisions. This study focuses on deliberation but does so within the collaborative structure of design teams.

From my perspective, generative AI holds great promise for enriching deliberation. By reducing linguistic and cognitive barriers, and by enabling new ways to explore scenarios and structure dialogue, AI can support teams in becoming more inclusive, creative, and effective. Yet this potential can only be realised if organisations are willing to evolve. Real impact lies not only in the capabilities of the technology, but in the mindset with which it is applied.

3. Conceptual framework

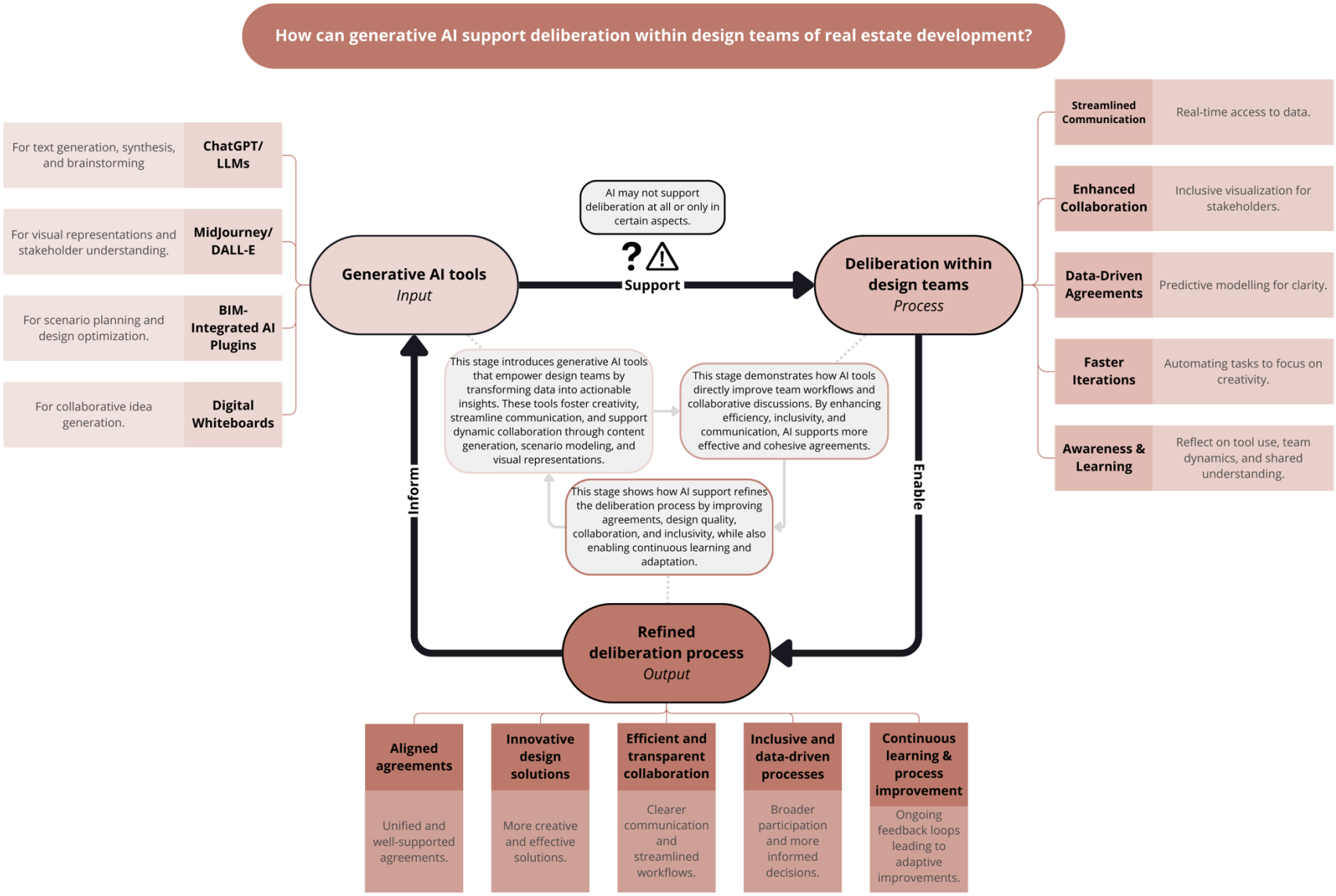

Figure 3: Conceptual framework (own work)

This chapter presents the conceptual framework developed to investigate how generative AI can support deliberation in multidisciplinary design teams. Building on the theoretical foundations discussed in the previous chapter the framework offers a structured perspective on how these elements interact in practice.

The framework is organised into three interconnected stages: input, process, and output. Its cyclical structure reflects the iterative character of deliberation. As teams engage with AI-supported deliberation, they generate insights that influence both project outcomes and the way deliberation is practiced. In turn, these experiences inform the ongoing development of AI tools. This feedback loop ensures that deliberation remains adaptive to evolving project needs and stakeholder relationships, thereby reinforcing the relevance and effectiveness of AI in design environments.

3.1 Input

The input stage introduces generative AI tools as foundational elements supporting design team deliberation. These tools transform data into actionable insights, foster creativity, and streamline communication to improve collaborative discussions. Generative AI tools, such as Large Language Models (LLMs) like ChatGPT, support brainstorming and idea synthesis among diverse stakeholders (Feuerriegel et al., 2023). Visualisation tools help teams translate abstract ideas into concrete visuals, which improves understanding of urban planning processes (Geiser et al., 2024). AI plugins integrated into Building Information Modelling (BIM) platforms aid in scenario-based design optimisation, which allows teams to explore alternatives and address constraints early in the process (Eastman et al., 2008). Additionally, AI-supported digital whiteboards offer interactive spaces for ideation and co-creation.

The transition from input to process is characterized by support. Generative AI tools actively support deliberation by improving communication, visualizing complex ideas, and facilitating data-driven agreements. This support empowers teams to collaborate more effectively and creatively.

3.2 Process

The process stage captures how AI-supported tools enable more structured, inclusive, and effective deliberation within design teams. This stage reflects the immediate improvements in how teams engage deliberation, all directly influenced by the support of generative AI tools.

Generative AI tools support deliberation by facilitating streamlined communication and improving information flows, fostering better understanding and stakeholder engagement (Karacapilidis et al., 2024). Improved collaboration emerges as visualization and co-creation tools make complex ideas and data more accessible (Jiang et al., 2023). These tools support diverse team members in participating more meaningfully in deliberative processes.

Data-driven agreements are also a critical part of the process of AI-supported deliberation. Evidence-based reasoning improves by facilitating the exploration of design scenarios, analysing trade-offs, and clarifying the potential impacts of decisions, which fosters informed discussions among stakeholders (Garard et al., 2018). Additionally, AI enables faster iterations in deliberative cycles by automating repetitive tasks, allowing teams to focus their discussions on creativity and innovation. Finally, awareness and learning are integral to practical deliberation. They help teams reflect on how they communicate, make decisions, and work together.

Enabling defines the transition from process to output. AI-supported deliberation enables teams to refine and advance their deliberative processes. This transformation empowers teams to address design challenges more effectively and strategically.

3.3 Output

The output stage reflects the long-term impact of AI-supported deliberation, resulting in a continuously refined and evolving deliberation process. This refined process supports more strategic, creative, and practical deliberation within design teams. Effective deliberation fosters aligned agreements by promoting unity among stakeholders and ensuring their support for project goals through inclusive and structured discussions (Garard et al., 2018). It also encourages innovative design solutions by enabling teams to explore more creative and effective outcomes through dynamic scenario modelling and visualisation (Feuerriegel et al., 2023). Furthermore, the automation of workflows facilitates efficient and transparent collaboration by improving communication and automating workflows, making processes more straightforward and more transparent (Eastman et al., 2008). Inclusive and data-driven processes are supported as AI tools foster broader stakeholder engagement and more informed decision-making, ensuring diverse perspectives are considered. Finally, AI tools promote continuous learning and process improvement of deliberation processes by enabling feedback loops that support ongoing reflection.

The transition from output back to input represents informs, where the refined deliberation process informs the continued development and customisation of generative AI tools. This feedback loop ensures that AI tools evolve alongside the team's deliberation needs.

3.4 Potential risks when AI does not support deliberation

While generative AI tools offer valuable support, their effectiveness in design team deliberation depends on how well they are integrated into collaborative reasoning processes. If AI fails to contribute meaningfully, deliberation may become fragmented, inefficient, and disconnected from project outcomes.

A key risk is the weakening of stakeholder engagement and the lack of structured dialogue. Without AI support in synthesising arguments, clarifying trade-offs, or organising shared reasoning, deliberation may become repetitive, dominated by stronger voices, or difficult to navigate. This can lead to cognitive overload and limit inclusive participation, especially in complex design contexts.

Another concern is the ineffective use of AI-generated insights. When these outputs are not actively integrated, they may be misunderstood or ignored, reducing AI to a passive information source rather than a tool that enhances reflective and structured exchange. This undermines AI's potential to support deliberation as a process of mutual understanding.

Finally, the absence of AI engagement breaks the feedback loop central to the conceptual framework. Without meaningful support in deliberation, AI tools do not evolve in response to team needs, and the connection between input, process, and output weakens.

3.5 Propositions

Propositions in this research connect the variables identified in the conceptual model and provide a guiding lens for interpretation. Rather than serving as definitive hypotheses to test or as a framework for structuring the investigation, these propositions offer exploratory assumptions that help to focus the analysis and reflect on the relationships observed in the data.

Proposition 1 (Input stage): Generative AI can support inclusivity in deliberation by making complex information more accessible, enabling all stakeholders to contribute effectively.
In multidisciplinary design teams, deliberation requires stakeholders with different technical backgrounds to engage in structured discussions. However, participation is often unequal due to disciplinary silos, varying levels of expertise, and differences in how information is processed (Den

Otter & Emmitt, 2008). Stakeholders without specialized technical knowledge may struggle to fully engage in discussions, leading to an over-reliance on a subset of experts in the team.

Generative AI has the potential to lower these barriers by visualizing complex information, simplifying technical jargon, and generating structured summaries of stakeholder inputs (Geiser et al., 2024; Karacapilidis et al., 2024). By improving accessibility and cognitive support, AI ensures that all participants can interpret, evaluate, and contribute their perspectives without being excluded due to knowledge gaps. As a result, deliberation becomes more inclusive, allowing for a broader range of stakeholder contributions and ultimately enriching the deliberative process.

Proposition 2 (Process stage): Generative AI can improve the efficiency of deliberation by structuring stakeholder inputs, organizing argumentation, and reducing cognitive workload.
One of the main challenges in deliberation is fragmented information flows, where stakeholders must manually process large amounts of data, synthesize multiple viewpoints, and structure arguments without formalized frameworks (Forester, 2006). This often leads to deliberative inefficiencies, where discussions become repetitive, resolution processes slow down, and critical trade-offs remain unresolved due to a lack of structured engagement (Caballar, 2024).

Generative AI can improve the efficiency of deliberation by automating routine cognitive tasks, such as summarizing stakeholder viewpoints, identifying areas of consensus and conflict, and structuring key arguments into organized deliberative pathways (Chong et al., 2017). By acting as a facilitative tool rather than a decision-maker, AI-supported deliberation reduces the cognitive burden on stakeholders, allowing them to focus on higher-order reasoning instead of administrative or repetitive tasks. In this way, AI has the potential to accelerate deliberation cycles while maintaining a structured and transparent engagement process.

Proposition 3 (Output stage): The effectiveness of AI-supported deliberation depends on stakeholder trust in AI-generated insights and the preservation of human reasoning authority.
While AI can support deliberation by structuring information and improving workflow efficiency, the extent to which it improves deliberative outcomes depends on whether stakeholders trust AI-generated outputs and maintain active engagement in reasoning processes (Howarth & Wilson, 2006). Suppose AI is perceived as opaque, biased, or overly influential. In that case, deliberation may shift from a structured human-driven reasoning process to a passive evaluation of AI-generated suggestions, ultimately undermining stakeholder agency (Zhang et al., 2023).

Furthermore, AI models trained on historical data risk reinforcing biases in deliberative reasoning, privileging dominant perspectives while overlooking minority viewpoints (Feuerriegel et al., 2023). If AI-generated outputs become epistemically dominant in deliberation, stakeholders may defer to AI-suggested alternatives rather than engage in critical deliberation. Therefore, the success of AI-supported deliberation depends not just on AI's technical accuracy but also on how well AI tools are designed to promote transparency, explainability, and trust among human participants (Forgues & Koskela, 2009).

4. Research method

This research methodology consists of four phases. First, the exploratory phase defines stakeholder deliberation within design teams and identifies the critical design phases where deliberation is most essential. The second phase identifies and evaluates generative AI tools with potential to support these deliberative processes. In the third phase, a draft framework is developed and refined based on insights from the previous phases and tested in an interactive feedback session with professionals from NEOO. Finally, the expert panel validation phase assesses the practical applicability, usability, and alignment of the framework with academic and industry standards.

SQ1

Understanding deliberation

"What is meant by stakeholder deliberation in the context of design teams in real estate development, and at which stages is it most essential?"

OBJECTIVE

Define stakeholder deliberation and identify the design phases where deliberation is most critical.

OUTPUT

A clear understanding of stakeholder deliberation practices and the critical design phases where deliberation is most essential.

PARTICIPANTS

Participants include internal professionals from NEOO, including a project manager, a commercial developer, and a partner of the company.

External participants include two PhD researchers in data-driven design and AI-supported deliberation, the director of TKI Bouw & Techniek, two real estate developers from different companies (Boelens de Gruyter and RYSE), the Head of Digitalisation at VORM, and a consultant specialised in AI integration at Cumlaude.ai.

METHODOLOGY

Theoretical orientation:
A literature review synthesizing existing knowledge on stakeholder deliberation, collaboration, and design processes.

Exploratory interviews:
Semi-structured interviews (combined with SQ2) with 10 participants to explore current deliberation practices, challenges, and opportunities.

SQ2

Identification and evaluation of AI tools

"Which generative AI tools are currently employed to facilitate deliberation?"

OBJECTIVE

Identify and evaluate generative AI tools currently employed or holding potential for facilitating deliberation in design teams.

OUTPUT

A detailed understanding of relevant generative AI tools and their practical applications for supporting deliberation. These insights will directly inform the initial draft framework for AI-supported deliberation.

PARTICIPANTS

The same participants from the exploratory phase will be involved, supplemented by broader industry professionals for the quantitative survey.

METHODOLOGY

Theoretical orientation:
Review of relevant AI tools (LLMs, visualization tools, BIM-integrated plugins, and digital collaboration tools) and their use in collaborative settings.

Exploratory interviews:
Part 2 of the exploratory interviews. Building on Phase 1, these interviews will explore specific AI tools and their perceived impact on deliberation.

Quantitative survey:
A survey distributed to a broader audience (target = 25 responses) within the real estate and design industries to capture trends in AI adoption, stakeholder attitudes, and challenges.

SQ3

Framework development and iteration

"How can the main challenges and advantages of implementing generative AI tools be incorporated into the deliberation process within design teams?"

OBJECTIVE

Develop and refine the practical framework. The draft framework will be created based on the insights gathered from SQ1 and SQ2 and iteratively refined.

OUTPUT

A refined and practical framework for generative AI-supported deliberation, developed and improved through stakeholder feedback.

PARTICIPANTS

Participants included three professionals from NEOO, each representing a different functional role: a project manager, a construction overseer, and a commercial developer.

These participants were purposefully selected to reflect a variety of perspectives and varying levels of familiarity with generative AI, ensuring a diverse and balanced feedback process.

METHODOLOGY

Validation workshop:
A1.5 hour workshop with three NEOO professionals is used to test and refine both the framework and implementation strategy. Their feedback helps improve clarity, relevance, and practical alignment.

Expert panel validation

OBJECTIVE

Validate the practical applicability and relevance of the developed framework.

METHODOLOGY

Expert panel review:
Critical assessment of the framework's practicality, usability, and alignment with industry standards.

OUTPUT

A validated and ready-to-implement framework for AI-supported deliberation, aligned with industry needs and organizational goals.

PARTICIPANTS

The expert panel included one PhD researcher in AI-supported deliberation and one NEOO project manager closely involved in design teams.

Figure 4: Research method (own work)

This chapter outlines the methodological approach applied throughout the study. It describes the phased research strategy, data collection methods, and analytical procedures. Additionally, it explains how the research ensures rigour, transparency, and ethical integrity through structured data management and responsible participant engagement.

4.1 Research design

This research adopts an exploratory, mixed methods approach to investigate how generative AI can support stakeholder deliberation within design teams in real estate development. A phased research strategy is applied, integrating qualitative and quantitative methods to comprehensively understand deliberation processes, relevant AI tools, and their practical integration into workflows. The unit of analysis is NEOO as an organisation, focusing on its deliberation practices and the potential for generative AI integration.

The first phase focuses on defining stakeholder deliberation and identifying the design phases where deliberation is critical. This is achieved through a combination of theoretical orientation and exploratory interviews. The theoretical orientation knowledge will guide the development of interview questions and subsequent research phases (Blaikie & Priest, 2019; Groat & Wang, 2001). Semi-structured exploratory interviews with ten participants provide deeper insights into deliberation dynamics, challenges, and opportunities across different contexts. Given the relatively uncharted nature of this topic, exploratory research is particularly suited rather than testing existing theories.

The exploratory interviews are structured in two distinct parts. The first part examines how deliberation currently functions within design teams, focusing on existing practices, challenges, and opportunities without the influence of generative AI. This segment aims to capture an unbiased perspective on the current state of deliberation. The second part of the interview introduces the topic of generative AI, encouraging participants to reflect on how AI tools could support deliberation processes. By separating these topics within the same interview, the study ensures that the baseline understanding remains grounded in existing practices while allowing forward-looking discussions on AI integration. To encourage openness and allow for unexpected insights to emerge, the interviews combine a semi-structured format with an open-ended reflection segment at the end. This enables the researcher to systematically address key themes while also creating space for new and unanticipated ideas to surface.

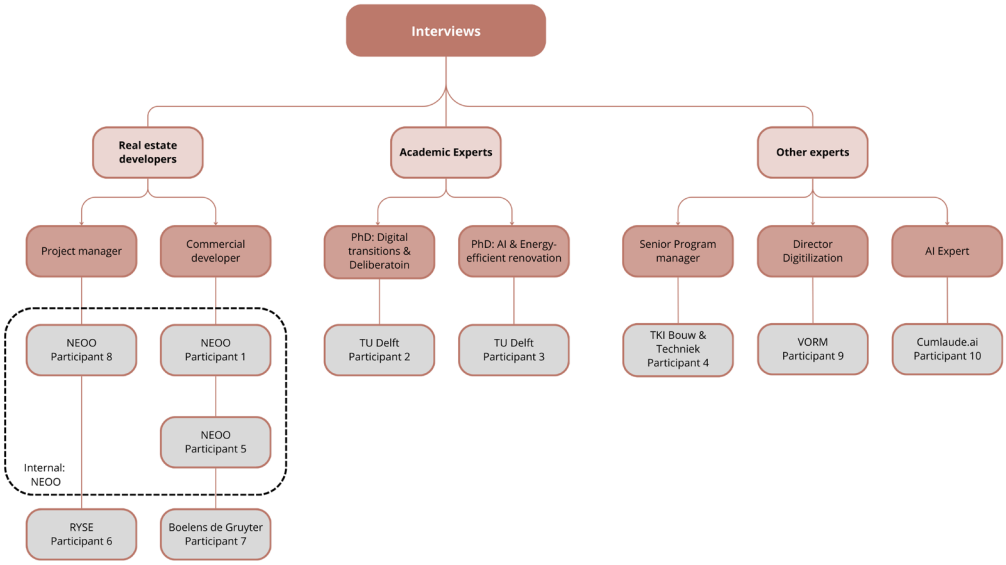

Figure 5: Interview participants (own work)

Participants are carefully selected for their expertise and relevance to the study. Internal participants from NEOO include a commercial developer involved in AI strategies, a partner overseeing organisational operations, and a project manager with experience in leading design team deliberations. These participants offer complementary perspectives on internal workflows, team dynamics, and innovation opportunities.

External participants include two PhD researchers from TU Delft with expertise in data-driven design and AI-supported deliberation in circular construction. Additional insights were provided by a director from TKI Bouw & Techniek, a national innovation platform for construction and technology. Two professionals from real estate development firms Boelens de Gruyter and RYSE contributed perspectives on market feasibility and AI integration. Further input came from the Head of Digitalisation at construction company VORM and an AI consultant from Cumlaude.ai, specialised in applications for the built environment.

The second phase focuses on identifying and evaluating generative AI tools that can support deliberation in design teams. A review of relevant AI tools is conducted to understand their role in collaborative settings. Part two of the exploratory interviews from Phase 1 explores specific AI tools and their perceived impact on deliberation. Additionally, a quantitative survey is distributed to a broader audience within the real estate and design industries to capture trends in AI adoption, stakeholder attitudes, and challenges. This survey complements qualitative insights with measurable data and ensures a comprehensive understanding of generative AI's potential. The goal is to collect 25 responses from industry professionals. The interview and survey questions were carefully designed based on insights from the literature to ensure alignment. The questions for the exploratory interviews and the survey are included in Appendix B & C.

Given the bilingual nature of the research participants, interviews and surveys will be conducted in Dutch for Dutch-speaking participants and in English for international participants. For clarity and consistency, the concept of "deliberation" is translated as "deliberatie" in Dutch. It is explained as: "*Deliberatie verwijst naar een gestructureerd overlegproces waarin verschillende perspectieven en argumenten zorgvuldig worden afgewogen, zonder dat er direct een besluit wordt genomen. Het doel is niet om een definitieve keuze te maken, maar om een dieper inzicht te krijgen, alternatieven te verkennen en gezamenlijk tot een goed onderbouwde richting te komen".* This translation has been carefully tailored to ensure the intended meaning is preserved in both languages, maintaining alignment with the research focus.

All interview transcripts are coded in Atlas.ti using a two-stage process. Deductive codes are developed from the theoretical orientation and reflect key themes in the existing literature on deliberation, design teams, and generative AI. These codes provide a structured framework for interpretation. In parallel, inductive codes are created based on emerging insights from the interviews. A "most interesting/surprising" overview is made for each interview, highlighting quotes and reflections that stood out due to their novelty, relevance, or unexpected nature. These overviews are included in Appendix D. These observations are then translated into inductive codes to enrich the analysis with grounded insights from practice.

The first-order constructs represent the codes used in Atlas.ti. These were initially derived from the theoretical framework and later complemented with recurring themes that emerged during the coding process. The second-order constructs were developed by analysing the selected quotes and extracting the most salient elements, allowing for a more conceptual interpretation of participants' statements. The third-order constructs reflect overarching theoretical themes that synthesise the second-order insights. This approach ensures a layered analysis that connects practical insights to broader academic debates. The codebook and analysis process are detailed in Appendix D. Survey

results are analysed using descriptive statistical methods. The goal of this analysis is to identify general patterns in responses, detect trends in adoption, and highlight points of consensus or divergence across roles and sectors.

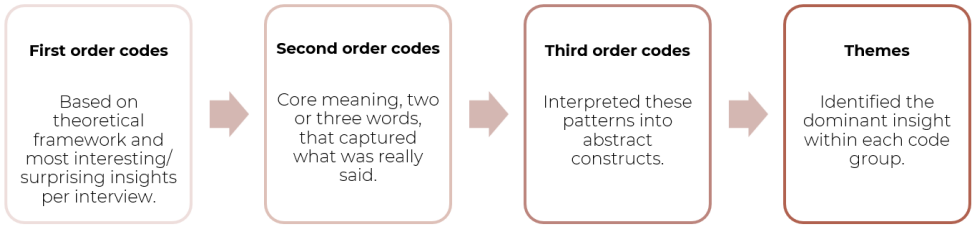

Figure 6: Constructs development (own work)

The third phase focuses on developing, refining, and validating a practical framework for generative AI-supported deliberation within design teams. Drawing on Phases 1 and 2 insights, a draft version of the framework is constructed to reflect key deliberative moments and potential AI applications. This draft is then tested through an interactive feedback workshop with three professionals from NEOO, each representing a different role within the organisation (project manager, construction manager, and commercial developer). These participants are purposefully selected to ensure variation in functional expertise and familiarity with AI, allowing diverse perspectives to be gathered. Following the session, the feedback is analysed and used to revise and improve the framework.

The final phase focuses on validating the practical applicability and relevance of the developed framework. An expert panel is assembled to critically assess its usability, strategic alignment, and academic rigour. The panel includes one academic expert with a background in AI-supported deliberation and one project manager from NEOO with experience in managing real estate design teams. This combination ensures a balanced evaluation from both theoretical and practical perspectives. Their feedback is systematically analysed and incorporated into the final framework to strengthen its real-world relevance and usability. In addition, insights from this validation phase inform the formulation of future recommendations.

The primary deliverables of this research are a practical framework and implementation strategy designed to support stakeholder deliberation within real estate design teams. These provide actionable guidance for integrating generative AI tools into deliberation processes, tailored to the specific needs and workflows of NEOO and applicable to the broader real estate development context.

4.2 Data plan

This research follows the FAIR Guiding Principles for Scientific Data Management and Stewardship to ensure that all collected and generated data is findable, accessible, interoperable, and reusable (FAIR) (Wilkinson et al., 2016). All data will be systematically organised using clear file naming conventions and structured folder systems to ensure findability. For accessibility, all data will be securely stored on encrypted, password-protected systems, with access restricted to authorised research team members. Upon completion of the research, anonymised and non-sensitive data will be made openly available through institutional repositories that support open access. Sensitive data will remain confidential and accessible only under strict ethical guidelines and upon formal request.

Data will be saved in widely accepted, non-proprietary file formats (e.g., .csv, .docx, .pdf) to facilitate ease of use across different software and platforms. Standardised terminology and controlled vocabularies related to stakeholder deliberation and generative AI will be used to enable seamless data integration with another research. For reusability, each dataset will be accompanied

by comprehensive metadata explaining its context, provenance, and methodological details to allow accurate interpretation and reuse.

4.3 Ethical considerations

Ethical considerations are fundamental to this research, especially given the involvement of human participants and the qualitative nature of data collection (Blaikie & Priest, 2019). This study strictly adheres to ethical standards to safeguard all participants' rights, privacy, and well-being throughout the research process. Before participation, individuals received comprehensive information about the study's objectives, methodology, and data handling procedures. Informed consent was obtained through signed consent forms, confirming that participation was voluntary and that participants could withdraw at any point without consequence. All participants signed this form, which is included in Appendix E. To protect participant privacy, all collected data were anonymised and securely stored on encrypted, password-protected systems. Strict confidentiality measures were applied to foster trust and encourage open, honest participation, ensuring the collection of rich and valuable insights.

Given the collaborative nature of this research with NEOO, the potential for conflicts of interest is acknowledged. To address this, participants across all research phases, including interviews, the survey, and the expert panel, represent a deliberate mix of internal professionals from NEOO and external experts from academia and industry. This diversity ensures that the perspectives of NEOO are included without dominating the research outcomes. The inclusion of external voices contributes to a balanced, independent, and academically rigorous evaluation of the findings and the final framework.

5. Empirical research

This chapter presents the empirical findings of the study, combining insights from the survey and a series of expert interviews. Together, these methods explore how generative AI is currently used, perceived, and integrated into stakeholder deliberation within design teams, as well as what opportunities it offers to enhance these processes.

5.1 Survey analysis

With 25 respondents from diverse professional backgrounds, the findings provide insight into AI adoption, its perceived value, and the barriers that hinder its broader implementation. To maintain clarity and conciseness, this section summarizes the key insights from the survey. The full survey results, statistical analysis, and graphical representations can be found in Appendix F.

The survey results reveal that while AI awareness is high, structured implementation remains limited. Over half of the respondents (56%) are experimenting with AI, but only 12% have fully integrated AI tools into their workflows. This suggests that many professionals see AI's potential but lack the support and strategies for systematic adoption. ChatGPT emerged as the most widely used AI tool (88%), primarily for documentation, text structuring, and summarization. Other AI-supported applications, such as BIM tools (24%) and AI-driven visualization software (24%), indicate growing interest in AI-enhanced design and planning capabilities. However, the survey highlights a gap between individual AI use and formal organizational adoption, with many professionals relying on AI independently rather than as part of a company-wide initiative.

Beyond automation, professionals expressed strong interest in AI tools that actively support deliberation. Among the most desired AI functionalities, 64% of respondents highlighted AI-assisted design generation, 52% identified AI-supported structuring of deliberation, and 48% wanted real-time AI feedback during discussions. These findings suggest a shift in expectations: rather than viewing AI as a simple tool for automating routine tasks, professionals see the potential for AI to help facilitate stakeholder engagement, improving collaboration and agreement-building.

Despite the enthusiasm for AI's potential, several barriers hinder its widespread adoption. Lack of expertise (60%) was the most cited challenge, followed by concerns over AI reliability (40%) and regulatory uncertainty (28%). These findings align with interview insights, where participants emphasized that AI is only as effective as its implementation strategy. While professionals recognize AI's ability to support structured discussions, capture diverse perspectives, and reduce administrative burdens, trust in AI-generated outputs remains challenging. Confidence in AI is not significantly higher among those working in AI-adopting organizations, suggesting that exposure alone is insufficient to build trust.

To bridge the gap between AI awareness and its structured integration, professionals emphasized the need for training programs (60%), case studies demonstrating AI's value (52%), and implementation roadmaps (48%). These findings indicate that while many professionals' experiments with AI informally, organizations must provide structured support to transition from exploration to meaningful AI adoption. The lack of transparent best practices and regulatory uncertainties also contribute to hesitation, reinforcing the need for industry-wide discussions on responsible AI integration.

These results show the urgency of a strategic and collective approach to bridge the gap between individual experimentation and structured AI integration in the real estate sector. Moving beyond isolated use, organizations must take active steps to embed AI meaningfully into their workflows through clear strategies, support systems, and shared learning.

5.2 Interview analysis

Appendix G contains the full coding tables, including quotes and the first-, second-, and third-order constructs. In the main text, the focus is on the third-order constructs, as these represent the most significant themes emerging from the analysis. This structure ensures clarity and prevents the text from becoming overloaded. For readability, all third-order constructs are underlined throughout the chapter. Each section concludes with a synthesis theme that captures cross-cutting insights. These themes help to integrate findings across interviews.

5.2.1 Deliberation

Deliberation is a process grounded in rational discourse, reflection, inclusivity, and the negotiation of competing interests. It requires time, effort, and structured facilitation to ensure all voices are heard. The following sections explore how deliberation functions within design teams, its challenges, and the conditions necessary for successful deliberation. To contextualize the upcoming discussion of third-order constructs, Figure 5 presents a full overview of the first-, second-, and third-order constructs developed during the thematic analysis.

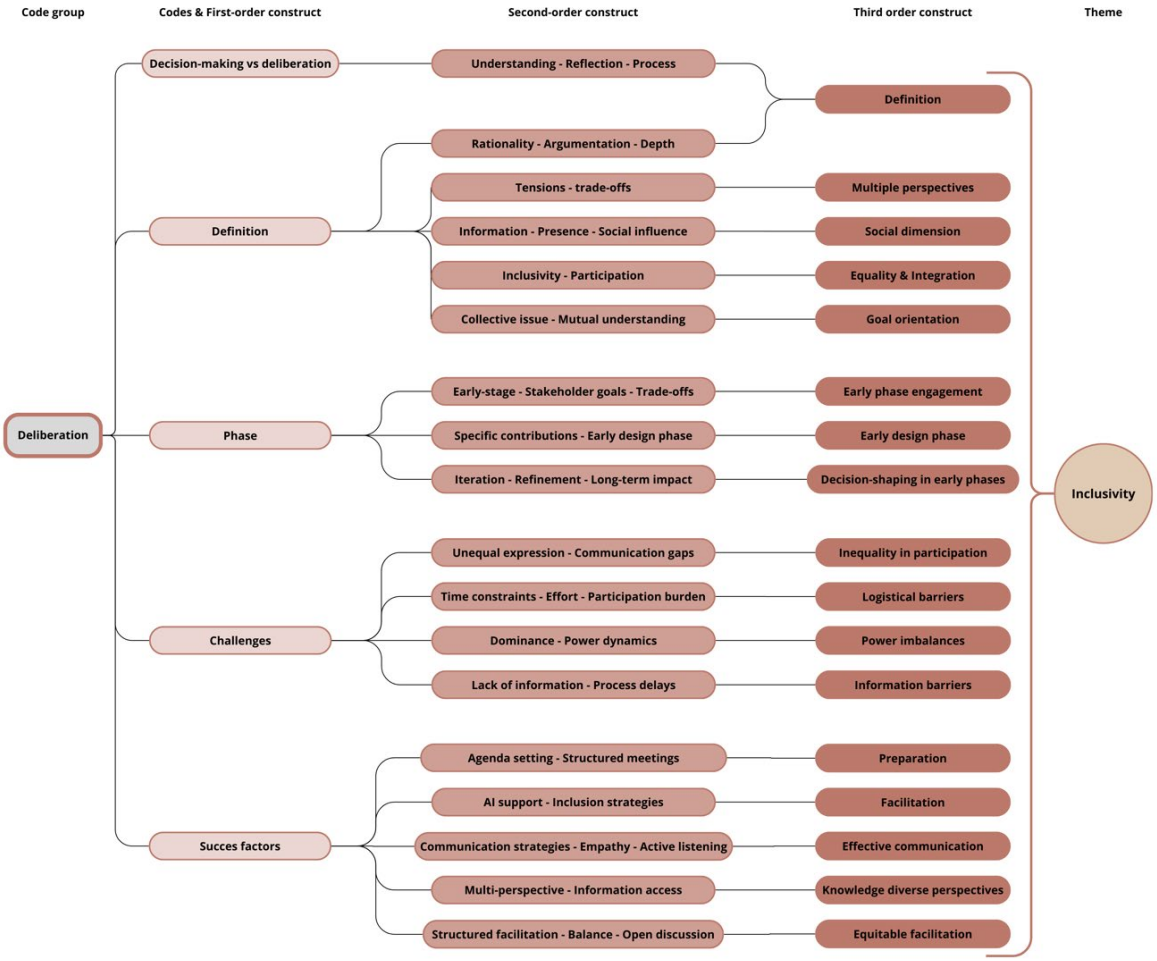

Figure 7: Deliberation constructs (Own work)

Definition

Deliberation is a process that embraces complexity rather than reducing it, requiring engagement with diverse perspectives before concluding. One participant explicitly distinguished deliberation from decision-making, noting that deliberation *"is not about making the most efficient outcome, but about argumentation and reflection."* While decision-making often seeks to streamline processes and reach conclusions quickly, deliberation prioritises depth of discussion, weighing competing

interests and ethical considerations to arrive at more informed outcomes. This reflects the definition of deliberation, which focuses on structured reasoning rather than mere efficiency.

A key characteristic of deliberation is its role in reconciling conflicting priorities. Unlike standard collaboration, where all stakeholders may align around a shared objective, deliberation requires balancing multiple perspectives that may not initially align. Deliberation also occurs at different scales, ranging from large-scale urban transitions to more focused organisational settings within companies. One participant explained that deliberation within an organisation differs from broader public discourse: *"If you limit deliberation to some portfolio or some building, it's more about organisational deliberation. Inside some companies or associations, I would say it's different, it's less democratic, but it's still deliberation."* This highlights the social dimension of deliberation, where interactions within smaller teams influence how agreements take shape. The structure, scale, and participants impact the deliberative process, making it distinct from broader public deliberations.

Another defining aspect of deliberation is its emphasis on equality and integration. Practical deliberation ensures that all voices are heard, and that participation is not merely symbolic. As one participant noted: *"You try to bring people together to discuss the reasons behind different measures and try to make them understand each other. It also requires the equal participation of different stakeholders so that people have equal saying in that."* While deliberation does not always require consensus, it aims to establish a foundation for future discussions based on goal orientation in deliberation. Even when complete agreement is not reached, mutual understanding is an important step toward collective agreement.

Deliberation fosters structured discussion, integrates diverse viewpoints, and addresses competing interests. Its application varies across contexts, yet its core function remains the same: ensuring that all voices are heard and that there is deep engagement with different perspectives.

Phase

Participants emphasised that deliberation within design teams operates differently from broader decision-making processes. While decision-making often prioritises efficiency and streamlined execution, deliberation is characterised by iterative engagement across the project timeline. In the early phases, it centres on early-phase engagement, where diverse stakeholders such as architects, engineers, and clients explore competing goals and perspectives. As the design process progresses, deliberation continues in more structured and convergent forms, focusing on coordination, feasibility, and finalisation. This evolving nature highlights that deliberation is not limited to the beginning, but adapts to the demands of each design stage.

One participant highlighted the importance of early-stage deliberation: *"Deliberation mostly happens in the early design phase"* because stakeholders have fundamentally different priorities. For example, a social housing provider may focus on minimising costs, while tenants advocate for higher living standards. From a theoretical perspective, deliberation also plays its most significant role in these early stages: *"If you want to look into more like the specific contributions from deliberation theory, then I think the early design phase is more."* This suggests that early design phase deliberation fosters an environment where multiple perspectives can be considered before the design solidifies, making it a critical phase for shaping project outcomes.

Deliberation in design teams is also characterised by decision-shaping in early phases. In the early phases, many possibilities are explored, but as the process progresses, options become more constrained. One participant described this shift: *"In the early design phase, there are many options. Over time, these are refined, but early deliberation determines the overall direction."* This

iterative nature reflects how deliberation allows for exploration before design constraints narrow the choices.

Together, these insights highlight that early-phase deliberation is not only central to aligning diverse stakeholder interests, but also instrumental in setting the strategic direction of a project before critical design constraints emerge.

Challenges

Participants identified several challenges that can hinder the effectiveness of deliberation. Without careful facilitation, these issues can limit the quality of deliberation and slow progress in the design process.

One significant challenge is inequality in participation, as not all stakeholders have the same ability to articulate their perspectives. Differences in expertise, experience, or confidence in group discussions can impact the deliberative process. One participant noted: *"A lot of people don't have the equal capability to express their reasons,"* highlighting how disparities in communication skills can create imbalances. When certain voices dominate while others struggle to be heard, deliberation risks becoming skewed toward those with more significant influence, making reaching agreements that reflect all perspectives harder.

Another significant barrier to deliberation is logistical barriers, particularly the time and effort required to sustain engagement. The deliberation process demands a significant investment from participants, making it difficult to maintain consistent involvement. As one interviewee explained: *"It requires a lot of energy, requires a lot of participation, and people have their own lives, so it's hard to organize those kinds of deliberation."* While deliberation helps to integrate multiple perspectives, the practical demands on participants can make it difficult to consistently apply in real-world settings, particularly within fast-paced design projects.

Power imbalances also complicate deliberation. Some stakeholders, often due to seniority, technical expertise, or their role within an organization, tend to exert disproportionate influence over discussions. One participant observed: *"If you talk about design teams in a small scale, I will say it's usually dominated by some person,"* underscoring how authority dynamics can limit inclusivity. Another participant echoed this concern: *"Power dynamics often lead to dominance by certain individuals, reducing equal participation."* Without structured facilitation, deliberation can be overshadowed by a few strong voices rather than reflecting the collective input of all stakeholders, resulting in solutions that do not fully integrate all relevant viewpoints.

In addition, information barriers can restrict the effectiveness of deliberation. The availability of relevant information at the right moments in the deliberative process is crucial for meaningful discussions. A lack of critical data can lead to inefficiencies, as stakeholders may need to delay discussions until more information becomes available. One participant highlighted this challenge: *"Sometimes not all information is available, so discussions must be delayed until more data is collected."* This illustrates how deliberation can be constrained by external factors, such as project uncertainties or evolving requirements, making it difficult to maintain progress in the design process.

Deliberation has the potential to integrate diverse perspectives and facilitate agreements, but its success depends on overcoming these challenges. Ensuring equitable participation, mitigating power imbalances, and providing timely access to information are essential strategies for fostering a genuinely deliberative environment. Without these safeguards, deliberation risks becoming an exclusive rather than an inclusive process, limiting its effectiveness in guiding projects forward.

Success factors

Despite the challenges associated with deliberation, participants identified several key factors that contributed to its success. These include structured facilitation, thorough preparation, and fostering an inclusive environment where diverse perspectives are actively encouraged. When these conditions are met, deliberation becomes more balanced and productive.

A central factor in deliberation is preparation. Structured meetings with clear agendas allow participants to engage meaningfully in discussions, ensuring that deliberation remains focused and purposeful. One participant emphasized the importance of preparation, stating, *"I think that it is important that people are prepared, so that there is a clear agenda in advance."* This suggests that providing discussion materials ahead of time and setting expectations for contributions can significantly improve the quality of deliberation.

Facilitation also plays a crucial role in ensuring that all voices are heard. Without proper facilitation, specific individuals can dominate deliberation, reducing inclusivity. One participant illustrated this point by describing how AI-supported facilitation could help mitigate such imbalances*: "An AI engine can notify the mediator to say that, look, this person hasn't been talking at all. Maybe you should give them space to express themselves."* While AI can support facilitation, human mediators remain essential in managing discussions, ensuring that power dynamics do not hinder equitable participation.

Additionally, effective communication contributes to the success of deliberation. Open engagement with diverse viewpoints requires active listening, patience, and a willingness to understand others' perspectives. One participant noted, *"Good communication skills, patience, and motivation to understand others' viewpoints"* are essential for productive deliberation. This highlights how fostering an environment of respect and open-mindedness allows deliberation to be more constructive and prevents discussions from becoming polarized.

Another critical factor is the integration of knowledge of diverse perspectives. Deliberation benefits from a well-rounded information input, ensuring that multiple viewpoints inform decisions. One participant explained*, "An informed deliberation process requires multiple perspectives and access to information."* This shows the importance of knowledge-sharing mechanisms within deliberation, allowing stakeholders to contribute insights based on their expertise while collectively working toward a reasoned outcome.

Finally, equitable facilitation helps manage power dynamics within deliberation. Clear facilitation strategies ensure that discussions remain balanced, and no single party dominates. One participant stressed, *"Clear facilitation of discussions helps avoid dominance by one party and ensures all voices are heard."* This reinforces the role of structured mediation in maintaining fairness and fostering an inclusive deliberation process.

Together, these success factors suggest that structured approaches improve the quality of deliberation. By creating an environment where all participants feel valued and heard, deliberation can effectively resolve conflicts, integrate diverse perspectives, and improve deliberation outcomes.

Synthesis theme: Inclusivity

The theme of Inclusivity emerged directly from the thematic analysis of deliberation presented in Figure 5, building on both theoretical insights and rich empirical findings from the interviews. Participants consistently emphasised that inclusive deliberation within design teams is often

challenged by a variety of structural and interpersonal obstacles. Issues such as unequal participation, dominant voices, and limited access to relevant information were frequently mentioned as key barriers to ensuring that all stakeholders can contribute meaningfully to the design process.

These difficulties were not only viewed as limitations but were also described as critical risks that can compromise the quality and legitimacy of deliberation. At the same time, participants identified several success factors that help overcome these challenges. Equitable facilitation, careful preparation, and effective communication practices can foster more balanced and inclusive deliberation. These measures were seen as essential for enabling diverse perspectives to be expressed, understood, and considered within collective reasoning.

Inclusivity in this context refers not only to the presence of a diverse group of participants but also to the extent to which their contributions shape the course and outcomes of discussions. Participants highlighted that, without intentional efforts to address power dynamics and communication barriers, deliberation risks becoming skewed in favour of dominant actors. This concern was reflected in several second-order constructs related to the structure of conversations, the accessibility of information, and the ability of participants to engage equally in dialogue.

The synthesis of Inclusivity thus reveals that it is both a normative value and a practical requirement for successful deliberation. Inclusive processes are more likely to generate outcomes that are not only robust from a technical standpoint but also broadly supported and socially legitimate. As such, Inclusivity forms an important link between the ethical and procedural dimensions of deliberation and offers a conceptual basis for exploring how digital tools can support more participatory practices in design settings.

Finally, the findings emphasise that deliberation is not a static phenomenon. Participants described how the nature of deliberation changes throughout the design process. In the early stages, discussions tend to be more exploratory and inclusive, allowing for a wide range of ideas and perspectives. As the project progresses, deliberation becomes more evaluative and focused, with decisions shaped by emerging constraints and practical considerations. This temporal dynamic suggests that deliberative practices need to be adapted to the specific demands of each design phase.

5.2.2 AI in deliberation

Interviews highlight AI's potential to improve facilitation and streamline workflows, revealing concerns about bias and over-reliance on automation. While AI can assist in deliberation, human judgment remains essential for meaningful engagement and well-founded agreements. The supporting constructs from the interview analysis are summarised in figure 6.

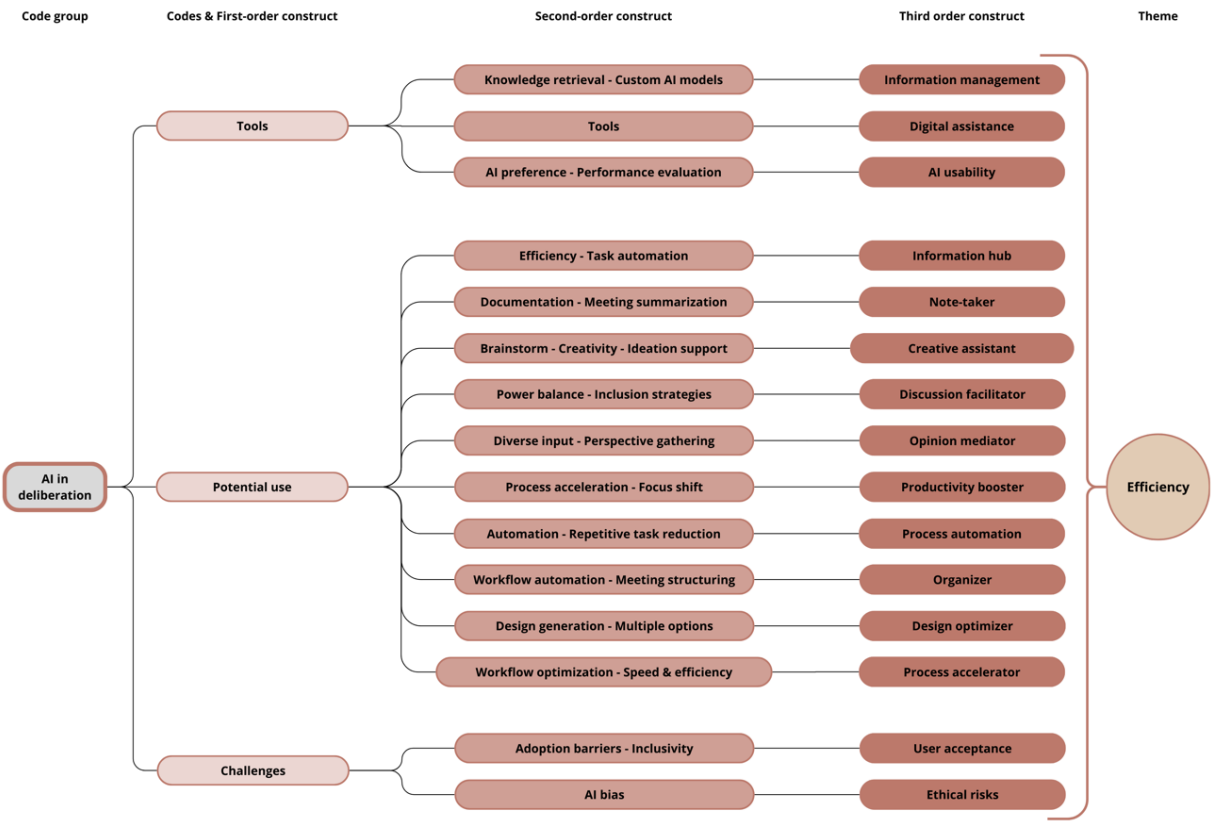

Figure 8: AI in deliberation constructs (Own work)

Tools

A key function of AI in deliberation is its ability to centralise and retrieve information in real time. Some participants highlighted how they use AI-powered chatbots and customised GPT models to store and instantly access project-related data. One participant explained, *"What I often do in projects is create a kind of knowledge chatbot. You upload all project documentation, and during meetings, you can instantly access the necessary knowledge."* This suggests that AI can help deliberation remain well-informed, reducing the time spent searching for relevant materials. This highlights information management as a crucial benefit of AI tools in deliberation.

Beyond information retrieval, AI also plays a crucial role in structuring discussions and capturing key arguments. Automated transcription and summarization tools assist in recording deliberation processes, ensuring that critical points are not overlooked. One participant described how this improves deliberation: *"It listens in, takes notes, and structures discussions, making it easier to track different viewpoints and ensure key arguments are captured."* This illustrates how AI can reduce administrative burdens, allowing participants to focus on substantive discussions rather than manual documentation. These functions align with digital assistance, where AI supports human interactions by organizing and streamlining conversations.

Despite the advantages of the tools, AI usability remains a key consideration. While some AI tools are widely used and recognized for their effectiveness, others may require significant adaptation to specific deliberation contexts. One participant stated, *"At the moment, ChatGPT is by far the best AI tool."* Highlighting the importance of selecting intuitive, reliable, and well-integrated tools into existing workflows. The ease of use and accessibility of AI tools influence their adoption in deliberation, with some platforms proving more practical and efficient than others.

Potential use

Participants highlighted a range of potential applications, from automating administrative tasks to enhancing stakeholder engagement and ensuring inclusivity.

A key advantage of AI in deliberation is its ability to function as an information hub, providing real-time access to relevant knowledge. Instead of spending valuable time searching for documentation, AI enables instant retrieval of project-related data. One participant explained,
"I frequently create a knowledge chatbot for projects... It speeds up deliberation processes significantly." This capability ensures that discussions remain well-informed, reducing delays caused by missing information. Additionally, AI assists as a note-taker, summarizing meetings, capturing key arguments, and identifying biases. One participant noted, *"AI can transcribe and summarize meetings instantly,"* helping teams track discussions more effectively and focus on content rather than manual documentation.

Beyond information management, AI contributes as a creative assistant, accelerating brainstorming processes by rapidly generating multiple alternatives This allows stakeholders to explore a broader range of options before deciding. One participant illustrated this potential: *"If you ask me for ten ideas for facades, and then ask again, ChatGPT can generate them 15 times faster than a human."* Such capabilities enhance creativity and iteration in the design process, making deliberation more dynamic.

AI also plays a role as a discussion facilitator by improving inclusivity and balancing participation. In many deliberative settings, some voices dominate while others remain unheard. AI can monitor engagement patterns and prompt facilitators to encourage participation from underrepresented stakeholders. One participant described this function, *"Some stakeholders dominate discussions. AI can ensure that everyone's opinions are acknowledged."* Beyond participation monitoring, AI can extract diverse viewpoints from sources such as social media, broadening the range of insights available for deliberation. Another participant explained, *"AI can extract opinions from social media and bring them into the deliberation process,"* illustrating its ability to expand perspectives and enrich discussions as an opinion mediator.

Another significant benefit of AI is its impact as a productivity booster, automating routine tasks and enabling teams to focus on higher-value deliberation. AI-driven tools facilitate workflow automation, from drafting reports to structuring meeting agendas. One participant emphasized, *"I use AI to create agenda templates based on prior emails,"* demonstrating how AI can optimize deliberation logistics as an organizer. Similarly, AI automates processes, reducing repetitive work in process management, calculations, and document drafting. A participant summarized this benefit: *"I think many processes will become automated: process management, report writing, calculations, drawing plans. Essentially, all the repetitive work. AI will help automate these tasks more intelligently."*

AI also plays a role as a design optimiser, generating and refining spatial planning options based on user-defined criteria. As one participant stated, *"AI can present multiple layout options based on user-defined criteria,"* illustrating its ability to facilitate design exploration and improve workflow efficiency.

Finally, AI's ability as a process accelerator can speed up deliberation significantly. By reducing time spent on repetitive tasks, teams can dedicate more effort to strategic thinking and creative problem-solving. One participant predicted, *"I think that ultimately, an entire design process can be completed much faster. But there are still obstacles to overcome before we get there."* While AI's full potential has yet to be realised, its capacity to optimise workflows suggests a future in which deliberation can be conducted faster and more efficiently.

Challenges

Despite its potential, AI also introduces significant challenges in deliberation. Participants highlighted concerns about user acceptance, ethical risks, and cognitive limitations, all of which can impact the fairness and effectiveness of AI-supported deliberation. AI's integration must be carefully managed to avoid reinforcing inequalities or distorting deliberative outcomes.

A primary challenge is user acceptance, particularly among individuals struggling with digital literacy. Some participants raised concerns about whether all stakeholders, especially older generations, can effectively adapt to AI-driven deliberation tools. If certain groups are unable or unwilling to engage with AI, deliberative processes risk becoming imbalanced, benefiting technologically proficient users while excluding others. One participant questioned this challenge, asking, *"It also depends on whether everyone can adapt to it. Do we get the older generations on board?"* This suggests that AI adoption is not just a technical issue but also a social and cultural one, requiring careful consideration of accessibility and training to ensure equitable participation.

Beyond adoption barriers, ethical risks arise from biases embedded in AI models. AI systems are trained on existing data, meaning they can inherit and reinforce biases in that data. If AI tools reflect or amplify societal biases, they may skew deliberative outcomes by favouring dominant perspectives while overlooking minority viewpoints. One participant noted, *"Bias comes from psychology... we have confirmation bias."* This highlights how AI, like human reasoning, is susceptible to reinforcing existing patterns rather than challenging them, leading to deliberation outcomes that lack true diversity of thought. These ethical implications are discussed in greater depth in Section 5.2.3, which explores how bias and trust influence the legitimacy of AI-supported deliberation.

Synthesis theme: Efficiency

The theme of Efficiency emerged from participants' reflections on how AI tools support the everyday functioning of deliberative processes. Across interviews, AI was described as a practical assistant that reduces repetitive tasks, centralises project knowledge, and accelerates information processing. These applications were seen to improve the overall flow and productivity of meetings by helping teams remain focused on the substantive aspects of deliberation.

Participants shared how AI supports tasks such as note-taking, structuring agendas, summarising discussions, and retrieving relevant documents in real time. In doing so, AI reduces the administrative burden placed on design teams and allows more space for creative and strategic thinking. Tools such as knowledge chatbots or summarisation assistants help streamline communication and make previously time-consuming processes more efficient and accessible.

However, the interviews also revealed that this increase in efficiency does not automatically reduce workload. Instead, it often shifts responsibilities and can create new expectations for faster responses, more frequent iterations, and quicker decision-making. This dynamic reflects a broader change in how deliberation is practiced when supported by AI: less time is spent on preparation and documentation, but more is demanded in terms of adaptability, critical engagement, and oversight.

Efficiency in this context is not just about speed or output. It refers to the AI-enabled ability to structure, support, and maintain momentum in collaborative design discussions. When well-integrated into existing workflows, AI enhances the clarity and continuity of deliberation. Yet, as participants emphasised, such benefits depend on selecting the right tools, training users, and maintaining a focus on meaningful use rather than technology for its own sake.

In summary, Efficiency captures both the functional advantages and the shifting expectations that accompany AI-supported deliberation. It reflects a growing recognition that AI, when thoughtfully applied, can support not only faster outcomes but also more focused and informed dialogue.

5.2.3 Risks & Concerns of AI in deliberation

While AI can provide valuable support in structuring deliberation, it also brings important risks that must be carefully addressed. Interview participants raised concerns about bias, overreliance, and ethical uncertainty. Because AI systems are trained on existing data, they often reinforce rather than challenge prevailing assumptions, which may jeopardise fairness and inclusivity. In some cases, stakeholders may place too much trust in AI-generated outputs, which can reduce space for critical reflection and discussion. These risks are further complicated by the lack of clear regulations, raising questions about transparency, data use, and accountability. To safeguard the quality of deliberation, participants emphasised that AI should support human judgment rather than replace it. Ensuring that AI remains a tool guided by human oversight is essential for maintaining meaningful and inclusive dialogue. Balancing the efficiency that AI offers with strong ethical safeguards is therefore crucial for its responsible integration. The underlying constructs that support these insights are summarised in Figure 7.

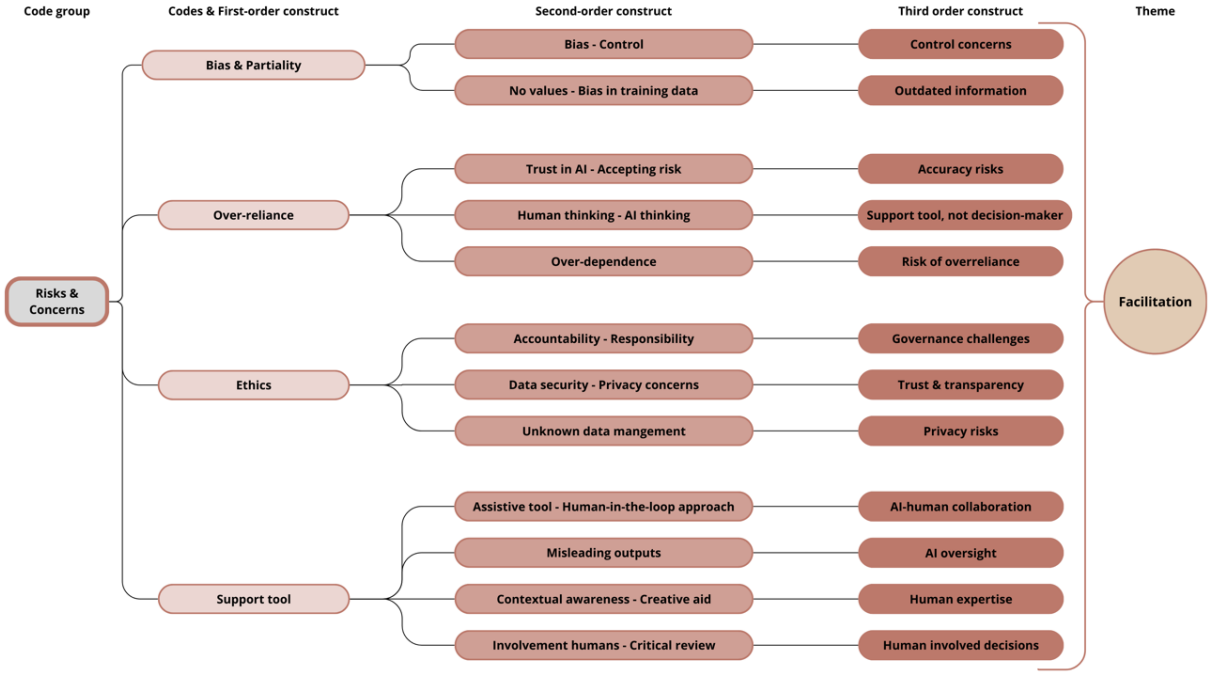

Figure 9: Risks & concerns constructs (Own work)

Bias & Partiality

One of the most frequently mentioned concerns was AI's tendency to reinforce existing biases rather than challenge them. Since AI models are trained on historical data, they may amplify dominant perspectives and overlook minority viewpoints, thereby unintentionally excluding underrepresented voices in deliberation. Participants expressed concerns about AI's ability to remain neutral and transparent, noting that if AI is not carefully curated, it may favour mainstream opinions rather than fostering a balanced discussion. As one participant noted, *"AI also has bias. Who should be in control?"* This highlights control concerns, as it remains unclear who is responsible for AI's outputs and how its role in deliberation should be regulated. Another participant added, *"AI does not have any values... The information is based on outdated sources."* This reflects the risk of outdated information, where AI models rely on historical data that may not reflect current realities or diverse viewpoints.

Additionally, the lack of transparency in AI processes makes it difficult for stakeholders to verify whether biased datasets influence AI-driven recommendations. This issue raises ethical concerns about how AI should be designed and monitored in deliberation. Without addressing control concerns and mitigating outdated information risks, AI may fail to contribute meaningfully to inclusive and well-informed deliberative processes.

Over-reliance

Another significant risk identified was the tendency for users to place excessive trust in AI-generated outputs, leading to a decline in critical thinking and independent judgment. Participants noted that AI-generated summaries or recommendations are not always accurate, yet stakeholders may accept them as fact without further scrutiny.

One participant warned of this over-reliance, stating, *"AI-generated outputs are not always correct, yet people assume they are."* This highlights accuracy risks, as the perceived reliability of AI may lead users to accept incorrect or incomplete information without critical evaluation.

Another participant emphasized the importance of human oversight, stating, *"We need to deliberate with AI, not listen to AI."* This underscores the necessity of viewing AI as a support tool, not a decision-maker, reinforcing that AI should assist deliberation rather than dictate outcomes. This risk is particularly concerning in high-stakes deliberation, where AI-generated outputs may lack context and depth. If stakeholders accept AI-generated insights without questioning their validity, deliberation could become less reflective and more automated, potentially leading to narrower perspectives rather than enriched discussions. One participant pointed to this danger, stating, *"People assume AI is neutral, but its recommendations may be biased."* This reflects the risk of overreliance of AI over-dependence, where users may fail to recognize that biased data and limited reasoning capabilities can shape AI-generated insights.

To mitigate these risks, it is essential to maintain a balanced approach where AI complements human judgment rather than replacing it. Encouraging critical reflection and questioning AI outputs can help ensure that deliberation remains an active, thoughtful process rather than passively accepting algorithmic recommendations.

Ethics

A major challenge is accountability in AI-supported deliberation. One participant questioned, *"Who is responsible when AI-driven decisions go wrong?"* This highlights governance challenges, as unclear legal frameworks make determining responsibility when AI influences deliberative processes difficult. Without clear regulations, stakeholders may struggle to define where human oversight ends and AI-generated recommendations begin.

Another participant raised concerns about trust & transparency, noting, *"We don't know what happens to our data when using external AI tools."* This reflects the uncertainty surrounding how AI processes sensitive information, particularly in cases where external AI providers manage deliberation data. Similarly, a participant emphasized the privacy risks associated with AI-generated insights, stating, *"AI-generated insights raise privacy concerns."* This points to the broader challenge of ethical risks, where the lack of transparency in AI-driven deliberation raises concerns about intellectual property, security, and data ownership.

These regulatory and ethical uncertainties suggest that AI's role in deliberation must be carefully managed. Addressing legal and ethical concerns through clear governance frameworks,

transparent data practices, and well-defined accountability structures will ensure AI's responsible integration into deliberation processes.

Support tool

A recurring concern among participants was the appropriate role of AI in deliberation. While AI can enhance discussions by providing structured insights, organizing information, and highlighting biases, many participants stressed that AI should remain a support tool rather than a decision-maker. One participant expressed this concern: *"We need to deliberate with AI instead of listening to AI."* This highlights the importance of AI-human collaboration, where AI should provide input but not replace human judgment. Another participant emphasized the risks of unquestioningly accepting AI-generated outputs, stating, *"What AI produces is not always correct. There is a risk that people accept something as the truth when it is not necessarily accurate."* This shows the necessity of AI oversight, ensuring that AI-generated insights are always critically evaluated rather than taken at face value.

Additionally, participants pointed out that while AI can generate design variations and automate tasks, human creativity remains irreplaceable. One participant remarked, *"An architect's job will never be replaced, but you need to be able to think deeply about what suits a particular place and how it will truly transform it. AI might develop to assist in this process but automating everything is ultimately just coding."* This statement reflects the importance of human expertise, where AI can serve as a creative aid. However, it cannot replicate the depth of contextual awareness and critical thinking that human professionals bring to deliberation.

Ensuring that AI remains an assistive tool rather than a decision-maker requires clear guidelines and human oversight. Participants stressed the need for keeping humans actively involved in AI-supported deliberation, with one stating, *"It is always important to keep humans involved. There should always be a critical review of AI-generated content."* This highlights the significance of human-involved decisions, reinforcing that AI should facilitate rather than dictate deliberative processes.

By carefully managing AI's role, organizations can leverage its benefits while maintaining the integrity of human deliberation. Striking a balance between automation and human oversight is essential to ensure that AI remains a facilitator rather than an authoritative voice in deliberation.

Synthesis theme: Facilitation

The theme of Facilitation was developed in response to participants' repeated reflections on the appropriate role of AI within deliberative processes. Although much of the discussion in this chapter focused on risks such as bias, overreliance, and ethical ambiguity, these concerns consistently pointed toward the same conclusion. Participants agreed that AI should support, but never replace, human judgment. This emphasis on preserving human agency and oversight became the conceptual foundation for the Facilitation theme. Instead of treating AI as a system that delivers answers, participants described it as a tool that helps to organise, structure, and moderate the deliberative process.

This theme brings together a range of insights, including the need for bias detection, the importance of trust and transparency, and the insistence on human involvement in decision-making. These elements highlight that the value of AI lies not in its conclusions, but in its ability to support the structure and integrity of deliberative discussions. Participants explained how AI can be used to surface overlooked voices, retrieve relevant information, or summarise complex conversations. However, they also warned that without proper human oversight, these benefits could be undermined by blind trust in automated outputs.

Facilitation resolves an initial tension that emerged from the data. Although the chapter primarily addressed risks, the resulting theme is inherently constructive. It captures a shared belief among participants that AI is most beneficial when it plays a supportive and enabling role. This role strengthens deliberation without disrupting its human-centred nature. By identifying this recurring perspective, the theme of Facilitation emerged as both a practical and ethical principle for integrating AI.

In the end, this theme reflects a deeper normative stance. Deliberation should remain grounded in human reasoning, empathy, and accountability. While AI can enhance the clarity, balance, and organisation of discussions, it must always do so in a way that reinforces human participation. Framing AI as a facilitator ensures that deliberation continues to be a thoughtful, inclusive, and critically engaged process.

5.2.4 Implementation of AI in deliberation

Integrating AI into deliberation requires structured adoption, training, and transparent governance. A strategic approach focusing on education, phased adoption, and human oversight ensures AI supports rather than disrupts deliberation. The supporting constructs from the interview analysis are summarised in figure 8.

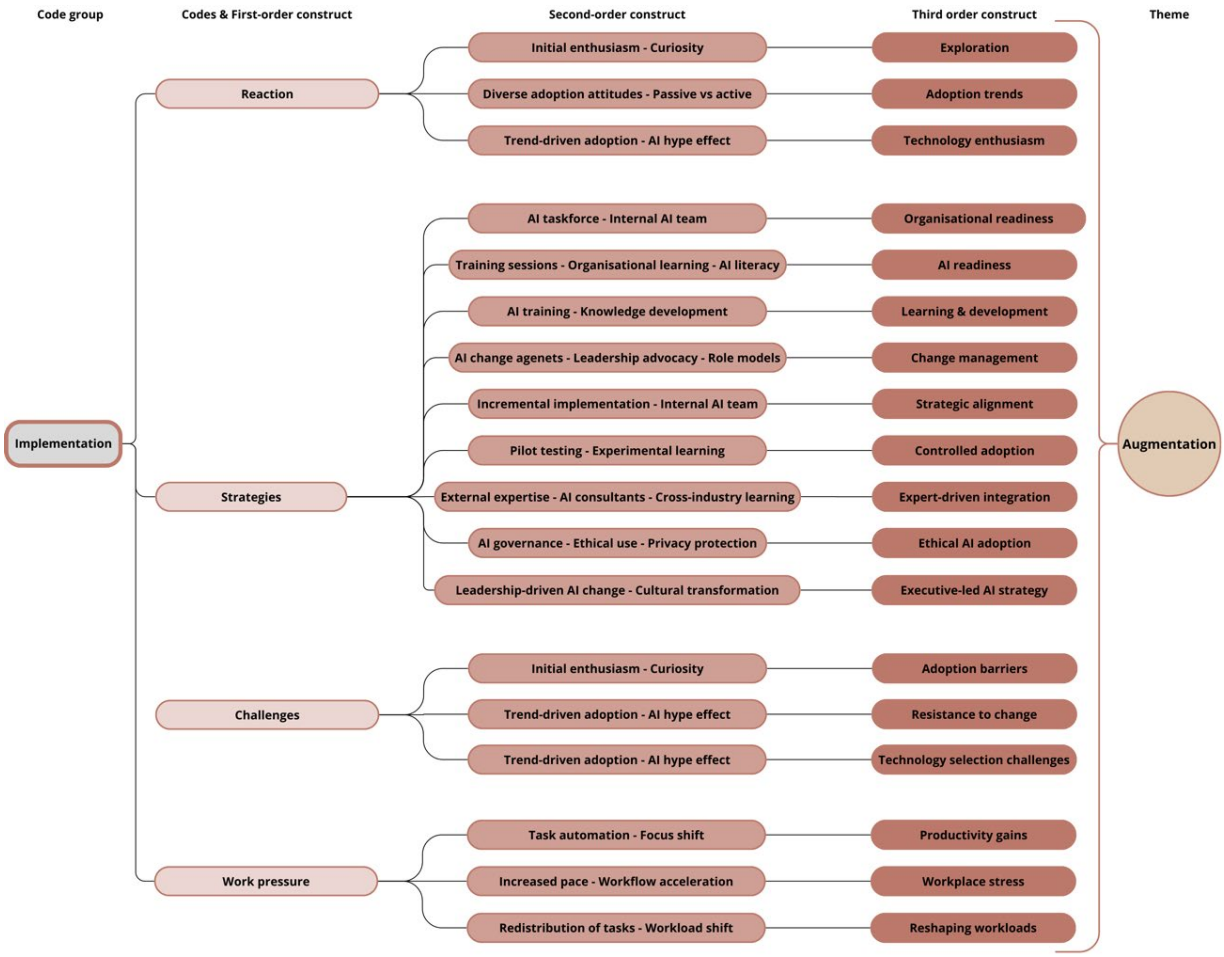

Figure 10: Implementation constructs (Own work)

Reaction

Introducing AI into deliberation often generates excitement, particularly when employees witness its capabilities firsthand. Many describe initial amazement at AI's ability to automate tasks,

generate insights, and simplify complex processes. This enthusiasm creates momentum, encouraging people to the exploration of AI's potential. However, the novelty may fade without structured learning and integration, leaving AI as an underutilized tool rather than a transformative asset.

Reactions to AI adoption vary significantly across individuals and teams. Some professionals actively experiment with AI, testing its capabilities and finding ways to incorporate it into their workflows. In contrast, others take a more passive approach, waiting for guidance before engaging with AI tools. One participant noted, *"Some colleagues are eager to explore AI, while others just let it happen to them."* This highlights the importance of structured onboarding, training, and ongoing support to ensure adoption trends are sustained across all employees, regardless of their initial stance.

Additionally, external technology trends influence AI adoption. The rapid rise of AI has created a sense of urgency, with some organizations rushing to implement AI without fully considering how it aligns with their needs. One participant observed, *"People want to join the AI hype,"* reflecting how external enthusiasm can sometimes drive adoption faster than practical considerations. While excitement can fuel experimentation, organizations must ensure that AI adoption is purpose-driven, focusing on meaningful workflow improvements rather than merely keeping up with technology enthusiasm.

Strategies

Successful AI adoption requires structured strategies that balance enthusiasm with practical implementation. Participants emphasized the importance of organizational readiness, including establishing AI task forces to align adoption with company goals. A dedicated team helps streamline implementation, identify use cases, and support employees in effectively using AI tools. *"We have an AI team to explore implementation,"* one participant noted.

A key driver of AI readiness is education. Structured training sessions help employees understand AI's capabilities, reducing hesitation and encouraging experimentation. *"We started with company-wide sessions to introduce AI and show what it can do,"* a participant explained, illustrating how AI literacy initiatives build confidence. Continued learning and development ensure that employees remain proficient in AI tools, preventing stagnation after initial adoption.

Beyond training, change management is essential. Designating AI champions within organizations helps normalize AI usage and encourage adoption. *"You need people who champion AI within the company,"* one participant shared, emphasizing the role of internal advocates in driving cultural acceptance. Complementary to this, strategic alignment through phased implementation, such as pilot testing in smaller teams, ensures AI is introduced in a controlled adoption, allowing organizations to assess effectiveness before broader deployment.

External collaborations also play a crucial role in expert-driven integration. Companies seek guidance from AI consultants and research institutions to refine their AI strategies. *"An AI task force would make sense, but we are still real estate developers, not AI experts. Maybe we need external expertise to guide us,"* one participant remarked, underlining the importance of cross-industry learning.

To ensure ethical AI adoption, organizations establish governance frameworks that address data privacy and responsible AI use. *"We made guidelines on how to use AI, including privacy concerns like not uploading sensitive documents to ChatGPT,"* a participant noted, stressing the need for clear policies on AI engagement.

Finally, executive-led AI strategy is critical for long-term adoption. Leadership-driven initiatives create momentum for AI integration, ensuring that change is supported at all levels. *"Change must come from leadership. AI adoption will fail if it's only grassroots without management support,"* a participant emphasized.

By combining structured education, phased implementation, governance policies, and leadership endorsement, organizations can transition from AI experimentation to meaningful, sustained adoption.

Challenges

Despite AI's potential to enhance workflows, its adoption faces several challenges. A primary obstacle is adoption barriers, with employees struggling to identify practical applications for AI in their workflows. One participant noted, *"The biggest obstacle is that we still don't know how to use it effectively,"* illustrating how uncertainty about AI's role can slow integration. Additionally, digital literacy gaps, particularly among older employees, further complicate adoption. *"Older employees struggle with digital tools and AI,"* a participant remarked, highlighting how generational divides influence engagement with AI technologies.

Resistance to change is often exacerbated by early negative experiences with AI. Users may become reluctant to continue experimenting when AI tools fail to meet expectations. *"AI outputs sometimes don't work well, so people give up quickly,"* one participant stated, demonstrating how initial frustration can lead to disengagement.

Beyond usability concerns, technology selection challenges present another significant hurdle. The rapid expansion of AI solutions has created an overwhelming number of options, making it difficult for organizations to determine which tools best fit their needs. *"We see a huge proliferation of AI tools, making it hard to choose the right one,"* one participant observed, pointing to decision fatigue as a common issue.

To overcome these challenges, organizations must provide clear guidance on AI applications, support employees in developing AI literacy, and ensure that early interactions with AI tools are positive. AI implementation risks being met with scepticism and slow adoption without addressing these barriers.

Work pressure

AI is often introduced to streamline workflows and reduce workload, but its impact on work pressure is complex. Many participants acknowledged AI's ability to increase productivity by automating repetitive tasks and allowing employees to focus on more strategic or creative work. *"AI allows us to focus on creative work, reducing manual tasks,"* one participant noted, emphasizing AI's role in shifting cognitive load toward higher-value activities.

However, this increased efficiency can also lead to workplace stress as expectations for faster output rise. *"As automation increases, work expectations rise, creating more stress,"* one participant explained, illustrating how AI-driven acceleration can result in heightened pressure and faster decision cycles. Additionally, AI often reshapes workloads rather than reducing them. While automation eliminates specific tasks, employees frequently take on new responsibilities, altering their work-life balance without necessarily decreasing their overall workload. As one participant observed, *"People won't necessarily earn more or gain more freedom, workload will just shift."*

Ultimately, AI's influence on work pressure depends on how organizations manage integration. Without careful planning, increased efficiency can lead to unrealistic demands rather than reduced workload, reinforcing the need for structured implementation and realistic expectations.

Synthesis theme: Augmentation

The theme of Augmentation captures how AI is not simply introduced as a tool, but as a process that enhances how professionals work, learn, and adapt during implementation. Rather than replacing human effort, AI expands individual and collective capacity by supporting experimentation, stimulating curiosity, and encouraging new ways of engaging with work processes. Participants described the early phases of AI adoption as moments of enthusiasm and amazement, often triggered by visible results and hands-on interaction with AI tools.

This initial momentum, however, requires structure and support to translate into lasting change. Without training, leadership engagement, and clear strategic alignment, the novelty of AI can fade, leading to confusion, uneven adoption, or even disengagement. Participants emphasised the need for guided onboarding, accessible learning opportunities, and the presence of internal advocates to maintain momentum. Augmentation, in this context, is both technical and cultural: it involves reshaping how people approach their work and how organisations facilitate learning and change.

Importantly, the interviews revealed that AI enables professionals to work differently, often shifting attention from manual tasks to more creative or strategic work. However, this shift also brought increased expectations and, in some cases, higher work pressure. AI's potential to free up time does not always result in reduced workload; instead, it often changes the nature of that workload. This highlights the double-edged nature of augmentation: it empowers users while simultaneously requiring organisations to carefully manage new demands.

Augmentation therefore refers to more than task support. It represents a change in mindset, in which AI becomes a catalyst for learning, collaboration, and confidence-building. Successful augmentation depends on an environment where exploration is encouraged, support is ongoing, and implementation strategies are grounded in both technical guidance and human development.

In sum, Augmentation illustrates that the successful integration of AI is not just a matter of tool deployment, but a people-driven process. When supported by inclusive strategies, transparent governance, and strong leadership, AI can enhance professional capacity, foster innovation, and contribute to more resilient and adaptable project teams.

5.2.5 Design team

While previous sections explored how AI can support deliberation, this part of the analysis turns attention to the human and organisational structures that shape deliberative processes within design teams. Deliberation does not occur in isolation but is embedded in dynamic project settings where multiple actors, phases and priorities must be aligned. The composition of teams, the presence of competing interests and the evolving nature of collaboration all influence how deliberation is practised and how decisions take shape over time. Drawing on the Double Diamond model and participants' insights, this section unpacks how coordination across roles, phases and perspectives is essential for effective stakeholder engagement in real estate design projects.

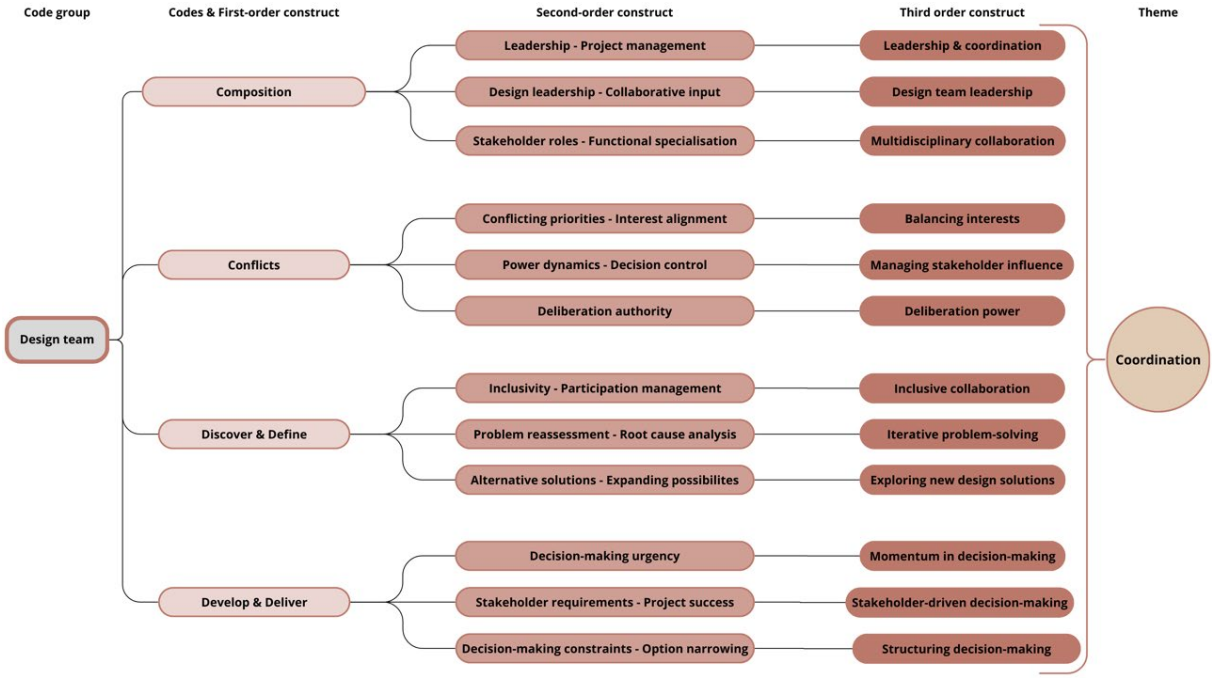

Figure 11: Design team constructs (Own work)

Composition

The structure of design teams significantly influences how deliberation unfolds. Each team comprises diverse stakeholders, including developers, architects, engineers, and financial advisors, each contributing expertise while balancing distinct interests. Participants emphasized that the team's composition determines the nature of deliberation and the challenges that arise.

Project managers are central in guiding deliberation, ensuring discussions remain aligned with project objectives. *"There is always a project manager at the table. Their role becomes more prominent as the project reaches the schematic and detailed design stages,"* one participant explained. Leadership & coordination becomes increasingly important as projects progress. Additionally, architects often lead early-stage design discussions, while technical consultants, such as structural engineers and building services specialists, provide input at later stages. Design team leadership ensures that design decisions are informed by technical expertise while maintaining a clear vision.

Despite the structured nature of design teams, coordination challenges frequently emerge. *"Installation advisors and fire safety consultants often join discussions too late, waiting for architectural plans before starting their work. This creates delays and misses opportunities for integration,"* a participant noted. These challenges highlight the importance of multidisciplinary collaboration and early stakeholder involvement.

Conflicts

The competing interests of different stakeholders' shape deliberation within design teams. Developers focus on financial feasibility, architects prioritize design quality, and engineers ensure technical viability. Participants highlighted that these differences create friction, requiring structured deliberation to align perspectives. Balancing interests is crucial to managing these conflicts, as each stakeholder brings their own objectives to the table.

One participant described how conflicts emerge when stakeholders prioritize their disciplines over collective project goals: *"An architect cares about aesthetics, but a sound expert only focuses on noise reduction. The developer, meanwhile, is thinking about cost and regulations."* This dynamic

necessitates careful facilitation to ensure that discussions remain productive and lead to integrated solutions.

Power imbalances also affect deliberation. Some stakeholders dominate discussions, while others struggle to have their concerns acknowledged. *"Some people try to control the process, while others' opinions get ignored,"* a participant noted, emphasizing the challenge of managing stakeholder influence to ensure equitable participation.

Additionally, deliberation power often rests with investors, who may overrule technical or design recommendations. One participant explained, *"In the end, the investor decides, even on aspects like the colour of the building, which has nothing to do with technical feasibility."* While investors play a crucial financial role, their influence on design and technical decisions can create tension within the team.

By addressing these conflicts design teams can ensure that deliberation leads to well-integrated outcomes rather than being dominated by a single perspective.

Discover & Define

The first two phases of the Double Diamond model, Discover and Define, set the foundation for effective deliberation by opening the problem space and collectively framing project goals. These phases invite stakeholder engagement early on, creating opportunities for inclusive collaboration and shared understanding.

Inclusive collaboration plays a central role in the Discover phase. Design teams consist of diverse stakeholders such as architects, developers, technical consultants, and clients, each bringing their own priorities and perspectives. Participants emphasised that engagement from all disciplines is essential to avoid misalignment later in the process. As one participant explained, *"Each perspective must be integrated to arrive at a functional solution."*

In the Define phase, deliberation begins to narrow as the team works toward a shared understanding of the design challenge. At this stage, iterative problem solving becomes vital. Teams are required to translate broad discussions into actionable briefs, while still navigating conflicting interests. One project manager explained, *"We often need to take a step back to reassess the problem, but time pressure sometimes forces us to move forward before we've fully explored alternative solutions."* These moments of back-and-forth illustrate how defining the problem is itself a deliberative act, one that demands critical reflection, compromise, and alignment.

Although generative AI plays a more visible role in later phases, early-stage ideation is not without digital support. Some participants saw opportunities for AI to assist with exploring new design solutions, even in the Discover and Define phases. As one noted, *"Some things would never be considered in a traditional design process, but AI opens up new possibilities."* While still emerging, these examples point to the potential for AI to stimulate creativity and broaden the scope of initial problem framing.

Together, the Discover and Define phases form the deliberative backbone of the design process. Through inclusive collaboration, iterative problem solving, and the early exploration of new solutions, design teams begin to build a shared vision that will guide subsequent phases. These early efforts lay the groundwork for more focused, integrated decision-making as the project advances.

Develop & Deliver

The second half of the Double Diamond model, Develop and Deliver, marks a shift from open exploration toward concrete implementation. These phases centre on translating ideas into actionable outcomes through iteration, convergence, and structured commitment.

In the Develop phase, design teams actively generate and test alternative solutions. This phase is inherently iterative, involving cycles of refinement as teams balance creativity with technical realism. AI tools play a supportive role by enabling rapid prototyping and evaluation of design options. As one participant observed, *"Some things would never be considered in a traditional design process, but AI opens up new possibilities."* This highlights how digital tools can extend the design space and facilitate informed comparisons between alternatives.

As teams transition into the Deliver phase, the emphasis shifts to commitment and execution. Deliberation becomes more decisive, with stakeholders required to finalise choices and prepare for implementation. This stage reflects the third-order construct of momentum in decision making, where the capacity to make timely decisions becomes essential to project continuity. *"You must make choices. Otherwise, the project won't move forward. No decision is also a decision, but it's usually not a good one,"* one participant remarked, pointing to the necessity of advancing with conviction.

Simultaneously, stakeholder-driven decision making becomes more pronounced. Technical experts contribute recommendations, but financial stakeholders often exert the final influence. One participant explained, *"At the end of the process, it's not always the technical quality that determines the outcome, but whether the investor agrees with the decision."* This highlights how deliberation at this stage is shaped by the power dynamics between financial imperatives and technical feasibility.

Throughout both phases, AI remains present as a facilitator rather than a leader. By automating repetitive tasks, optimising layouts, and streamlining reporting, AI tools help structure the decision-making process without replacing human judgment. *"AI can help automate parts of the process, like generating reports or optimising layouts, but ultimately, we have to make the final call,"* as one participant clarified. This reinforces the importance of structuring decision making, where AI supports clarity and efficiency, but human agency remains the guiding force.

In summary, the Develop and Deliver phases illustrate how deliberation evolves from exploratory dialogue to structured decision-making. Through the careful integration of AI tools, timely coordination, and ongoing negotiation among stakeholders, projects move from concept toward realisation in a way that balances innovation with feasibility.

Synthesis theme: Coordination

The theme of Coordination emerged from a close analysis of how deliberation unfolds within multidisciplinary design teams. Unlike more abstract or strategic deliberations, those in the design context are deeply embedded in the practical reality of aligning diverse stakeholders across different project phases. Participants described how architects, engineers, project managers, and financial stakeholders must continuously reconcile different objectives, often under time pressure and evolving constraints. These recurring patterns led to the identification of Coordination as a distinct theme, capturing the operational nature of deliberation in design teams.

This theme was built upon data showing that the structure and timing of team involvement significantly influence deliberation outcomes. Participants described how delays in including technical consultants or fire safety advisors disrupted the integration of perspectives, leading to inefficiencies or missed opportunities. Such examples highlighted the importance of proactive,

well-sequenced collaboration. Coordination in this sense is not merely logistical; it is foundational to ensuring that deliberation supports well-informed and feasible design decisions.

The theme also encompasses the leadership dimension of design teams. Project managers and architects were frequently cited as central figures in steering deliberative processes. Their ability to guide discussions, mediate between conflicting priorities, and keep the project aligned with its goals was seen as essential. This dynamic reinforces that coordination is both a structural and interpersonal function. It involves not only organizing team input but also managing the power dynamics that shape whose voices are heard.

Finally, Coordination emerged as a critical factor in managing the design process over time. Drawing on the Double Diamond model, participants described how early-stage exploration gives way to convergence and finalization. Across these phases, deliberation must shift focus without losing momentum. Effective coordination ensures continuity, allowing ideas to mature and stakeholder input to be meaningfully incorporated at the right moments.

In summary, Coordination captures the embedded, temporal, and role-driven aspects of deliberation in design teams. It reflects the need to align diverse inputs through structured collaboration, sustained facilitation, and thoughtful sequencing. As teams move from ideation to delivery, coordination serves as the connective tissue that holds deliberative processes together, ensuring that technical feasibility, design quality, and stakeholder needs remain in productive balance.

5.2.6 Synthesis of findings in the interview analysis

The interview analysis identified five overarching themes: Inclusivity, Efficiency, Facilitation, Augmentation and Coordination. Together, these themes offer a comprehensive understanding of how deliberation unfolds in design teams and how generative AI can influence, support or challenge this process.

Inclusivity emerged as a core condition for meaningful deliberation. It emphasises the importance of ensuring that all participants can contribute in ways that influence the direction and outcome of deliberative talks. Barriers such as unequal participation, dominant voices and information gaps highlight the need for deliberate strategies that promote inclusion.

Efficiency highlights how AI can streamline workflows by reducing administrative burdens, centralising knowledge and accelerating information processing. Participants described how AI tools support tasks such as summarising meetings, organising agendas and retrieving documents in real time. However, they also noted that increased efficiency often brings new demands, such as expectations for faster decisions, more iterations and continuous engagement. As such, efficiency was not viewed as an automatic benefit but as a dynamic that must be managed through careful implementation, appropriate tool selection and organisational support.

Facilitation captures the shared belief among participants that AI should assist rather than replace human deliberative efforts. While concerns were raised about bias, trust and ethical use, participants emphasised that AI could strengthen the structure and clarity of deliberation. It can surface neglected viewpoints, organise information and support balanced participation, provided that human oversight remains central to the process.

Augmentation refers to the transformative role of AI during implementation, where it enhances professional capacity and encourages new ways of working. Participants described early adoption phases as moments of experimentation and enthusiasm, particularly when AI tools were introduced

in accessible and engaging ways. Yet this momentum requires structured support in the form of training, leadership endorsement and organisational strategies to become sustainable. Augmentation was seen not only as a technical enhancement but also as a cultural and behavioural shift, where professionals are empowered to learn, create and collaborate differently.

Coordination reflects the operational dynamics of deliberation within multidisciplinary design teams. Participants described how collaboration between stakeholders such as architects, engineers and developers require continuous alignment throughout the phases of the design process. The structure and timing of team involvement, as well as leadership roles, significantly affect the effectiveness of deliberation. Coordination was seen as essential for maintaining momentum, balancing conflicting priorities and ensuring that stakeholder input is integrated at the right moments.

5.3 Connecting survey and interview analysis

The purpose of combining the survey and interview data in this research was to gain both breadth and depth in understanding how generative AI influences stakeholder deliberation within design teams. While the interviews offered rich and detailed insights into deliberative dynamics and the implementation of AI, the survey provided a broader overview of current practices, perceptions and adoption trends across a wider group of professionals. This section explains how the findings from both methods relate to each other by reinforcing, extending or qualifying key insights.

Several key themes that emerged from the interviews were also reflected in the survey responses, which supports the validity and relevance of the findings. For instance, the importance of inclusivity was consistently emphasised in both datasets. Survey respondents indicated that AI could help create more balanced participation by managing time, tracking input and reducing the dominance of certain voices. This mirrors the interviews, where participants described how tools such as chatbots or meeting monitors can help create space for more diverse contributions.

A similar overlap can be observed in the theme of efficiency. Many survey participants reported that AI helps reduce administrative burdens, improves access to information and accelerates documentation. This corresponds with the interview findings, where participants described how AI tools such as automatic summarisation or knowledge retrieval support the flow of deliberation. At the same time, both methods pointed out that increased efficiency often comes with new expectations, including faster decision-making and more continuous engagement.

The theme of facilitation also appeared in both data sources. In the survey, AI was most often used to support human facilitators, rather than to replace them. This aligns closely with the interviews, in which participants expressed a clear preference for AI as a tool that helps to structure discussions and coordinate interactions but should not overtake the role of human guidance.

While most findings were consistent, some nuances emerged between the two methods. For example, the theme of augmentation was more strongly developed in the interviews than in the survey. Interview participants described how AI stimulated experimentation, increased curiosity and encouraged new ways of working. By contrast, the survey responses showed that while many professionals are aware of AI's potential to support innovation, relatively few have yet experienced this transformation in practice. This suggests that augmentation remains an aspirational goal rather than a widely embedded reality.

The theme of coordination was less explicitly discussed in the survey but could be observed indirectly. Respondents referred to challenges such as fragmented workflows, delayed involvement of experts and difficulties in maintaining alignment. These concerns reflect the findings from the

interviews, where participants emphasised the importance of timely collaboration and clear leadership in deliberative design settings. Although different terminology was used, both datasets pointed to a shared concern about the need for better alignment across team roles and phases.

The integration of both data sources strengthens the study through triangulation. The survey confirmed that many of the challenges and opportunities identified in the interviews, such as uneven AI adoption, the risk of overreliance, and the importance of human oversight, are widely experienced among practitioners. At the same time, the interviews added explanatory depth to these survey findings by exploring the reasoning, experiences and contexts behind the numbers.

In conclusion, the connection between the survey and interview analyses reveals a high level of agreement on the main findings of this study. Both sources show that AI is beginning to support stakeholder deliberation in meaningful ways, particularly through increased efficiency and structured facilitation. However, successful integration also requires careful attention to inclusion, coordination and human judgment.

From my perspective, the combination of survey and interview data has greatly enriched this study. The survey provided a broad view of how AI is currently perceived and applied, while the interviews revealed the complex realities behind those perceptions. This combination not only validated key themes but also uncovered deeper layers of meaning through qualitative insights. Especially in the case of augmentation and coordination, the interviews helped me understand how AI adoption is both a technical and cultural process, shaped by organisational dynamics and individual attitudes. By integrating both methods, I was able to capture the nuanced and evolving role of generative AI in stakeholder deliberation more comprehensively than either method alone would have allowed.

6. Results

This chapter presents the research results, integrating insights from theoretical orientation, industry context, survey analysis, and interviews. The findings are structured according to the three sub-questions. The final sub-question will be further explored by developing a framework that guides integrating AI into deliberation in a structured and effective manner.

6.1 Deliberation in design teams

(Addressing Sub-Question 1: What is meant by stakeholder deliberation in the context of design teams in real estate development, and at which stages is it most essential?)

Stakeholder deliberation in the context of design teams in real estate development can be understood as a structured, inclusive, and reflective process in which participants engage in dialogue to explore, refine, and justify design decisions. In contrast to conventional decision-making, which often emphasizes efficiency, authority, or speed, deliberation is characterized by mutual reasoning, the integration of diverse perspectives, and critical engagement with alternatives before arriving at shared conclusions.

This understanding is firmly grounded in the conceptual framework discussed in Chapter 3. Deliberation, as defined by Forester (2006), Garard et al. (2018) and Zhang et al. (2023) is epistemic: it prioritizes understanding, reflection, and reason-based discussion over bargaining or positional defence. This distinction was confirmed in the empirical data. One participant described deliberation *as "more about argumentation with each other... more rational, more acceptable,"* while another emphasized that it is *"totally different... more about understanding, reflection, and rationality."* These views highlight that deliberation is not merely a way to reach decisions but a process of co-constructing meaning and insight among stakeholders.

Crucially, deliberation is also about inclusion and equity. Participants stressed the importance of creating space for all voices to be heard: *"You try to bring people together to discuss the reasons behind different measures... it requires equal participation of different stakeholders so that people have equal saying in that."* This positions deliberation not as a top-down or expert-dominated activity but as a collaborative and relational practice. Importantly, this inclusivity does not necessarily aim for complete consensus but seeks to build shared understanding: *"Even if some people said deliberation doesn't need to form agreement, still you need a collective issue to start with... to achieve some mutual understanding."* In this way, deliberation is inherently social, as another respondent explained: *"Decision making is more information and individual based. In deliberation, you have also interpersonal discussions where the physical presence might play a big role."*

Another key insight from theory and practice is that deliberation unfolds as an iterative process. Rather than occurring in a single moment, it develops over time, allowing teams to revisit and revise ideas as projects evolve. Rapanta and Blair (2011) argue that effective deliberation relies on recursive cycles of argumentation and reflection, in which participants gradually refine their understanding through successive rounds of critical engagement. This view aligns with the observed practices in design teams, where ideas are continually re-evaluated and adapted across different project stages. One participant noted, *"In the early design phase, there are many options. Over time, these are refined, but early deliberation determines the overall direction."* Another highlighted that design teams move *"from SO to VO to DO, to TO, to UO, choices become fewer, and deliberation happens more in early stages."* These reflections suggest that, rather than strictly iterative, deliberation also evolves over time. In early phases, it is characterised by broad exploration and open-ended discussion, whereas in later stages it becomes more focused and

constrained as design choices are narrowed down. This temporal progression reflects a shift in the nature and function of deliberation across the design process.

Building on these empirical insights, this research identified three distinct deliberative modes, each reflecting a different phase and function of stakeholder interaction. These modes emerged from an inductive analysis of the interview data, as presented in Chapter 5.2, and were subsequently interpreted and labelled as Exploratory, Convergent, and Operational Deliberation. Together, they describe how the nature of deliberation shifts over the course of a project: from open-ended idea generation, to synthesis and alignment, to final coordination and implementation.

The identification of these modes is grounded in theoretical insights from deliberation studies. Rapanta and Blair (2011) emphasise that deliberation is a process of iterative argumentation and reflection, where participants gradually refine their understanding across different moments of engagement. Garard et al. (2018) add that effective deliberation requires varying degrees of inclusivity, structure, and critical thinking depending on the stage of a process. These perspectives support the idea that deliberation is not a one-size-fits-all practice, but rather a dynamic and context-sensitive activity that evolves in form and function as projects progress.

The three identified deliberative modes also correspond to established design process models. The Double Diamond model (Discover, Define, Develop, Deliver) and the Dutch BOB model (Beeldvorming, Oordeelsvorming, Besluitvorming) provide a structural lens through which the findings can be interpreted. Exploratory Deliberation aligns with the Discover and Beeldvorming phases, characterised by open dialogue, broad exploration, and divergent thinking. Convergent Deliberation reflects the Define and Develop phases and Oordeelsvorming, where ideas are synthesised, trade-offs are assessed, and teams begin to converge around shared solutions. Operational Deliberation corresponds with the Deliver and Besluitvorming stages, in which final decisions are made and coordinated across stakeholders to enable implementation. The mapping between deliberative modes and design stages helps to clarify how deliberation takes on different forms and purposes throughout the real estate development process.

Each mode not only reflects a specific deliberative character but also corresponds with phases in the real estate design process and specific types of AI tools that were reported to be useful in those contexts. In the early phases, namely Sketch Design (SO) and Concept Design (VO), Exploratory Deliberation is most prominent. This stage is marked by open-ended dialogue and broad engagement, where stakeholders seek to surface ambitions, share ideas, and align visions. One interviewee explained, *“For the design team, I think deliberation mostly happens in the early design phase. People really have different goals... The tenants want better living quality, the housing company wants lower cost.”*

In the mid-phases, namely Definitive Design (DO) and Technical Design (TO), deliberation becomes more focused and evaluative. This Convergent Deliberation mode involves assessing trade-offs, integrating technical requirements, and prioritizing constraints. *“In early phases, many options are considered,”* one participant explained, *“but as we move forward, choices become more constrained.”*.

Finally, in the Construction-ready Design (UO) and Realisation phase, Operational Deliberation takes over. At this point, teams focus on finalising agreements, validating design decisions, and coordinating their implementation. Deliberation in this stage is typically more structured and focused, with less room for ambiguity, as decisions must be executed efficiently and in alignment with previous agreements.

Despite its benefits, deliberation is not without challenges. The analysis revealed four recurring barriers that can undermine its effectiveness: power imbalances, time constraints, communication inequalities, and information asymmetry. These findings closely mirror theoretical concerns raised by Buhmann and Fieseler (2021), who argue that unequal access to communication channels and digital tools can hinder inclusive deliberation. Forester (2006) emphasises that power dynamics and strategic manipulation can distort communicative planning processes, while Zhang et al. (2023) highlight how time pressure and fragmented information flows can weaken the depth and fairness of deliberative exchanges. For example, one participant observed, *"Well, if you talk about design teams in a small scale, I will say it's usually dominated by some person,"* while another warned, *"Power dynamics often lead to dominance by certain individuals, reducing equal participation."* Others highlighted that *"a lot of people... don't have the equal capability to express their reasons,"* and that *"sometimes not all information is available, so discussions must be delayed until more data is collected."* These insights underline the importance of fostering deliberation and designing for it, ensuring equitable participation, access to information, and sufficient time and resources.

In conclusion, stakeholder deliberation in real estate design teams is best understood as an epistemic, inclusive, and dynamic process of mutual reasoning and co-exploration. It is essential in the early design stages when visions are still forming, and the project's direction remains open. However, it continues to play a vital role throughout the project lifecycle. By engaging with diverse perspectives and supporting critical dialogue, deliberation enhances the quality and legitimacy of design agreements. These findings form a strong foundation for further exploring how generative AI might support deliberative practices, which will be discussed in Chapter 6.3.

6.2 Generative AI tools in deliberation

(Addressing sub-question 2: Which generative AI tools are currently used to facilitate deliberation?)

Generative AI is emerging as a powerful enabler of deliberation within real estate design teams. While predictive AI focuses on forecasting outcomes, generative AI actively creates new outputs such as visuals, text, or structured arguments, drawing on large datasets. As outlined in Chapter 2, these tools offer capabilities that extend beyond automation, supporting creativity, knowledge sharing, and inclusive dialogue (Feuerriegel et al., 2023; Karacapilidis et al., 2024). However, as the findings reveal, their application in deliberation remains experimental and uneven.

Survey data suggests that professionals in the built environment already engage with generative AI tools, albeit in informal ways. 88% of respondents reported using ChatGPT primarily for brainstorming, documentation, and summarizing discussions. However, only 12% have embedded these tools structurally into their workflows. This illustrates a gap between individual experimentation and organizational adoption. Nonetheless, professionals express strong interest in using AI for more than administrative support: 52% want AI to help structure deliberation, and 48% are interested in real-time AI feedback during stakeholder discussions. These numbers suggest a growing awareness of AI's potential to support collaborative and inclusive dialogue.

The interview data confirms and deepens these insights. Participants described using AI not only for generating content but also for supporting deliberative structure. One interviewee shared: *"What I often do in projects is create a kind of knowledge chatbot. You upload all project documentation, and during meetings, you can instantly access the necessary knowledge."* This reflects AI's function as an information hub, allowing teams to remain well-informed throughout the deliberation process. Another participant highlighted how AI supports structured reasoning: *"It listens in, takes notes, and structures discussions, making it easier to track different viewpoints and ensure key arguments are captured."*

These functions align with the theoretical orientation, emphasising that generative AI can support deliberation by improving knowledge access, summarization, and structuring stakeholder dialogue. Rapanta and Blair (2011) argue that effective deliberation requires structured argumentation and reflection, processes that can be enhanced by AI tools that facilitate cognitive scaffolding. Stefaniak and Moore (2024) further suggest that generative AI can improve collaborative decision-making by summarising complex input, visualising arguments, and prompting inclusive contributions, thereby enhancing the quality and inclusivity of group reasoning. Several participants also acknowledge this potential. One stated, *"AI can notify facilitators when certain voices are missing in a discussion, ensuring that all perspectives are represented and leading to better alignment among stakeholders."* Here, AI acts as a discussion facilitator, helping mitigate power imbalances by prompting more equitable participation.

Across interviews and surveys, three broad categories of generative AI tools emerged as most relevant for deliberation: text-based assistants, visualisation tools, and documentation systems. These categories reflect the most frequently mentioned applications in current practice, but they do not fully capture the diversity of tools described in the empirical data. Several tools offer more specialised or hybrid functionalities that cut across these categories. They are included here because they illustrate emerging directions and extend the scope of how AI might support deliberation in more advanced or contextualised ways.

Text-based AI assistants, such as ChatGPT and Copilot, are the most widely used. These tools help with brainstorming, comparing arguments, and structuring communication. One participant explained: *"If you ask me for ten ideas for facades, and then ask again, ChatGPT can generate them 15 times faster than a human."* Another added that these tools allow the surfacing of alternative viewpoints, enabling more inclusive and reflective discussion. This supports claims in the literature that large language models (LLMs) can simulate diverse perspectives and democratize access to complex information (Zhang et al., 2023).

Visualisation tools such as DALL·E, MidJourney, and Rendair.ai are growing in concept development, particularly during early design phases. These tools assist in translating abstract or technical ideas into visual representations, facilitating mutual understanding between expert and non-expert stakeholders. One interviewee said, *"Some things would never be considered in a traditional design process, but AI opens up new possibilities."* This illustrates how generative AI enhances creative exploration and iterative dialogue.

Documentation tools, including Fireflies.ai, Read AI, and NotebookLM, automate meeting transcription, summarisation, and archiving. One participant emphasized the value of structured memory: *"AI can transcribe and summarize meetings instantly."* Another explained how this supports iterative deliberation: *"It significantly reduces time spent on documentation and administrative work, allowing teams to focus on actual design discussions."* These tools also support continuity, helping design teams revisit previous decisions and avoid fragmentation.

Emerging tools like Dembrane Echo and OPENRED offer even more advanced functionalities, including real-time argument mapping and scenario modelling. One interviewee noted that AI can help surface external perspectives: *"AI can extract opinions from social media and bring them into the deliberation process."* These tools demonstrate how generative AI can widen the scope of deliberation beyond the immediate team, offering new forms of engagement and knowledge augmentation.

It is important to note that not all tools included in this analysis are exclusively generative. Many tools combine generative capabilities such as producing text, visuals, or summaries with analytical functions such as clustering, extraction, or optimisation. These hybrid tools are nonetheless considered relevant to the research question because their generative aspects play an essential role in how they support deliberation. The classification therefore reflects how tools are applied in practice rather than following a strict technical distinction.

The table below summarises the main AI tools referenced in interviews and surveys, their key functionalities, and their relevance to deliberative practices.

Tool	Function	Potential use in deliberation
Adobe Firefly	Creates and edits images and visual content using generative AI.	Supports visual prototyping in collaborative design discussions.
Bremial	Analyses large documents to extract key information.	Helps access technical or legal data during deliberation.
ChatGPT	Generates text, summaries, and arguments through language modelling.	Structures dialogue, compares viewpoints, and supports brainstorming.
Copilot	Processes documents and automates workflows.	Supports structured preparation and follow-up in deliberative settings.
DALL-E	Produces images based on text prompts.	Translates abstract ideas into visuals, aiding mutual understanding.
Dembrane Echo	Supports structured discussions through argument mapping.	Facilitates structured reasoning and comparison of viewpoints.
Fireflies.ai	Transcribes, summarises, and analyses meetings automatically.	Enhances continuity and transparency in deliberation through documentation.
Gaia	Interacts with environmental datasets.	Supports deliberation around sustainability and environmental considerations.
MidJourney	Generates conceptual images for design ideas.	Enables creative exploration during early-stage design deliberation.
NotebookLM	Supports structured retrieval and analysis of uploaded documents.	Provides context-specific information during deliberation sessions.
OPENRED	Conducts spatial analysis and site research.	Broadens deliberation with contextual knowledge and area-based insights.
Planalogic	Models urban and spatial scenarios using AI.	Assists zoning and city development discussions through simulation.
Read AI	Transcribes and summarises spoken input in meetings.	Improves memory and traceability of stakeholder contributions.
Rendair.ai	Renders design concepts into visual outputs.	Supports iteration and refinement in visual design discussions.
Struck	Checks compliance with regulations using AI analysis.	Aids regulatory deliberation and risk discussions with clear compliance insights.

Table 1: Tools currently used (Own work)

In conclusion, generative AI is already used in real estate design teams to facilitate deliberation through diverse tools that support text generation, visualization, and documentation. While these tools' use remains informal and individual-driven, their functionality aligns with the demands of deliberation: enabling inclusivity, supporting iterative dialogue, and reducing fragmentation. Sub-question 2 is thus answered by identifying which tools are currently in use and how they are applied to specific deliberative tasks within the design process. This forms the basis for the next section, which considers how the advantages and risks of implementing these tools can be strategically integrated into real-world design team workflows.

6.3 Challenges and advantages of AI in deliberation

(Addressing Sub-Question 3: How can the main challenges and advantages of implementing generative AI tools be incorporated into the deliberation process within design teams?)

Generative AI holds significant promise for supporting deliberation within design teams in real estate development, but its integration also introduces several challenges that must be actively addressed. Drawing on the empirical findings from the survey and interviews and grounded in the theoretical orientation discussed in Chapter 2, this section explores how generative AI's advantages and risks can be incorporated into deliberative practice. The analysis is structured along five overarching themes: Facilitation, Augmentation, Efficiency, Inclusivity and Coordination, which emerged from the data and reflect how AI shapes stakeholder dialogue. Each theme includes both enabling conditions and limitations that should inform responsible implementation.

6.3.1 Inclusivity

Perhaps AI's most compelling contribution lies in its potential to enhance inclusivity in deliberation. Some tools monitor participation dynamics and help facilitators detect imbalances. As one participant explained, *"AI can notify the mediator to say that, look, this person hasn't been talking at all. Maybe you should give them space to express themselves."* This application aligns with the normative requirement that all stakeholders have equal opportunity to speak and be heard (Rapanta & Blair, 2011).

AI can also help reduce communication inequalities by translating technical concepts into accessible formats or generating visualizations to support mutual understanding. *"AI helps extract and explain complex data in simpler terms,"* one interviewee said. However, the interviews also reveal that these same tools may exclude stakeholders with lower digital literacy, especially older professionals or non-technical users. As one participant asked, *"Do we get the older generations on board?"*

6.3.2 Efficiency

Generative AI also offers clear efficiency gains, particularly in automating repetitive tasks like meeting documentation, agenda creation, or summarization. Several interviewees reported using tools such as Fireflies.ai and NotebookLM to reduce administrative burdens: *"AI significantly reduces time spent on documentation and administrative work, allowing teams to focus on actual design discussions."* This supports the idea of deliberative space (Zhang et al., 2023), where time saved through automation can be reallocated to deeper engagement.

However, this benefit comes with an important caveat. The empirical findings suggest that efficiency gains may lead to increased work pressure or expectations for accelerated delivery rather than improved deliberative quality. One participant noted, *"As automation increases, work expectations rise, creating more stress."* This reflects the risk of efficiency replacing deliberation rather than enabling it. Incorporating this insight means ensuring that AI-driven productivity is deliberately reinvested into meaningful dialogue, for instance, by expanding reflection periods or scheduling additional design reviews. In this way, AI supports the conditions for deliberation without reducing its depth.

6.3.3 Facilitation

One of the most direct advantages of AI in deliberation is its ability to structure discussions, retrieve relevant information, and support meeting facilitation. As one participant described, *"It listens in, takes notes, and structures discussions, making it easier to track different viewpoints and ensure key arguments are captured."* This aligns with the theoretical requirement for procedural structure in deliberation, where transparency, documentation, and a shared reference point are crucial for legitimacy and continuity (Forester, 2006). AI tools like custom GPT chatbots and transcription assistants function as digital facilitators, ensuring consistency and reducing fragmentation in complex design conversations.

However, this strength also introduces a challenge. Using AI for structuring discussions may lead to over-reliance on AI-generated outputs, weakening active listening and critical engagement. As one interviewee warned, *"AI-generated outputs are not always correct, yet people assume they are."* This reinforces concerns raised by Zhang et al., (2023) and Feuerriegel et al. (2023) regarding automation bias and the need to maintain human oversight. To incorporate this duality effectively, AI tools should be positioned as preparatory or supportive instruments, used to summarize or prompt reflection, but always embedded in human-led agendas and ethical review. For example, using AI to prepare a discussion outline can support more structured dialogue, but decisions should remain grounded in collective reasoning, not algorithmic suggestions.

6.3.4 Augmentation

The fourth advantage of generative AI is its capacity to augment human reasoning. In early-phase design, where exploratory deliberation typically takes place, AI can generate alternatives and support creativity. One participant explained, *"If you ask me for ten ideas for facades, and then ask again, ChatGPT can generate them 15 times faster than a human."* This capacity enhances deliberation by broadening the scope of ideas and supporting epistemic reasoning, a key dimension identified by Garard et al. (2018).

However, this same generative capability raises concerns. AI systems are trained on historical data and often reinforce existing assumptions rather than challenge them. As one interviewee noted, *"AI also has bias. Who should be in control?"* This echoes theoretical concerns about confirmation bias and algorithmic reinforcement (Buhmann & Fieseler, 2021; Zhang et al., 2023) which may narrow the range of perspectives instead of enriching them. To address this, AI-generated outputs should be treated as inputs for group discussion, not as conclusions. Teams can use AI prompts as a starting point for co-reflection and encourage stakeholders to assess AI suggestions critically. In doing so, AI becomes a creative partner that supports, rather than supplants, the human reasoning central to deliberation.

6.3.5 Coordination

Generative AI can play a supportive role in improving coordination within design teams, where alignment across roles and phases is essential for effective deliberation. Participants emphasised the importance of timely and structured involvement of different stakeholders. One interviewee noted, *"Installation advisors and fire safety consultants often join discussions too late,"* indicating how delays can hinder integration and slow progress.

Coordination also depends on leadership roles within the team. As one participant explained, *"There is always a project manager at the table. Their role becomes more prominent as the project reaches the schematic and detailed design stages."* AI tools can enhance this coordination by improving continuity and helping to keep discussions aligned with project objectives.

Despite its potential, AI does not resolve deeper interpersonal and hierarchical dynamics. One participant remarked, *"Some people try to control the process, while others' opinions get ignored."* This highlights that AI-supported coordination must be combined with active facilitation to ensure inclusive and balanced participation.

Together, these five themes demonstrate that while generative AI can offer substantial support to deliberation within design teams, its integration also introduces new demands. Each theme highlights specific conditions under which AI can enhance deliberative practice, as well as critical trade-offs that must be managed. In the case of coordination, for example, AI does not automatically result in better alignment across stakeholders and project phases. Human leadership and appropriate timing remain essential to ensure that collaboration is well structured.

To answer the sub-question *"How can the main challenges and advantages of implementing generative AI tools be incorporated into the deliberation process within design teams?"* a more concrete approach is needed. The following chapter presents a framework and outlines an implementation strategy to support the responsible integration of AI in deliberative processes within real estate development projects.

6.4 Results linked to the conceptual framework & propositions

The updated framework shown in this figure 10 builds on the earlier conceptual model by incorporating empirical insights from the survey and interview data. It retains the core structure introduced in Chapter 3 and confirms the original logic of how generative AI supports deliberation through distinct phases of input, process, and output. All components from the initial framework are substantiated by the findings and remain relevant. At the same time, several new elements have been added or refined to reflect the complexities observed in practice.

The most significant update lies in the integration of five key mechanisms that shape how AI tools influence deliberation: Inclusivity, Efficiency, Facilitation, Augmentation, and Coordination. These emerged as synthesis themes during the analysis and are now explicitly linked to the outputs of the model, illustrating how AI contributes to different aspects of deliberative practice. Rather than acting as separate steps, they help explain how AI contributes to or challenges the quality of deliberative outcomes.

The updated input stage includes three clearly defined types of AI tools. These categories reflect how professionals currently use generative systems in practice. While this supports the idea that AI can help reduce barriers to participation, the results also complicate this. Participants mentioned that some stakeholders, especially those with limited digital skills or little experience with AI systems, may feel excluded from the process. This observation qualifies the assumption that AI necessarily increases inclusivity and shows that specific support structures are needed for inclusive practice to be achieved.

In the process phase, AI contributes to several functions that help structure and support deliberation. While AI can improve workflow and collaboration, participants also reported that its use may create pressure to deliver faster, potentially reducing the depth of engagement. This tension reveals that increased speed is not always accompanied by better reasoning or richer dialogue. Although AI helps organise discussions and maintain alignment, these benefits may come at the cost of reduced reflection and deliberative space.

The refined output section highlights several new outcome areas that emerged from the empirical data. Although these were already implicit in the original model, they have now been expanded and described in greater detail. The five analytical themes are conceptually linked to all outputs as a whole rather than to individual ones. These outputs include improvements in decision quality and the generation of innovative ideas, as well as procedural benefits such as stronger collaboration and enhanced learning. Participants emphasised that these benefits are only realised when AI tools are applied with critical reflection. Some described instances where AI-generated summaries were accepted without further discussion, or where algorithmic suggestions influenced outcomes before meaningful deliberation had taken place. This points to a recurring concern that reliance on AI may come to replace human reasoning instead of strengthening it.

In relation to the original propositions, the findings broadly confirm their relevance but also introduce several critical observations. The first proposition, which claims that AI supports inclusivity, is confirmed but only under specific conditions. Without proper access, facilitation, or

training, AI may reinforce existing gaps. The second proposition, that AI improves deliberative quality through efficiency and structure, is also confirmed but needs to be qualified. Efficiency gains may sometimes come at the expense of depth or equity in participation. Finally, the third proposition, which emphasises the need to maintain human judgment, is strongly supported but remains fragile in practice. Several participants expressed concern that AI tools are sometimes treated as unquestionable sources, weakening deliberative engagement.

In summary, the revised framework provides a more complete and practice-based account of how generative AI supports stakeholder deliberation. It confirms the value of the original model while revealing new conditions, limitations, and tensions that influence how AI is experienced and applied. The model shows that AI can support high-quality deliberation, but only when used reflectively, with attention to process, power, and participation. These findings form the basis for the next chapter, which offers a strategy for putting these insights into action within real estate design teams.

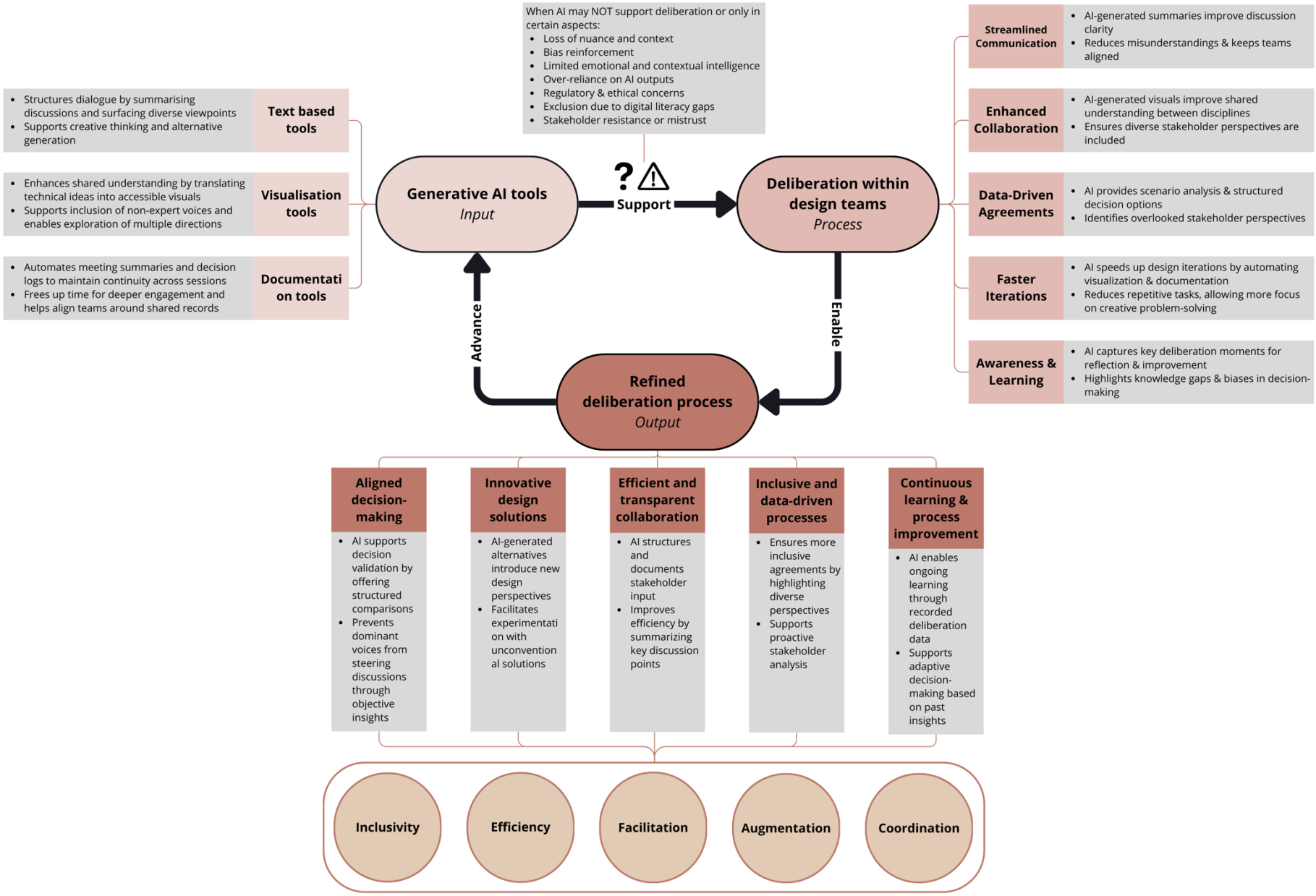

Figure 12: Results linked to conceptual framework (Own work)

7. Framework and implementation strategy

This chapter outlines the development of the AI-supported deliberation framework and the accompanying implementation strategy. These tools aim to support stakeholder deliberation in real estate development by offering guidance on how and when generative AI can be applied in design team deliberation.

The first version of the framework and strategy was developed based on the findings from the analysis. This version was then validated and refined through a workshop and an expert panel. Based on their feedback, a final version was created that is better aligned with practical needs and organisational dynamics.

7.1 First version

The initial version of the AI-supported deliberation framework and accompanying implementation strategy was developed following the analysis presented in Chapter 6. This first version served as a prototype to explore how generative AI tools could support stakeholder deliberation across different phases of the real estate design process. It was used as the basis for validation in the subsequent workshop and expert panel sessions. The initial version is included in full in Appendix H.

In this early version, the framework outlined a three-part distinction between Exploratory, Convergent, and Operational Deliberation, each linked to specific phases in the design process. The strategy proposed a concentric model for implementation, emphasising gradual adoption and alignment with organisational readiness. While the overall structure remains consistent in the final version, several elements were further developed in response to stakeholder feedback and practical reflections during testing.

7.2 Workshop

On April 9th, 2025, a two-hour validation workshop was held at NEOO with three professionals who work in different stages of real estate development. The session aimed to critically assess the first version of the AI-deliberation framework and implementation strategy, focusing on its realism, clarity, and usability. A complete overview of the setup, input, and all resulting changes is included in Appendix I.

The participants represented a broad range of project phases, from early conceptual design to technical detailing and execution. This diversity allowed for a holistic evaluation of how the tools function across the full lifecycle of a development project. Rather than organising multiple separate sessions, the decision to conduct one integrated workshop enabled cross-phase reflections and broader learning.

Participants found the framework helpful for making implicit team dynamics explicit. They recognised the value of distinguishing between divergent, convergent, and operational deliberation modes and saw the framework as a useful structure for supporting design discussions. However, they also pointed out limitations. The terminology was sometimes abstract and unfamiliar, especially for non-academic users. The visual layout was perceived as overly rigid, failing to reflect the iterative and overlapping nature of real-world design processes. Several AI tools included in the framework felt disconnected from the deliberative modes in which they were placed. Participants suggested adding a horizontal layer that captures AI-supported functions like transcription, risk monitoring, and team coordination, which occur across all phases. They also called for more accessible language and greater flexibility in how the framework represents overlapping phases and deliberation types.

Feedback on the implementation strategy was generally positive. Its phased structure and emphasis on small-scale experimentation were seen as suitable for the real estate context. However, participants observed that the model leaned too heavily on technical actions while underplaying behavioural dynamics such as emotional resistance, internal motivation, and the role of informal leadership. They proposed a stronger role for internal champions to drive cultural change from within and emphasised the importance of keeping the strategy adaptable over time, given the rapid development of AI tools. Visual improvements were also proposed to clarify the concentric structure and colour coding.

In addition, the workshop surfaced several implicit assumptions. The materials assumed a shared understanding of deliberation, which was not always the case. Some participants described the term as academic or abstract and recommended using more intuitive phrasing or examples. The materials also presupposed a relatively high level of digital literacy and openness to innovation. In reality, participants noted that not all colleagues are comfortable with AI tools and that opportunities for experimentation are limited in time-pressured project settings.

Overall, the workshop validated the core concepts behind the framework and strategy while providing essential feedback for refinement. Key revisions included adjusting the visual structure of the framework, reassigning and contextualising AI tools, adding a cross-cutting layer for general functions, simplifying terminology, and strengthening the behavioural grounding of the implementation strategy by aligning it with Kotter's 8-Step Change Model. Appendix I provides a detailed list of all adjustments made as a result of the session.

7.3 Expert panel

To complement the insights from the workshop and ensure both academic and practical validity, two expert panel interviews were organised. The first panel interview focused on academic coherence, while the second addressed practical applicability within the field of real estate development. A full overview of the feedback and resulting changes is provided in Appendix J.

The academic expert affirmed the value of distinguishing between divergent, convergent, and operational deliberation modes and supported the overall structure of the framework. He recommended clarifying which tools genuinely qualify as generative AI, improving consistency in terminology, and emphasising that deliberation is an iterative rather than linear process. Reflection was identified as a recurring activity that should be moved to a cross-phase layer. The term "advantages and challenges" was seen as overly binary and was replaced with "advantages and trade-offs" to reflect more nuanced tensions in collaborative processes.

The practical expert found the framework highly relevant but too abstract in its original form. Suggestions included simplifying the language, using more intuitive visuals to show where and how AI tools support specific activities, and expanding the tool descriptions to cover documentation, contract management, and integrality checks. These changes were especially important for the execution phase, where errors and inefficiencies are common. Based on this feedback, features like AI-supported contract change management and cross-disciplinary alignment were added to the framework.

Both experts raised concerns about the way creativity was initially treated. The framework had described "standardized ideas" as a disadvantage of AI use. Drawing on recent work by Doshi and Hauser (2024), the academic expert argued that AI can actually enhance individual creativity by helping users overcome cognitive barriers. However, this often comes at the cost of reduced diversity of ideas within groups.

Feedback on the implementation strategy was also constructive. The academic expert stressed the importance of clearly distinguishing the strategy as a practical tool rather than an academic contribution. He supported the concentric layout and the decision to align the model with Kotter's 8-Step framework. The practical expert emphasised the need for concrete implementation steps such as toolkits, templates, or prompt libraries. She encouraged the inclusion of internal champions and leadership engagement to transition from local experimentation to a broader organisational vision.

The expert panels also revealed several underlying assumptions. The academic expert challenged the idea of AI as a neutral support tool and argued that it should be understood as an active agent that shapes how attention, autonomy, and understanding are constructed in deliberation. This perspective complicates the assumption that AI merely enhances deliberation and instead suggests that it may fundamentally transform it. The distinction between deliberation and decision-making was also questioned, with a recommendation to more clearly link AI functions to deliberative values such as mutual understanding. The practical expert noted that many AI tools require digital environments that are not yet standard in real estate practice and that teams often lack the time or confidence to engage in extensive experimentation.

These expert insights led to further improvements in the framework and strategy. Terminology was refined, the cyclical nature of deliberation was better integrated, tool placements were clarified, and new functionalities such as integrality checks and AI-supported contract workflows were added. A full list of these updates is included in Appendix J. The panels also suggested valuable directions for future research, including the need to develop more accessible tools and visual aids, the integration of reflection into fast-paced workflows, the impact of AI on wellbeing due to rising productivity expectations, and the development of practical entry points to support adoption. These themes are further discussed in Chapter 10.

7.4 Final framework & Implementation strategy

This section presents the final version of the AI-supported deliberation framework and the accompanying implementation strategy, refined through iterative development and validation. Together, they represent the core output of this research. While the framework conceptualises deliberation and the role of AI within it, offering academic guidance on what tools can be used and when, the implementation strategy complements this by outlining how these tools can be introduced and embedded in professional practice.

The framework is primarily intended for design team members, including architects, engineers, project managers, and other professionals involved in daily design deliberation, who require guidance on when and how AI tools can support their collaborative reasoning. In contrast, the implementation strategy is aimed at organisational leadership, innovation managers, and project directors, who are responsible for enabling and sustaining AI adoption across projects and teams. While both outputs are interconnected, they are tailored to different user needs and levels of responsibility within the organisation.

Both tools are intended for professionals operating at the intersection of design, management, and innovation. They aim to bridge the gap between the technical capabilities of AI and the human, collaborative nature of design team deliberation. Importantly, they are not meant to prescribe rigid workflows or tools, but to support reflection, awareness, and structured experimentation.

7.4.1 The AI-supported deliberation framework

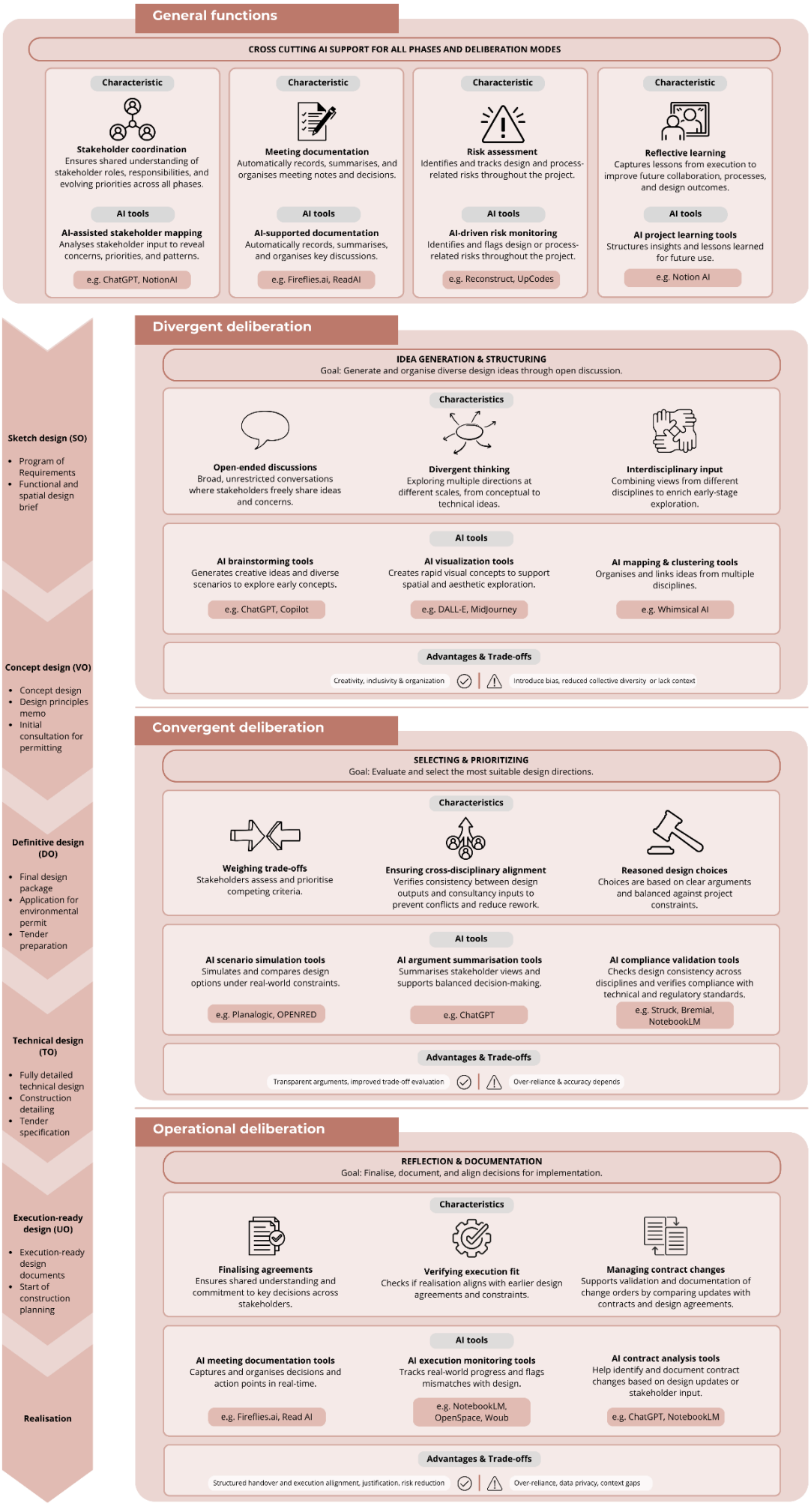

Figure 13: Framework (Own work)

The AI-supported deliberation framework presents a visual model for integrating generative AI into stakeholder deliberation processes throughout the design phases of real estate development. At its core, the framework is structured around three deliberative modes: Divergent, Convergent, and Operational Deliberation. These modes are aligned with the standard design phases used in the Dutch context, namely SO, VO, DO, TO, and UO. These phases are displayed as a continuous vertical timeline on the side of the framework. Key project milestones, such as the Program of Requirements (PvE), the building permit application, and the delivery of technical execution drawings, are incorporated to anchor deliberative processes to tangible outcomes.

Although the framework is presented in a linear layout for visual clarity and practical usability, the process of deliberation it represents is inherently non-linear and cyclical. Real-world design and deliberation involve feedback loops, iterative adjustments, and recurring interactions between stakeholders. The framework is thus best understood as a navigational aid rather than a rigid sequence.

While the framework explains what AI tools can be used and how they can be applied, it is equally important to clarify why generative AI is introduced into design team deliberation. This purpose is captured in five overarching themes that emerged from the literature and empirical findings: Inclusivity, Efficiency, Facilitation, Augmentation, and Coordination. These themes represent the core values and ambitions of AI-supported deliberation. They express what deliberative processes in real estate development can and should gain from the meaningful application of AI.

Figure 14: The five themes and goals (Own work)

Rather than being embedded in the visual layout of the framework, the five themes are presented here as a distinct guiding layer. This separation makes their function as deliberative goals more explicit, highlighting that these are the intended effects of AI on the quality of team interaction, rather than operational functions of individual tools.

Importantly, these five themes are not uniformly distributed throughout the process but shift in prominence across the design phases. Drawing on the BOB-model (Beeldvorming – Oordeelsvorming – Besluitvorming), table 2 links each BOB-phase and corresponding design stage to the most relevant deliberative goals.

BOB phase	Design stage	Dominant deliberation mode	Promintent AI support themes
Beeldvorming	SO / VO	Divergent deliberation	Inclusivity, Facilitation, Augmentation
Oordeelsvorming	DO / Early TO	Convergent deliberation	Augmentation, Efficiency, Coordination
Besluitvorming	Late TO / UO	Operational deliberaiton	Coordination, Efficiency, Facilitation

Table 2: Deliberative focus per phase (Own work)

This temporal shift shows that AI's contribution to deliberation is not static, but varies depending on the project's goals, complexity, and stakeholder dynamics. In early stages, AI helps open up ideas and structure diverse input (Inclusivity, Facilitation). In mid-stages, AI supports structured reasoning, technical alignment, and efficient integration of feedback (Augmentation, Efficiency). In

later stages, it helps ensure shared understanding, reliable execution, and traceability (Coordination, Facilitation).

This “why” layer reinforces the framework’s core ambition: to strengthen the deliberative capacity of teams, not just speed up tasks. The five themes thus serve as a normative compass for AI implementation, helping professionals reflect on the kind of deliberation they aim to foster in each phase and how AI can serve that purpose.

With the purpose of AI-supported deliberation now clarified, the framework can be further unpacked by exploring its three core modes of deliberation. These are Divergent, Convergent and Operational deliberation, each reflecting different stakeholder dynamics and design objectives throughout the development process.

Divergent Deliberation occurs primarily in the early stages of a project, during SO and VO. This mode supports idea generation, creative exploration, and open-ended dialogue across stakeholders. Generative AI plays a role here by enhancing the breadth and speed of idea development, enabling rapid visual prototyping, and structuring diverse perspectives. In practice, teams might use tools like ChatGPT to shape narratives, MidJourney for early spatial visualisation, and NotebookLM to organise stakeholder input and ambitions. This mode is particularly important for promoting inclusivity, creativity, and alignment in the initial phases of a project.

As the project progresses into the DO and TO phases, Convergent Deliberation becomes more dominant. In this mode, deliberation focuses on evaluating trade-offs, ensuring cross-disciplinary alignment, and arriving at justified decisions. AI tools support these processes by simulating scenarios, summarising arguments, and verifying design compliance. Examples include tools such as Planalogic and OPENRED for comparing planning alternatives and prioritising stakeholder concerns, and Bremial and Struck for validating regulatory alignment. Additionally, AI may enhance cross-disciplinary alignment by flagging inconsistencies between architectural, consultancy, and contractual documents, especially when combining textual reports with technical models. This mode is characterised by reasoned evaluation, structured facilitation, and alignment of interests across disciplines.

Operational Deliberation, which is most relevant in the TO and UO phases, supports the transition from decision-making to execution. It involves validating agreements, coordinating implementation efforts, managing contract changes, and documenting outcomes for accountability. In this mode, AI tools such as Fireflies.ai, Read AI, and Woub contribute by capturing meeting decisions, facilitating documentation, and tracking progress against expected deliverables. Additionally, tools like ChatGPT and NotebookLM can support the detection, validation, and documentation of contract changes by comparing updated designs or stakeholder requests with existing agreements. The focus in this phase is on ensuring clarity, consistency, and shared understanding as projects move toward completion.

Beyond documentation and progress tracking, AI can also play a role in improving communication between disciplines. For instance, by cross-checking narrative reports with technical drawings, AI can flag inconsistencies or outdated information that might otherwise go unnoticed. This coordination function is essential in later phases, where misalignment between advisors can lead to costly errors or delays. As a result, AI may enable professionals to become more self-reliant in verifying the coherence of project inputs, reducing dependence on repeated external consultation.

In addition to the three deliberative modes, the framework includes a horizontal layer at the top that captures general functions supported by AI across all phases. These include stakeholder alignment,

notetaking, risk monitoring and reflective leraning. This layer was added in response to workshop feedback, which highlighted that certain deliberative activities recur throughout a project rather than being confined to a single stage. Tools such as NotebookLM and Notion AI are commonly used in this cross-cutting capacity, ensuring continuity and coherence across the design process.

Each deliberative mode is accompanied by a concise overview of potential advantages and trade-offs associated with integrating AI tools into that stage of the design process. These insights, developed through both literature and empirical feedback, help design teams anticipate where AI can enhance creativity, structure, or deliberation, and where risks such as over-reliance, bias, or lack of contextual awareness may emerge. By including these considerations, the framework encourages critical and reflective use of AI rather than blind adoption.

The framework is designed to be accessible for professionals without a technical background in AI. It uses intuitive, practice-oriented terminology to describe how AI can support deliberation in design teams. Instead of linking specific tools to fixed deliberative tasks, the framework offers a flexible set of suggestions. This approach allows project teams to choose and apply tools in ways that suit their own context, workflow, and objectives, encouraging thoughtful experimentation rather than rigid implementation.

To help users apply the framework, a practical "How to use" visual is included. It explains that teams can use the framework during key project meetings to reflect on their current phase, identify the type of deliberation taking place, and select AI tools that support their goals. For example, during early design discussions, the framework can guide teams to tools that enhance creativity and visualisation. During implementation planning, it can point to tools that support agreement tracking and documentation.

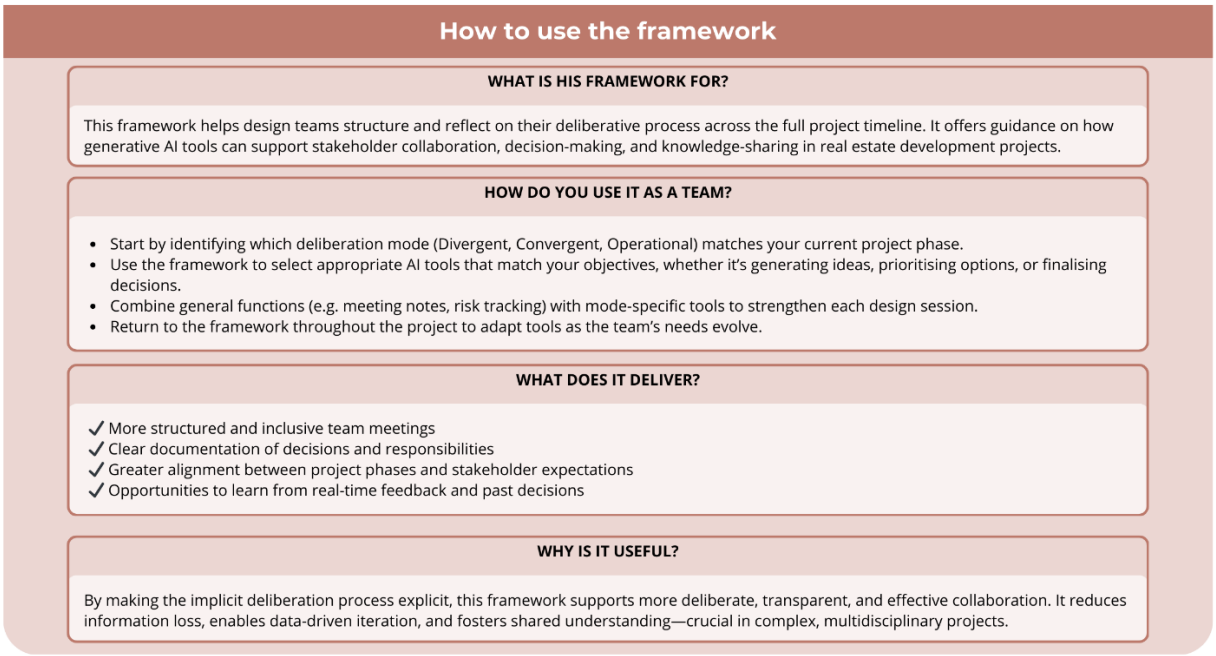

Figure 15: How to use the framework (Own work)

A detailed AI tools table accompanies the framework. Each tool is described by its function, the phase of use, the output it produces, and the related AI support theme (e.g., Facilitation, Efficiency). This table helps users choose suitable tools based on their role, workflow, and deliberative task. The tools listed are illustrative, not exhaustive. New tools may emerge, and teams are encouraged to update and adapt the list as they gain experience.

AI tool	Functionality	Phase of use	Output	Theme
Bremial	Assesses architectural and regulatory compliance in technical drawings	Convergent/operational deliberation	Technical validation	Efficiency
ChatGPT	Generates creative ideas and diverse scenarios to explore early concepts, summarises stakeholder views to support decision-making	Divergent & convergent deliberation	Ideas, summarised arguments	Augmentation, Facilitation
Copilot	Supports idea generation based on contextual input	Divergent deliberation	Concepts, suggestions	Augmentation
DALL-E	Creates rapid visual concepts to support early-phase brainstorming	Divergent deliberation	Conceptual visualisation	Augmentation
Fireflies.ai	Captures and organises meetings and key decisions	General functions	Meeting notes, action points	Facilitation, Coordination
MidJourney	Generates conceptual visualisations for spatial ideas	Divergent deliberation	Spatial visuals	Augmentation
NotebookLM	Organises project knowledge, notes, and documents; supports stakeholder memory	General functions	Knowledge database	Inclusivity, Facilitation, Coordination
Notion AI	Structures lessons learned and supports team documentation	General functions	Reflection and documentation	Inclusivity, Coordination
OPENRED	Explores trade-offs and helps compare multiple planning scenarios	Convergent deliberation	Weighed design alternatives	Efficiency
OpenSpace	Uses 360° image capture and AI to track progress on site, compare with BIM models, and detect deviations	Operational deliberation	Execution status reports	Efficiency, Coordination
Planalogic	Simulates different design alternatives and forecasts long-term impacts	Convergent deliberation	Compared design scenarios	Efficiency
Read AI	Transcribes meetings and generates structured summaries	General functions	Summarised transcripts	Facilitation
Reconstruct	Combines visual data and scheduling to monitor construction risk	Operational deliberation	Risk reports and construction progress validation	Efficiency, Coordination
STRUCK	Validates design compliance with regulations	Convergent deliberation	Compliance reports	Efficiency
UpCodes	Checks building design compliance with codes and flags risks or violations	Convergent/operational deliberation	Compliance checks and risk alerts	Efficiency
Whimsical AI	Maps and clusters ideas from multidisciplinary teams	Divergent deliberation	Visual idea maps	Facilitation
Woub	Dutch AI tool for real-time tracking and validation of construction execution and logistics alignment	Operational deliberation	Execution verification	Efficiency, Coordination

Table 3: Tools and deliberation modes (Own work)

7.4.2 The implementation strategy

Before outlining the steps of the implementation strategy, it is important to highlight the guiding principles that underpin its design. These principles articulate the normative assumptions about how AI should be integrated into deliberative processes and serve as anchors for responsible, inclusive, and adaptive adoption.

The strategy is developed for professionals who are responsible for enabling the use of AI in design projects. This includes organisational leaders such as project directors and innovation managers, but also team leads and project managers who help translate organisational ambitions into practice. These actors play an essential role in creating the right conditions for AI-supported

deliberation by removing structural barriers, providing resources for experimentation, embedding tools in daily workflows, and promoting a culture that supports inclusive and critical use of AI. Without active involvement from this group, even the most promising interventions at the team level are unlikely to scale or last. The strategy therefore focuses on the organisational and procedural conditions that make adoption possible, sustainable, and meaningful.

AI as a deliberative aid, not a decision-maker
AI should support knowledge structuring, trade-off analysis, and documentation, while final decisions remain human-driven.

Incremental and needs-driven implementation
AI adoption should begin with low-risk applications and expand progressively based on demonstrated benefits.

Transparency, oversight, and governance
AI-generated insights must be interpreted, validated, and transparently communicated within teams to ensure credibility.

Building internal AI capacity
Organizations must invest in training programs and governance structures to improve AI literacy and ensure informed decision-making.

Continuous monitoring and adaptation
AI strategies must remain flexible, with ongoing evaluation to assess AI's impact on deliberation quality and decision workflows.

Figure 16: Guiding principles (Own work)

The AI-supported deliberation framework outlines what is possible with generative AI by specifying which tools can be used, when they can be applied, and for which type of deliberation. In contrast, the implementation strategy focuses on how these possibilities can be translated into everyday practice. It provides a structured approach to embedding AI in real estate development organisations by addressing both organisational dynamics and human behaviour. The strategy was developed to support design teams, innovation managers, and organisational leaders in introducing AI in a way that is realistic, responsible, and aligned with existing workflows.

Figure 17: Implementation strategy (Own work)

The implementation strategy is presented as a concentric model of change, reflecting the iterative and layered nature of embedding AI in professional practice. While the structure draws inspiration from Kotter's 8-Step Change Model (Kotter, 2012), it does not prescribe a fixed sequence of actions. Instead, it outlines interrelated areas of action that can evolve in parallel, be revisited, or adapted based on context. The concentric form acknowledges that organisational change in complex environments such as real estate development is rarely linear; it involves overlapping interventions, shifting behaviours, and flexible entry points that allow organisations to tailor their approach to their own needs and stages of readiness.

The strategy outlines a set of interconnected areas of action that support the integration of AI in deliberative practices. It begins by creating a sense of urgency around the relevance of AI, aiming to raise awareness and mobilise both decision-makers and end users. In parallel, organisations are encouraged to form a guiding coalition. This is typically a group of internal champions who lead experimentation, connect strategic ambitions with practical insights, and foster engagement across teams.

Other strategic components include developing and communicating a shared vision for AI and enabling action through small-scale pilot projects. These pilots provide teams with opportunities to experiment, adapt, and build confidence incrementally. At the same time, the strategy emphasises the importance of empowering staff, removing institutional barriers, and celebrating early successes, all of which help to maintain momentum and reinforce learning.

To support long-term change, the strategy incorporates elements aimed at institutionalisation. These include formalising new procedures, aligning AI use with governance structures, and cultivating a culture of reflection and innovation. Mechanisms for monitoring tool performance, updating staff skills, and responding to technological developments are included to ensure the approach remains adaptive over time. Rather than following a fixed sequence, these components form a flexible and iterative model of change that allows organisations to revisit and combine different areas of action as needed.

The visual representation of the strategy captures these eight steps and presents them as a roadmap for navigating the adoption journey. Rather than offering a one-size-fits-all solution, the model encourages organisations to adapt the steps to their own pace, culture, and capabilities.

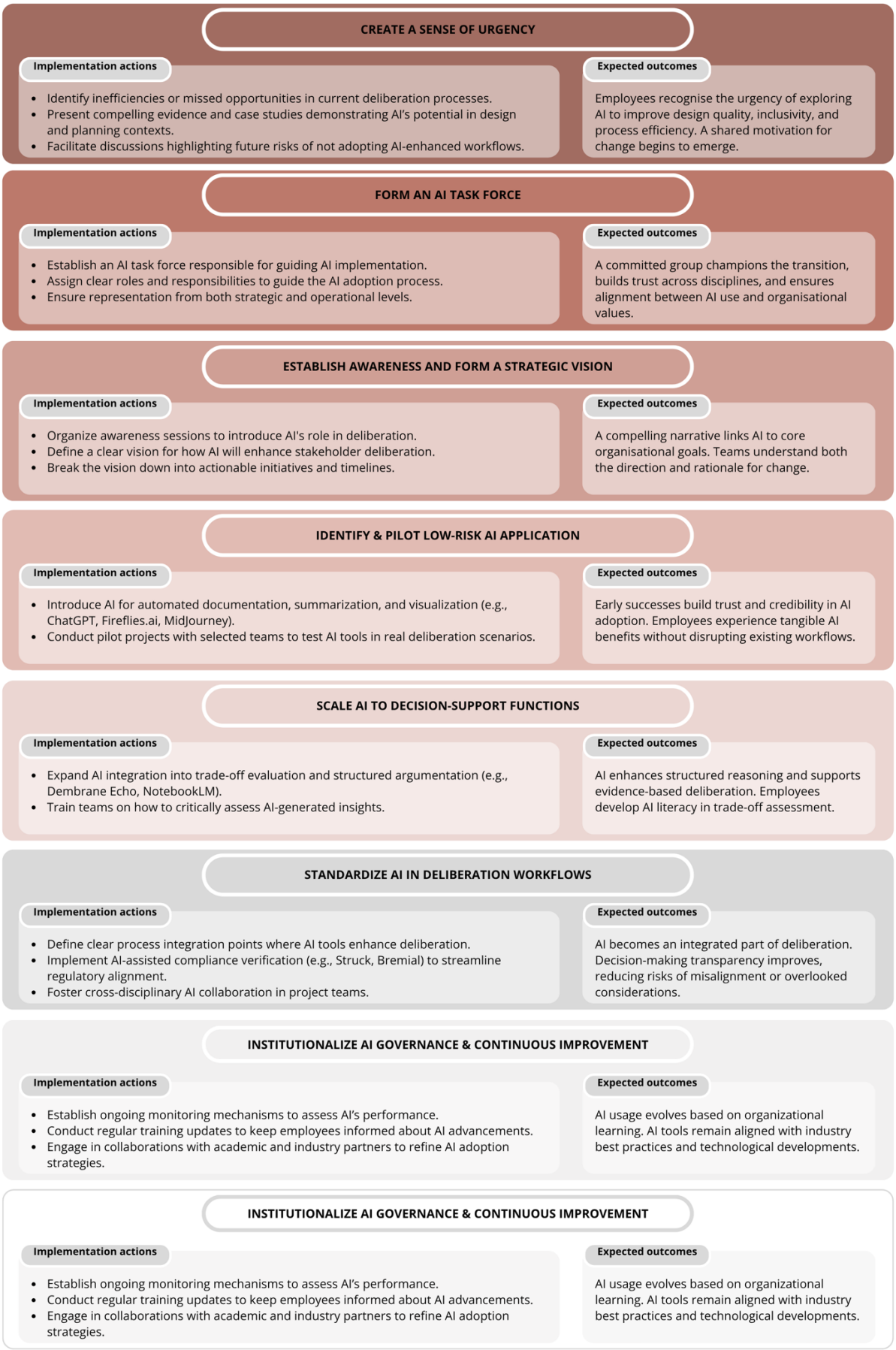

Figure 18: Implementation strategy steps (Own work)

To support responsible implementation, a complementary mitigation strategy was developed. This component addresses potential risks and barriers such as ethical concerns, low levels of digital literacy, and the danger of over-reliance on automated outputs. It provides practical guidance for fostering trust, promoting explainability, and ensuring alignment with the organisation's values and external regulations.

Challenge	Mitigation strategy
Lack of AI Awareness & Digital Skills Gaps	Implement structured AI training programs with practical use-case demonstrations. Develop an internal AI knowledge hub.
Resistance to AI Adoption	Identify and empower AI champions within teams who actively promote AI's benefits and assist colleagues in adoption.
Over-Reliance on AI Outputs	Train employees to critically assess AI-generated insights and maintain human oversight in deliberative reasoning.
Concerns Over AI Ethics & Transparency	Develop clear AI governance policies emphasizing responsible AI use, transparency, and data privacy protections.
Selection of Appropriate AI Tools	Conduct pilot testing and iterative evaluation to determine the most effective AI tools for deliberation.
Unrealistic Expectations & Workload Redistribution	Set realistic goals for AI adoption, clarifying that AI is an enhancement tool rather than a replacement for professional expertise.

Table 4: Challenges and mitigation strategies (Own work)

7.4.3 Interrelation

The AI-supported deliberation framework and the implementation strategy are not standalone products; rather, they are inherently interconnected and mutually reinforcing. The framework defines what is possible with generative AI by specifying which tools can support different types of deliberation and during which phases of real estate development. It serves as a diagnostic and planning tool for project teams, offering structured guidance for selecting and applying AI tools aligned with project goals and stakeholder dynamics.

The implementation strategy, in turn, focuses on how to bring these possibilities into practice. It is designed for those in leadership or coordination roles who shape organisational conditions and guide change management, including innovation officers, strategic leads, or internal champions. This differs from the framework, which provides design teams with hands-on support for applying AI tools within specific deliberative moments. It outlines the organisational and behavioural conditions necessary for embedding AI-supported deliberation into existing workflows. By addressing both technical and cultural readiness, the strategy ensures that AI integration is not only effective but also sustainable and aligned with the values of the organisation.

Together, the framework and strategy form a comprehensive roadmap. While the framework helps teams identify appropriate tools and deliberative needs, the strategy ensures these tools can be adopted in a way that is meaningful, participatory, and context-sensitive. Their joint application supports real estate organisations in developing both the capacity and the confidence to use AI in ways that support the quality and inclusivity of stakeholder deliberation.

Ultimately, successful AI integration depends on the willingness of organisations to experiment, learn, and adapt. These tools provide a foundation for that process, but it is up to practitioners to bring them to life in ways that are meaningful and context sensitive.

7.5 Propositions and underlying assumptions

This research was guided by three central propositions that served as conceptual anchors throughout the study. Rather than directly determining the framework, they provided orientation and a reflective lens during its development and during the design of the framework and the accompanying implementation strategy.

The first proposition suggests that generative AI has the potential to enhance inclusivity by making complex or technical information more accessible to a broader range of stakeholders. This is particularly relevant during the input phase of deliberation, when stakeholders are introduced to key issues, options, and perspectives. It is reflected in the Exploratory Deliberation mode of the framework, which supports idea generation, creativity, and the surfacing of diverse viewpoints. While particularly visible in this mode, the principle of inclusivity is also applicable across other deliberative modes throughout the process. In the implementation strategy, this proposition informed early-stage recommendations related to leadership engagement and the identification of accessible, low-barrier use cases.

The second proposition focuses on the potential of generative AI to improve the structure and efficiency of the deliberative process itself. By supporting tasks such as summarisation, comparison of alternatives, and scenario reasoning, AI can help design teams work more systematically and collaboratively. While these functions can be valuable across all stages of deliberation, they play a particularly central role in the Convergent Deliberation mode of the framework, where synthesis, trade-off analysis, and prioritisation become essential. This proposition also influenced the strategy's middle phases, which encourage experimentation, piloting, and organisational learning.

The third proposition concerns the role of trust and human judgement. It argues that the success of AI-supported deliberation depends on preserving stakeholder trust and ensuring that AI functions as a supportive instrument rather than replacing human reasoning. In contrast to the first two propositions, this idea applies across all deliberative modes and phases of the strategy. It shaped the positioning of AI as a facilitator within the framework and is reflected in the strategy's emphasis on transparency, ethical governance, and long-term organisational learning.

While these propositions offer a constructive foundation, recent academic literature and expert reflection suggest they may not fully capture the complexity of AI's role in deliberation. The academic expert in the validation panel noted that generative AI should not be seen as a neutral tool but as a transformative actor. Rather than simply supporting existing dialogue, AI may actively shape attention, interpretation, and meaning-making within deliberative processes. It can subtly influence what stakeholders notice, how they respond to one another, and which perspectives become central or marginal.

Furthermore, although AI holds the potential to broaden participation and reduce echo chambers, it also introduces new risks. Stakeholders who are underrepresented in training data, or who lack the capacity or confidence to engage with AI tools, may become further marginalised. In this sense, AI can unintentionally reinforce asymmetries in knowledge, voice, or power within deliberative settings.

Each of the three propositions rests on several underlying assumptions. The framework assumes that deliberation follows a relatively structured progression, starting with idea generation, continuing with comparative analysis, and ending with coordination and implementation. It also assumes that AI tools can be logically aligned with these stages. However, empirical findings indicate that, in practice, deliberation tends to be much more iterative and non-linear. Teams may return to earlier stages, transition between different modes, or construct shared meaning dynamically in response to new information and shifting stakeholder relationships.

Another assumption is that the three deliberative modes are distinct and sequential. While this categorisation was useful analytically, participants described real-world situations where these

modes overlapped or blended. For example, idea generation and evaluation often occurred simultaneously, especially under time pressure or conflicting stakeholder expectations.

The implementation strategy also relies on assumptions regarding organisational readiness. It presumes leadership support, capacity for experimentation, and availability of resources for training, governance, and learning. These conditions are not guaranteed. Digital maturity varies widely across real estate development organisations, and deadlines often leave little room for critical reflection or innovation.

Finally, the approach assumes that AI tools will function consistently across use cases. Yet the findings show that tool performance is highly sensitive to context. Outcomes depend not only on the technical functionality of the AI system, but also on how it is introduced, the roles of the users, and the prevailing culture of collaboration. For example, a tool like ChatGPT may foster openness in one team, while causing confusion or resistance in another, depending on levels of trust, digital literacy, and experience.

These insights highlight the importance of treating the framework and strategy as adaptive instruments rather than fixed prescriptions. They must always be interpreted in relation to the specific social, organisational, and technological context in which they are applied.

8. Discussion

This chapter reflects on the main findings of the research, situating them in relation to existing literature, practical implications, and the evolving role of generative AI in shaping deliberative design processes.

8.1 Interpretation of key findings

This research shows that generative AI can play a meaningful role in supporting stakeholder deliberation within design teams in real estate development. Deliberation in this context is not a straightforward decision-making process, but a dynamic and iterative form of collaboration. It involves joint reasoning, the exchange of perspectives, and the negotiation of spatial and technical trade-offs. Deliberation is also characterised as a process that encourages input and participation from all group members, allowing them to discuss and reflect on decisions that impact them. It combines public deliberation and internal reflections to support more profound, intentional conversations that lead to inclusive and thoughtful agreements (Zhang et al., 2023).

A central outcome of this study is that AI can contribute to five key deliberative goals: Facilitation, Augmentation, Inclusivity, Efficiency, and Coordination. These themes reflect the main benefits or intended outcomes of using AI to support stakeholder deliberation. At the same time, the specific role and use of AI vary depending on the deliberative mode in which it is applied. The framework distinguishes three such modes: Exploratory, Convergent, and Operational Deliberation. Each mode represents a different form of reasoning and collaboration within the design process. Understanding these modes helps clarify when and how AI can be meaningfully introduced to support deliberation.

While the framework and strategy aim to bring clarity to the role of AI in deliberative processes, it is important to recognise that deliberation itself is often marked by ambiguity, disagreement, and friction. Real-world deliberation rarely follows a linear or harmonious path. Instead, it involves uncertainty, negotiation, and sometimes conflict among stakeholders with diverging interests, values, or levels of influence. The introduction of AI into this already complex dynamic may give rise to new tensions. These tensions should not be viewed as problems that must be fully resolved, but rather as essential characteristics of deliberation that require thoughtful attention. The framework is not designed to remove these frictions, but to help design teams become more aware of them and to encourage more deliberate and inclusive ways of working with them.

This complexity is further reflected in the empirical findings. A pattern that appeared across different data sources is that people are both hopeful and cautious. While AI is appreciated for its ability to increase structure and productivity, professionals also warned of the risks of overreliance and loss of human judgment. Although inclusivity is often mentioned as a potential benefit of AI, it is not automatically realised in practice. Unequal digital access, lack of trust, or unclear ownership of AI outputs can all form barriers. Furthermore, AI influences which ideas are heard and which interpretations are prioritised. This makes AI not just a passive tool, but an active participant in the deliberative process, one that may subtly steer attention or shape how problems are framed.

8.2 Changing conditions of deliberation

To appreciate the significance of these findings, it is important to consider how deliberation functioned before the arrival of generative AI. Before the introduction of generative AI, deliberation in design teams relied entirely on human-driven communication and reasoning. Knowledge gaps, disciplinary boundaries, and informal hierarchies often determined who could meaningfully participate. Stakeholders with less experience or technical expertise sometimes remained silent during meetings, feeling unable to express their perspectives or question dominant interpretations.

Information exchange was fragmented and mainly dependent on verbal discussion or manually prepared materials, which made it difficult to establish shared understanding or record stakeholder input in a transparent way.

Generative AI has altered these conditions in several important ways. As described in Proposition 1, AI helps reduce barriers to participation by simplifying technical content and generating clear visual or textual explanations. This contributes to more inclusive deliberation by enabling a broader range of team members to join discussions that were previously shaped by technical expertise. In line with Proposition 2, AI also increases the efficiency of deliberation by helping to structure arguments, summarise contributions, and reduce the mental effort required to process multiple perspectives or identify shared concerns. These changes allow teams to spend more time on reflective reasoning, not by removing structure, but by enabling it. Structured AI support and reflective human judgment should not be seen as opposites. Instead, they form a dynamic interplay: AI-generated structure can create the conditions for deeper reflection, while reflective engagement is essential to interpret, adapt, and contextualise that structure. As stated in Proposition 3, these benefits depend on how AI is perceived and used. When AI outputs are trusted and integrated thoughtfully, they can support richer dialogue. But when users feel that automated systems constrain or override their judgment, deliberation risks becoming superficial or disengaged.

In this sense, the introduction of AI does not replace the fundamental goals of deliberation, such as inclusion, shared reasoning, and mutual understanding. Rather, it changes how these goals are pursued in practice. It reshapes the relationship between preparation and interaction, between individual expertise and collective exploration, and between human creativity and automated support. These are not binary choices but mutually reinforcing elements. For instance, AI-generated materials can enhance preparation, which in turn leads to more meaningful interactions. Similarly, automation can free up space for creative exploration by reducing routine workload. Recognising and navigating these interdependencies is key to realising the full deliberative potential of AI. These developments require teams to think critically about how they use AI and to reflect on the norms, roles, and expectations that guide their deliberative practices.

8.3 Dialogue with literature

The empirical findings also engage with key themes in the literature. In line with Feuerriegel et al. (2023) and Karacapilidis et al. (2024), AI was found to enhance efficiency by automating tasks such as documentation and summarisation, enabling participants to focus on higher-level design thinking. The visualisation capabilities of AI, highlighted by Kapsalis (2024), were also validated. Respondents emphasised the usefulness of AI-generated visuals in early-stage deliberation, especially when navigating abstract or complex ideas.

Findings related to inclusivity echo the arguments made by Zhang et al. (2023) and Landemore (2022), who suggest that AI can function as a bridge between disciplines and roles. Participants observed that AI tools made technical content more accessible, suggesting their potential as translational instruments that foster shared understanding in design teams. A practical example of this occurred during my own internship at NEOO. As an intern, I was part of a multidisciplinary design meeting where decisions were largely driven by senior team members. In preparation for the meeting, I used ChatGPT and a regulatory AI tool to explore the legal implications of a proposed design change. This helped me clarify my arguments and formulate an alternative perspective. During the meeting, I was able to question the proposal made by a senior colleague and suggest a different interpretation of the building regulations. Without the support of these tools, I would likely have remained silent, as I initially lacked the confidence and authority to challenge more experienced professionals. In this context, generative AI acted as a levelling mechanism, reducing knowledge asymmetries and empowering me to contribute meaningfully despite my intern position.

The iterative and reflective nature of deliberation, as described by scholars such as Forester (2006) and Rapanta and Blair (2011), was also affirmed. Particularly in the early phases of design, such as the Sketch Design and Concept Design stages, deliberation emerged as a process for aligning values, evaluating uncertainties, and co-constructing meaning. Moreover, Zhang et al. (2023) highlight the role of AI in supporting reflective learning within teams. By interacting with AI-generated insights, participants are able to revisit prior decisions, identify patterns or biases, and refine shared values. Although this potential is widely acknowledged in theory, it was only partially realised in practice during this study. In most cases, AI was used to accelerate tasks or structure discussion, but not yet to enable long-term reflection or improve deliberative learning over time.

Beyond confirming these theoretical insights, the research also surfaced emerging dynamics. While prior studies, including Caballar (2024), present AI as a source of innovation, several participants noted that AI often reinforces dominant design logics or generates superficial variations. This perspective resonates with Doshi and Hauser (2024), who argue that AI may support individual creativity but reduce collective idea diversity.

8.4 Framework and strategy development

In response to these findings, this thesis developed a framework and implementation strategy designed to support reflective and inclusive AI use in real-world settings. The framework helps teams reflect on their current mode of deliberation, whether divergent, convergent, or operational, and select AI tools that align with their objectives. The strategy explains how these tools can be gradually introduced in practice. It encourages step-by-step implementation. This approach recognises that AI adoption is not only about technology but also about people, culture, and behaviour. For successful application, teams need not only technical skills but also the ability to interpret AI outputs critically, keep discussions inclusive, and adapt tools to their specific project context.

The development of the framework itself was shaped by iterative feedback from interview participants and professionals involved in a validation workshop. These sessions provided essential insights into which elements of the framework were intuitive and which aspects required further refinement. Participants recognised the three deliberative modes as a helpful lens for reflecting on distinct forms of reasoning within their design processes. Some professionals initially experienced the distinction among exploratory, convergent, and operational deliberation as abstract or overlapping. This was particularly the case in fast-paced project environments where teams move fluidly from one mode of reasoning to another. In response, the visual representation and accompanying descriptions were adapted to make each mode more context-specific and directly connected to recognisable stages in the design process.

Feedback on the five AI support themes also contributed to refinements. While participants generally appreciated the concepts of facilitation, augmentation, efficiency, inclusivity, and coordination, they noted that the relationship between these themes and concrete applications was not always clear. To strengthen this connection, examples of relevant tools were added to the visual overview in Chapter 7.4, supported by an explanatory table that links each theme to practical situations in real estate development.

The workshop further underscored the importance of clearly distinguishing the conceptual framework from the implementation strategy. This insight led to additional guidance on sequencing, facilitation responsibilities, and integration into team routines. These revisions reflect a broader learning process in which theoretical insights were not simply applied to practice, but reassessed through collaboration with professionals. The reflective character of the validation process ensured

that the final framework and strategy are both theoretically grounded and usable in real project settings.

8.5 Broader implications

At a broader level, the study points to a shift in how design teams work together and how authority, knowledge, and creativity are distributed. AI influences not only the content of deliberation but also the structure and rhythm of collaboration. This raises important questions about who is included in the process, which ideas are taken seriously, and how decisions are legitimised. Organisations should therefore view AI adoption not only as a means to increase efficiency, but also as a cultural transition that demands space for reflection, openness, and shared learning. This calls for new forms of professional literacy: not just knowing how to use AI, but knowing how to question it, contextualise it, and combine it with human insight.

8.6 Cultural context and transferability

The applicability of the framework and strategy may be influenced by cultural and institutional contexts. The empirical research was conducted in the Netherlands, where professional deliberation is shaped by relatively flat hierarchies, a strong culture of direct communication, and a high degree of autonomy within design teams. In Dutch professional culture, it is generally expected that team members speak openly, question assumptions, and address disagreements directly during meetings. This communicative style supports a deliberative culture in which shared reasoning and critical reflection are actively encouraged. These cultural characteristics likely shaped the assumptions embedded in the framework, such as the expectation of open dialogue, equal participation, and collaborative problem-solving. These expectations may not hold in the same way in other national or organisational settings. For example, in contexts where authority structures are more hierarchical or where indirect communication is the norm, deliberative processes may unfold differently. The implementation of AI-supported tools in such contexts may require different facilitation styles or decision-making protocols. Furthermore, the design phases used in the framework reflect conventions specific to Dutch real estate development and may need to be adapted when applied in countries that use other project management models or design stages. For this reason, while the core concepts and deliberative modes may be transferable, both the framework and the strategy should be interpreted as flexible guides rather than universally prescriptive tools. Local adaptation is essential to ensure cultural fit, professional relevance, and effective integration.

8.7 Limitations

At the same time, the study has several limitations. First, although the interview sample included people from multiple real estate companies, part of the empirical focus was concentrated around the organisation NEOO. Several interviewees were affiliated with NEOO, and the workshop was conducted exclusively with NEOO professionals. This means that the framework and strategy were partly shaped within the organisational language and culture of one firm, which may limit the generalisability of the findings. The online survey, which included 25 professionals from across the sector, helped to broaden the scope of the research; however, the sample size remains relatively small, and the conclusions should therefore be interpreted as context-sensitive rather than generalisable.

Second, although the study focuses on generative AI, many tools that were analysed also have analytical functions such as clustering or optimisation. This hybrid nature makes it more difficult to assess which effects can be directly attributed to generative AI (e.g. text or image generation) and which stem from broader data structuring functions. This distinction is important for further theory-building, but was difficult to make sharply in this research.

A third limitation relates to the conceptual distinction between deliberation and decision-making. While the framework aims to support reflective and inclusive dialogue, some themes such as efficiency and coordination may also reflect a logic that is more oriented toward decision-making than deliberation.

Finally, the fast development of AI tools introduces a temporal limitation. Some tools discussed in this study may evolve quickly or become outdated. This means that the framework and strategy should not be seen as fixed models, but as instruments that can be updated and adapted over time.

9. Conclusion

This research set out to investigate the question: How can generative AI support stakeholder deliberation in design teams of real estate development? In order to answer this question, the study addressed three sub-questions that together explored the conceptual understanding, current practices, and strategic challenges of AI-supported deliberation within design teams.

The first sub-question asked: What is meant by stakeholder deliberation in the context of design teams in real estate development, and at which stages is it most essential? Building on literature and empirical data, stakeholder deliberation was conceptualised as an epistemic, inclusive, and iterative process in which team members engage in mutual reasoning to collaboratively explore, justify, and refine design decisions. This process differs from conventional decision-making by prioritising dialogue, reflection, and understanding over efficiency or hierarchy. The data revealed that deliberation unfolds differently across project phases, giving rise to three deliberative modes: Divergent Deliberation (prominent in Sketch and Concept Design), Convergent Deliberation (in Definitive and Technical Design), and Operational Deliberation (in the execution phase). These modes reflect shifting dynamics in terms of stakeholder interaction, facilitation needs, and decision maturity.

The second sub-question explored: Which generative AI tools are currently used to facilitate stakeholder deliberation in design teams in real estate development? The findings show that although the use of generative AI in this context remains largely informal and individually driven, a range of tools is already applied in practice. Text-based assistants such as ChatGPT and Copilot are frequently used to support brainstorming, scenario thinking, and the summarisation of discussions. Visualisation tools like DALL·E and MidJourney help translate abstract or technical ideas into shared images, which supports communication between experts and non-experts. Documentation tools, including Fireflies.ai and NotebookLM, are used to transcribe meetings, summarise decisions, and maintain continuity across sessions. However, these tools are rarely integrated structurally into project workflows. Most professionals use them on an experimental basis, often outside of formal deliberative moments. This reveals a significant gap between the perceived potential of AI tools and their systematic adoption within deliberative design processes.

The third sub-question examined: How can the main challenges and advantages of implementing generative AI tools be incorporated into the deliberation process within design teams? To answer this question, the analysis synthesised empirical insights into five overarching themes that describe how generative AI interacts with key deliberative functions: Facilitation, Augmentation, Efficiency, Inclusivity, and Coordination. AI enhances facilitation by capturing, structuring, and summarising discussions, yet it may also foster over-reliance and reduce critical engagement if outputs are not properly reviewed. It augments creative reasoning by generating alternative ideas, but may also reproduce biases or narrow the diversity of thought, especially when based on homogeneous training data. While AI increases efficiency by automating repetitive tasks such as documentation or agenda setting, these gains may unintentionally raise delivery expectations and compress deliberative time. Inclusivity can be improved through the simplification of technical information or visualisation of complex scenarios, though stakeholders with limited digital literacy may feel excluded or less empowered. Coordination is strengthened through AI-assisted documentation and tracking tools, but underlying interpersonal or hierarchical asymmetries are not automatically resolved. These findings demonstrate that AI-supported deliberation requires thoughtful design, human oversight, and critical reflection.

These findings led to the development of two complementary outputs: a framework that maps generative AI functions onto different deliberative modes and project phases, and an

implementation strategy that guides how organisations can adopt these tools responsibly and reflectively. The framework is intended for direct use by multidisciplinary design teams, while the implementation strategy is aimed at guiding leadership and innovation roles in supporting and embedding AI-supported deliberation within organisational routines. The framework visualises how AI can support deliberation across the stages of real estate design, while the strategy provides practical steps for embedding AI into team practices and organisational structures. Together, they operationalise the five deliberative themes and translate the empirical findings into actionable guidance.

Taken together, the answers to the sub-questions lead to the central conclusion that generative AI can support stakeholder deliberation by strengthening its core functions, namely Facilitation, Augmentation, Efficiency, Inclusivity, and Coordination, across the various stages of the design process and corresponding deliberative modes. This provides a substantiated answer to the main research question: generative AI supports stakeholder deliberation in design teams of real estate development by enhancing the structure, inclusivity, and epistemic quality of dialogue, provided that it is used reflectively, embedded in human-led processes, and aligned with the deliberative goals relevant to each phase of the project. The AI-supported deliberation framework and the accompanying implementation strategy developed in this research serve to operationalise these insights and offer concrete guidance for their responsible application in professional practice.

This study was also guided by three central propositions, each of which is now reconsidered in light of the empirical findings. The first proposition, which posited that generative AI can enhance inclusivity by making complex or technical information more accessible to a wider range of stakeholders, is confirmed, but only under specific conditions. Without adequate facilitation, digital support, and attention to varying levels of literacy and confidence, the same tools may instead reproduce or deepen existing exclusions. The second proposition, suggesting that AI can improve the structure and efficiency of deliberation, is also supported by the data; however, these gains must be strategically reinvested into deliberative quality rather than merely leveraged for accelerated output or compressed timelines. The third proposition, asserting that human judgment must remain central to AI-supported deliberation, is perhaps the most critical. While the findings validate this principle, they also reveal its vulnerability in practice: multiple interviewees recounted situations in which AI-generated outputs were accepted without sufficient scrutiny, highlighting the risk of automation bias and the need for robust procedural safeguards. Taken together, these propositions reaffirm that generative AI is not a neutral instrument but an active agent in shaping deliberative processes, its influence can be constructive or problematic depending on how it is embedded, governed, and critically engaged with.

9.1 Addressing the research gap

While previous research has explored the role of AI in design support, decision-making, and knowledge management, little attention has been given to how AI might contribute to stakeholder deliberation, which relies on epistemic dialogue, mutual understanding, and inclusive reasoning. Moreover, the potential of AI within the context of design teams in real estate development, which is characterised by complexity, time constraints, and the need for interdisciplinary collaboration, has remained largely underexplored. Existing studies often focused on isolated use cases or abstract scenarios, without offering integrated frameworks for real-world deliberative practices.

This thesis fills that gap by providing a theoretically grounded and empirically informed analysis of how generative AI supports deliberation across three distinct modes: divergent, convergent, and operational. The study identifies five core mechanisms that describe how AI influences stakeholder deliberation: Facilitation, Augmentation, Efficiency, Inclusivity, and Coordination.

In doing so, this research offers a structured and context-sensitive tool that connects AI functionality to deliberative values, addressing both theoretical blind spots and professional uncertainties in this emerging field.

9.2 Research contribution and added value

Theoretically, this study advances the discourse on AI in design and planning by conceptualising AI as a deliberative actor rather than merely a decision-support or productivity tool. It reframes stakeholder deliberation as a dynamic, epistemic process with shifting modalities across project phases, and explores how AI can support or challenge this process. By distinguishing between exploratory, convergent, and operational modes of deliberation, the research introduces a vocabulary and structure for analysing AI's contextual role. Moreover, it offers a normative perspective that recognises AI's capacity to influence attention, reasoning, and meaning-making, thereby raising important ethical and governance questions for future studies.

Methodologically, the research demonstrates the value of a phased, mixed-method design. By integrating literature analysis with surveys, semi-structured interviews, and participatory validation (workshop and expert panels), the study ensures both conceptual depth and practical relevance. The iterative design allowed for empirical insights to continuously inform the development and refinement of the framework, while maintaining academic rigour. This approach exemplifies how design-oriented research can combine analytic robustness with usability in real-world contexts.

Empirically, the study provides one of the first systematic mappings of generative AI adoption in real estate design team deliberation. It documents how professionals use tools and links these applications to deliberative functions and project phases. In doing so, it surfaces not only technological potential but also cultural, organisational, and behavioural barriers to adoption, and offers a richer, more human-centred understanding of AI in collaborative environments.

Practically, the research delivers two validated outputs: the AI-supported deliberation framework and the implementation strategy. These tools are designed to guide real estate professionals in introducing AI into their team processes in a responsible, context-sensitive, and adaptive manner. The framework links deliberative modes to appropriate tools and themes, while the strategy supports the organisational conditions necessary for successful integration. Both outputs prioritise reflection, flexibility, and inclusivity, and are intended to evolve alongside user needs and technological developments.

Together, these contributions establish a foundation for both academic inquiry and professional experimentation, showing that generative AI can, when thoughtfully implemented, meaningfully contribute to the deliberative capacity of design teams in complex development settings.

10. Recommendations

This final chapter presents three types of recommendations: theoretical directions for further academic inquiry, methodological suggestions for follow-up research, and practical steps to support implementation of the developed framework and strategy.

10.1 Theoretical recommendations

The findings of this research invite several theoretical directions for future inquiry into the role of generative AI in stakeholder deliberation. First and foremost, this study has demonstrated that AI should not merely be understood as a neutral support tool, but rather as a deliberative agent that shapes how attention is directed, how arguments are constructed, and how meaning is collectively produced. This calls for a conceptual shift in scholarly discourse: from viewing AI as an external aid to recognising its embeddedness within the epistemic fabric of collaborative processes. Future research should therefore explore the ontological and normative implications of AI's active participation in deliberation, especially in relation to issues of judgment, legitimacy, and trust.

Second, the identification of three distinct deliberative modes, namely exploratory, convergent, and operational, offers a valuable conceptual lens for understanding how dialogue unfolds across the design phases of real estate development. However, these modes have not yet been empirically validated beyond this domain. It is recommended that future studies test and refine this model in other high-stakes, collaborative settings such as infrastructure planning, health system design, or participatory policymaking. Such comparative work could help assess the model's generalisability and sharpen the theoretical vocabulary for analysing deliberation as a dynamic, context-dependent process.

Third, while this thesis has highlighted how generative AI can potentially democratise deliberation, it has also raised concerns about the reproduction of bias, the marginalisation of less digitally literate participants, and the risk of over-reliance on AI-generated content. These concerns foreground a broader theoretical need to interrogate AI's influence on power relations within deliberative settings. Who gets to frame the agenda, whose contributions are amplified or dismissed, and how authority is reconfigured when AI becomes a co-producer of knowledge are all critical questions that merit further theoretical exploration. Integrating perspectives from critical data studies, feminist theory, and science and technology studies may enrich this line of inquiry.

Finally, the notion of reflective learning, which this research introduced as a principle underpinning both the framework and the strategy, warrants deeper theoretical development. Although the implementation strategy proposes structured moments for reflection, expert validation sessions suggested that such moments are often sacrificed under the pressure of productivity demands. Future scholarship should examine how deliberative practices can better accommodate and sustain reflective learning, not only as a procedural step, but as a constitutive element of deliberative quality. This includes theorising how organisational cultures, incentives, and tools can be designed to support learning over time, and how AI might either hinder or facilitate that process.

10.2 Methodological recommendations

This study adopted a phased, mixed-method research design that combined theoretical exploration with empirical investigation and iterative validation. While this approach yielded valuable insights and resulted in a conceptual framework and implementation strategy, several methodological steps are recommended to further test, refine, and contextualise these outputs.

First, future research should apply the AI-supported deliberation framework in real-world design teams across a broader set of companies and teams. This study validated the framework through a

workshop and two expert panels involving NEOO professionals and one academic expert, but the findings remain context-specific. Testing the framework in other organisations, such as different real estate developers, architectural firms, or design consultancies, would help evaluate its adaptability and identify variations in AI adoption and deliberative dynamics across settings.

Second, longitudinal studies are recommended to better understand how AI becomes integrated into design workflows over time. This research provided a snapshot of current practices, but the implementation of AI in deliberation is likely to evolve as tools mature and organisational routines shift. Tracking these developments over an extended period could shed light on emerging barriers and enablers, and provide evidence for the sustained value of the framework and strategy.

Third, future research should further explore how to make the framework more actionable and user-friendly in daily practice. Expert feedback indicated that the current visualisation is perceived as clear but abstract. Developing practical tools such as interactive templates, visual guides, or embedded prompts that help users understand where and how AI can support deliberation may improve usability and uptake.

10.3 Next steps

To translate the framework and strategy developed in this thesis into practical impact, a series of future steps is proposed. These steps aim to assess the usability of the framework in real-world settings, to refine its components through iterative learning, and to evaluate its contribution to deliberative quality and design outcomes over time.

A logical first step would be to conduct a pilot study in which one or more design teams, for example at NEOO or within a comparable development organisation, apply the framework and strategy during an active project. This could involve selecting a suitable design phase such as the Sketch Design or Preliminary Design stage, identifying AI tools that correspond with the deliberative aims of that phase, and appointing a facilitator to support reflective implementation. Such a pilot would help determine whether the framework's conceptual distinctions and practical tools are sufficiently clear, relevant, and actionable for professional use.

To evaluate the pilot, a combination of qualitative and quantitative methods is recommended. Team members could complete reflection forms or participate in feedback sessions to share their experiences with AI-supported deliberation. Central questions may include how AI tools were integrated into team routines, whether deliberation became more inclusive or structured, and what kinds of obstacles emerged. Process indicators might include the extent and diversity of participation, the clarity with which trade-offs were articulated, the perceived fairness and transparency of the discussion, and the confidence expressed in final decisions. Impact indicators could focus on the integration and quality of the design output, for instance through earlier identification of issues, stronger stakeholder alignment, or improved coherence across technical, spatial, and financial dimensions. Together, these indicators would provide a multi-dimensional understanding of how the framework affects both the deliberative process and its outcomes.

In addition, the five overarching themes identified in this study, namely facilitation, augmentation, efficiency, inclusivity, and coordination, could offer a useful foundation for evaluation. Although originally derived as analytical findings from qualitative research, these themes may also serve as guiding criteria for developing more formal metrics. Future research could build on these themes to examine whether AI-supported deliberation demonstrably improves these dimensions across different organisational and project contexts.

Beyond process evaluation, outcome-based comparisons would offer an important extension. Researchers or practitioners may investigate how design trajectories differ with and without the framework in place, and whether its use contributes to improved team alignment, higher decision quality, or greater anticipation of stakeholder concerns. These comparisons could support a more rigorous validation of the framework's added value and encourage broader application across the sector.

If the pilot yields positive results, the next step would be to embed the framework and strategy within organisational routines. This may involve the creation of digital manuals, visual guides, internal training modules, or a curated tool library aligned with the framework's deliberative modes and corresponding project phases. Institutionalising these resources through onboarding processes, team charters, or collaborative platforms could help ensure that the framework becomes part of sustained practice rather than a one-time intervention.

Looking ahead, it is also recommended that the framework be tested beyond the real estate domain, in other sectors that rely on collaborative design processes. Potential applications may include infrastructure development, healthcare planning, or participatory urban governance. These domains may introduce new deliberative dynamics, which could both challenge and enrich the framework's core assumptions. Applying the framework in diverse cultural contexts would also provide insights into how norms of hierarchy, consensus, and communication influence deliberation, and whether the framework requires adaptation in response.

Finally, the reflective learning principle that underpins the implementation strategy offers a promising avenue for further development. Building on this foundation, future work could explore the design of structured learning modules, design retrospectives, or integrated prompts that stimulate metacognition within teams. These efforts would help organisations move beyond the use of AI as a one-dimensional efficiency tool and towards a more deliberate and learning-oriented use of AI in complex, collaborative environments. In doing so, the framework may continue to evolve as a robust and context-sensitive guide for supporting deliberation with generative AI.

11. Reflection

At the start of this graduation project, I set myself several personal study targets that would support both my academic and professional development. My central aim was to deepen my understanding of generative AI technologies and their potential applications within real estate development. I aspired to contribute insights that connect academic knowledge with professional practice by exploring how these tools could support stakeholder deliberation. Equally important was my goal to better express a personal perspective as a researcher, not only through rigorous analysis but also through interpretation and critical reflection. Lastly, through my internship at NEOO, I hoped to gain experience in a professional setting, improve my communication and collaboration skills, and explore how innovation is developed and applied in real projects.

The topic of my research is closely aligned with the Management in the Built Environment (MBE) track of the MSc AUBS programme, which focuses on innovation, complexity, and interdisciplinary collaboration in the built environment. My project addresses digitalisation and transformation within real estate development, which are core themes within both the MBE track and the Gamechangers in Transitions graduation lab. In this context, the role of AI as a tool for stakeholder deliberation fits the ambition to explore emerging transitions through applied academic research.

From a theoretical perspective, my understanding of AI and deliberation has grown considerably. While existing literature often presents deliberation as a linear or structured process, my empirical findings revealed that in multidisciplinary design teams, it is better understood as an ongoing and adaptive practice that evolves across phases, roles, and project settings. By distinguishing between three deliberative modes (exploratory, convergent, and operational), I was able to examine deliberation not as a fixed concept but as a dynamic process. I also came to see AI not just as a supportive tool, but as an actor that influences how teams reason together, exchange perspectives, and include broader forms of input. While theory provided useful starting points, it was the engagement with real-world practice that challenged, refined, and ultimately enriched my conceptual understanding.

These insights had a direct influence on the design of the framework and implementation strategy. The analytical process and theoretical development shaped how the framework was structured, while the process of translating the framework into a practical roadmap prompted me to return to the literature to reconsider certain assumptions. For example, the development of the framework visuals forced me to make deliberative modes more concrete, which in turn clarified the theoretical distinctions between them. In this way, the research influenced the design, and the design equally influenced the research.

Methodologically, I learned that a strong research design is only the beginning of an iterative process that demands continual adaptation. Although the mixed-methods approach made sense in theory, its practical implementation required ongoing learning. The depth and quality of interview data increased significantly after I adjusted my interview protocol and focused more sharply on the research sub-questions. In contrast, the survey was less effective in generating actionable results due to variation in interpretation. This experience taught me that methodological alignment across instruments is not automatic; it must be actively managed. I also learned the importance of making explicit how different data sources contribute to the overall analysis. Ultimately, I believe the phased and layered structure of my research added robustness and flexibility, even if not every part worked equally well.

From a practical standpoint, my internship at NEOO gave me invaluable insight into the professional practice of real estate development. I was able to observe and participate in ongoing design

processes, gaining a deeper understanding of how teams work, how decisions are made, and how innovation is both encouraged and constrained. This experience taught me that introducing generative AI into practice requires not only technical solutions, but also organisational and cultural adaptation. I observed the tensions between long-term innovation and short-term project delivery, and learned how new tools are adopted in stages, through processes of feedback, trust, and experimentation. I am grateful to the NEOO team for their openness, critical reflections, and willingness to involve me as a researcher.

Another key learning moment came from the feedback I received from my academic mentors. Aksel and Paul consistently encouraged me to reflect more actively on my own interpretation, rather than merely reporting or summarising academic literature and empirical findings. Early in the process, they recognised that while my analytical work was strong, it lacked a personal academic voice. This prompted me to add explicit *"from my perspective"* sections throughout the thesis. Doing so helped me clarify my line of reasoning, make underlying assumptions visible, and present a more original contribution. Later in the process, they also provided guidance on sharpening my conceptual framework and clarifying the distinction between the theoretical model and the practical implementation strategy. These revisions strengthened the academic quality of my thesis and helped me develop as a more confident, reflective researcher.

One of my personal goals was to develop a stronger and more authentic academic voice. Initially, I was hesitant to include my own perspective, even when I had strong intuitions about the material. Through the process, I learned that research does not only involve analysis; it also requires interpretation, judgment, and the courage to take a stance. I began to embed more reflective insights in the results and discussion chapters, allowing the reader to see how I arrived at key conclusions. This shift from observer to interpreter was one of the most important steps in my academic development.

The value of this graduation project lies both in its theoretical and societal contributions. Theoretically, it introduces a differentiated understanding of deliberation in the context of AI-supported design processes, and contributes to emerging discussions on AI as a non-neutral actor in collaborative settings. It also provides methodological insights for conducting layered, exploratory research in emerging fields. Societally, the framework and strategy offer a concrete yet adaptable roadmap for real estate professionals who wish to explore AI without undermining inclusivity, creativity, or reflective learning. Ethical issues, such as AI bias, exclusion risks, and over-reliance, were explicitly considered in both the theoretical discussion and the practical recommendations. These dimensions are not treated as side concerns, but as integral to responsible implementation.

Although the research was conducted within the context of NEOO, the findings and outcomes are designed to be transferable. The deliberative modes and AI support themes are not organisation-specific and can be applied in similar real estate or urban development contexts. During validation sessions with academic and professional experts, the framework was seen as a useful conversation tool and a flexible guide. However, the project also acknowledges that every implementation must be context-sensitive and reflect local dynamics, capacities, and team cultures.

In conclusion, this project has helped shape me into a more reflective, confident, and well-rounded researcher. I have learned how to combine analytical precision with practical sensitivity, how to engage in academic dialogue while staying grounded in real-world relevance, and how to work independently while integrating diverse perspectives. This project has prepared me to contribute meaningfully to both academic and professional environments, and has helped me grow not only as a student but also as a future gamechanger in the field.

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Appendix A: Industry insights

It is crucial to understand the current market landscape and practical applications of AI in the industry. This chapter presents key trends, practical insights from AI workshops, anticipated knowledge from upcoming industry events, and an overview of generative AI tools for deliberation. These insights will inform the development of a practical toolkit for integrating AI into stakeholder workflows at NEOO.

Current trends

The adoption of AI in real estate and construction is steadily growing as companies recognize its potential to streamline workflows and enhance decision-making (Wouter van Haaften, personal communication, 2024). AI tools are increasingly being used to automate repetitive design tasks, generate optimized layouts, and support adaptive reuse projects. Additionally, AI facilitates real-time data analysis, enabling better-informed stakeholder decisions and improving risk management. AI applications can automate routine project management tasks, enhancing efficiency and collaboration within design teams. Moreover, AI aids in selecting sustainable materials and reducing waste, contributing to environmentally responsible design practices (Van Haaften, 2024).

Insights from generative AI masterclass for NEOO

On January 30, 2025, NEOO hosted a generative AI workshop led by Wouter van Haaften. This session provided an introduction to the fundamentals of generative AI and explored its potential applications in the real estate sector. The workshop was highly interactive and practical, emphasizing the strategic impact of AI on daily workflows at NEOO.

A key takeaway from the session was that generative AI is not just a technological innovation but a transformative tool for improving efficiency and decision-making processes. AI was framed as an enabler rather than a replacement for human expertise, assisting with repetitive tasks and complex analyses. The importance of change management was highlighted as a crucial factor in successfully integrating AI into existing workflows. Participants learned how to craft effective prompts in ChatGPT, which is essential for generating accurate and relevant outputs. A particularly valuable insight was the ability to create a dedicated GPT for each project, allowing all project-related information to be consolidated into an AI-driven environment. This approach enables faster data analysis, structured documentation, and improved knowledge sharing within the organization. Several real-world use cases were discussed, including generating structured meeting notes, drafting contracts, and automatically summarizing project information. Additionally, the workshop addressed potential risks and ethical considerations associated with generative AI, such as data security and bias in AI models.

The session emphasized that successfully implementing AI at NEOO requires both technical proficiency and organizational adaptation. Employees need to not only understand how to use AI tools but also how to integrate them effectively into their workflows. Hands-on experience with prompt engineering was identified as a key skill for maximizing AI's potential.

The insights gained from this workshop directly align with this research on generative AI in deliberation processes within design teams. In particular, the session demonstrated how AI can facilitate structured communication, streamline decision-making, and enhance collaboration by centralizing relevant project data in an accessible and interactive format. By learning how AI-generated summaries, structured prompts, and contextualized GPT models improve workflow efficiency, this workshop gained a clearer understanding of how AI tools can be applied to support structured deliberation within design teams. These insights contribute to the development of a practical roadmap for AI integration in real estate development, ensuring that AI adoption enhances—not replaces—critical human-driven processes.

Insights from AI conference: "Versnellen door AI & digitalisering in de Bouw en Vastgoed"

On February 11, 2025, the conference "Versnellen door AI & Digitalisering in de Bouw en Vastgoed" took place at the Microsoft headquarters in Schiphol. This event brought together experts, policymakers, and industry leaders to explore the role of AI and digitalization in accelerating real estate and infrastructure development. Co-organized by Microsoft and Intwo, the conference provided valuable insights into the current applications of AI, regulatory frameworks, and the importance of collaboration across the value chain.

A key takeaway from the event was that AI is already being widely applied within the construction and real estate sectors, yet challenges remain regarding adoption, governance, and industry-wide integration. One of the main discussion points was how AI and digitalization can help achieve the ambitious goal of developing 100,000 new homes per year while simultaneously optimizing the management and sustainability of existing buildings. Several panel discussions highlighted the role of AI-powered tools such as Building Information Modeling (BIM), generative AI, and data-driven design optimization in accelerating decision-making processes and reducing inefficiencies.

Another recurring theme was the necessity of collaboration within the industry. AI can facilitate improved coordination between developers, municipalities, contractors, and financiers by enabling data-sharing and automating complex decision-making workflows. This discussion also touched upon data governance and security, with a presentation outlining the latest EU regulations on AI adoption in the built environment. The importance of a clear regulatory framework was emphasized, as AI implementation in real estate must align with legal and ethical considerations.

A significant regulatory discussion during the event focused on the EU AI Act, which establishes guidelines for AI applications based on risk classification (Intwo, 2025). The AI Act categorizes AI systems into three levels of risk:

- Unacceptable risk – AI practices that are prohibited, such as social scoring and predictive policing (Intwo, 2025).
- High risk – AI applications that require strict compliance and monitoring, including those used in employment, credit scoring, and law enforcement (Intwo, 2025).
- Low risk – AI tools such as chatbots and automated filtering systems, which are subject to transparency obligations (Intwo, 2025).

For the real estate sector, the AI Act presents key compliance challenges, particularly regarding the responsible use of AI in decision-making processes. AI-powered tools used for urban planning, property valuation, and tenant screening may fall into the high-risk category, requiring rigorous risk assessments, transparency measures, and human oversight (Intwo, 2025).

The discussion emphasized that organizations implementing AI in real estate development must ensure AI literacy, human oversight, and ethical compliance to meet these new regulatory requirements. Companies failing to adhere to the AI Act's stipulations may face significant financial penalties, including fines of up to €30 million or 6% of their global annual revenue (Intwo, 2025).

The conference also featured several innovation pitches from emerging technology firms, including STRUCK, OMRT, supRmen, and Reavant, showcasing how AI is being leveraged for design optimization, material efficiency, and energy management. Additionally, a session on AI and digitalization in sustainable real estate explored how cloud-based AI applications can contribute to achieving Paris Proof energy efficiency standards. Microsoft further emphasized the role of cloud computing in sustainability, demonstrating how AI-driven data analytics can optimize energy performance and circular construction strategies.

This conference provided concrete insights into how AI is shaping the construction and real estate industries and highlighted the challenges and opportunities for broader adoption. The discussions on AI-supported stakeholder deliberation were particularly relevant to my research, as AI has the potential to enhance data analysis, visualization, and scenario modelling, which are crucial for collaborative deliberation in design teams. Furthermore, the emphasis on industry-wide collaboration reinforced the need for structured AI implementation frameworks, aligning with my research objective of developing a roadmap for AI integration in design processes.

Ultimately, the event underscored that AI is not merely a technological advancement but a strategic enabler for more efficient and inclusive decision-making. These insights strongly support the relevance of my research on generative AI in stakeholder deliberation within design teams, highlighting the growing need for AI-driven tools that foster collaboration, efficiency, and innovation in real estate development.

Appendix B: Interview protocol

Interview protocol: Deelnemer 8 – Projectontwikkelaar NEOO

Inleiding – praktische informatie & consent

Goedemiddag, bedankt dat je tijd vrijmaakt voor dit gesprek. Mijn naam is Annefloor Pluut en ik werk momenteel aan mijn masterthesis binnen de opleiding Management in the Built Environment aan de Technische Universiteit Delft.

Voor mijn onderzoek voer ik interviews om beter te begrijpen hoe overlegprocessen binnen ontwerpteams verlopen en welke rol AI hierbij kan spelen. Alles wat je vandaag deelt, wordt volledig vertrouwelijk behandeld en geanonimiseerd. Dat betekent dat jouw naam of andere persoonlijke gegevens niet in het onderzoek zullen voorkomen. Deelname is vrijwillig, en je mag op elk moment besluiten om te stoppen of een vraag over te slaan."

Om ervoor te zorgen dat ik niets mis, wil ik dit gesprek graag opnemen. De opname wordt veilig opgeslagen en na transcriptie verwijderd. Geef je toestemming om dit interview op te nemen?

(Wacht op hun antwoord.)

Dank je wel! Als je tijdens het gesprek vragen hebt of iets wilt verduidelijken, stel ze gerust. Laten we beginnen!

Onderzoeksonderwerp & Introductie op deliberatie

Mijn onderzoek richt zich op hoe generatieve AI deliberatie binnen ontwerpteams in vastgoedontwikkelingsprojecten kan ondersteunen.

Wat bedoel ik met deliberatie? Deliberatie is een gestructureerd overlegproces waarin verschillende perspectieven en argumenten zorgvuldig worden afgewogen, zonder dat er direct een besluit wordt genomen. Het doel is niet om een definitieve keuze te maken, maar om een dieper inzicht te krijgen, alternatieven te verkennen en gezamenlijk tot een goed onderbouwde richting te komen.

Wat deliberatie NIET is:

- Geen gewone discussie, waarin argumenten chaotisch door elkaar lopen.
  Geen besluitvorming, waarbij een knoop wordt doorgehakt.

Mijn onderzoek gaat over hoe AI deliberatie kan ondersteunen of verstoren, bijvoorbeeld door argumenten te structureren, inzichten te genereren of bepaalde perspectieven te bevoordelen. Dit gesprek helpt mij te begrijpen hoe deliberatie nu werkt, welke knelpunten er zijn en waar AI een rol in kan spelen.

Achtergrondinformatie

Voordat we verder de diepte in gaan, zou ik graag iets meer willen weten over jouw achtergrond en ervaring bij NEOO.

- Wat is je huidige rol binnen NEOO en wat houden je werkzaamheden in?

Huidige deliberatiepraktijken & uitdagingen

Laten we inzoomen op deliberatie binnen ontwerpteams en hoe dit in de praktijk werkt.

- Om te beginnen: als ik het heb over deliberatie, wat betekent dat voor jou? Was je al bekend met dit begrip, of is het nieuw voor je?
- Hoe zou jij deliberatie binnen vastgoedontwikkeling omschrijven?
- Kun je een concreet voorbeeld geven van deliberatie binnen een ontwerpteam? Een situatie waarin een onderwerp diepgaand werd besproken zonder dat er direct een besluit werd genomen?
- Wat maakt deliberatie effectief binnen een ontwerpteam volgens jou? Welke factoren dragen bij aan een productieve en succesvolle afweging van argumenten?
- Wat zijn de grootste uitdagingen bij deliberatie in ontwerpteams?

- Welke methoden en tools gebruiken jullie om deliberatie in complexe projecten te structureren?

Vergelijking met vroeger

- Hoe verliep deliberatie vroeger, voordat digitale hulpmiddelen een grotere rol speelden?
- Wat is er sindsdien veranderd? Wat werkt nu beter/slechter?
- Hoe werden deliberatieprocessen gedocumenteerd en geanalyseerd vóór digitalisering?

Ontwerpproces

Om deliberatie beter te begrijpen, wil ik dit koppelen aan ontwerpteams. Dus heb ik daar een aantal vragen over.

- Hoe werken de verschillende rollen binnen een ontwerpteam samen tijdens het ontwerpproces?
- Hoe wordt deliberatie gefaciliteerd binnen het ontwerpteam?
- Zijn er bepaalde rollen die meer invloed hebben op deliberatie dan anderen?
- Welke knelpunten of conflicten ontstaan er vaak tijdens deliberatie binnen het ontwerpteam?
- Hoe wordt met meningsverschillen omgegaan?

Double Diamond model

Het Double Diamond Model is een ontwerp- en innovatieprocesmodel dat helpt om creatieve en besluitvormingsprocessen te structureren. Het model bestaat uit twee diamanten, die samen vier fasen omvatten:

- Discover (Ontdekken - Divergent denken): In deze fase wordt breed onderzoek gedaan naar het probleem en de behoeften van gebruikers of stakeholders. Hier worden verschillende perspectieven verzameld om een diepgaand inzicht te krijgen.
- Define (Definiëren - Convergent denken): De verzamelde inzichten worden geanalyseerd en verfijnd om een duidelijke probleemstelling of projectfocus te formuleren.
- Develop (Ontwikkelen - Divergent denken): Op basis van de gedefinieerde probleemstelling worden meerdere oplossingen en ideeën gegenereerd en getest.
- Deliver (Implementeren - Convergent denken): De beste oplossing wordt geselecteerd, verfijnd en geïmplementeerd.

Dit model helpt teams om zowel brede verkenning als gefocuste besluitvorming op gestructureerde wijze toe te passen. Ik ben benieuwd in hoeverre het ontwerpproces overeenkomt met deze structuur en waar deliberatie hierin een rol speelt. Elke diamant heeft twee fasen:

- Divergent denken: Het verkennen van meerdere mogelijkheden en alternatieven.
- Convergent denken: Het verfijnen en selecteren van de meest geschikte oplossing.

Dit model wordt gebruikt in ontwerp- en innovatieprocessen. Ik ben benieuwd in hoeverre jullie werkproces overeenkomt met deze structuur en waar deliberatie hierin een rol speelt.

Algemeen

- Doorloop je dit model één keer per project in het begin, of herhaalt dit model zich per ontwerpfase?
- Zijn er fasen waarin deliberatie minder belangrijk wordt en besluitvorming dominanter wordt?
- Zijn er specifieke momenten waarop ontwerpteams teruggaan naar een vorige fase in het Double Diamond Model?

Discover (Divergent – Probleem verkennen)

- Hoe wordt binnen vastgoedontwikkeling en in het ontwerpteam bepaald wat het probleem is dat moet worden opgelost?
- Welke stakeholders zijn betrokken bij deze fase en hoe verloopt deliberatie hier?
- Welke uitdagingen ervaren ontwerpteams bij het verkennen van problemen en mogelijkheden?

Define (Convergent – Probleem definiëren)

- Hoe wordt deliberatie gebruikt om het probleem of de scope van een project vast te stellen?
- Wordt deliberatie hier bewust gestructureerd, of verloopt het meer organisch?
- Zijn er tools of methoden die jullie gebruiken om deliberatie in deze fase te ondersteunen?

Develop (Divergent – Oplossingen bedenken en testen)

- Hoe worden ideeën en oplossingen gegenereerd binnen een ontwerpteam?
- Wordt deliberatie actief ingezet om nieuwe concepten te verkennen?
- Hoe beïnvloedt deliberatie de mate van innovatie en creativiteit in deze fase?
- Zijn er conflicten of uitdagingen bij het balanceren van verschillende ideeën en belangen?

Deliver (Convergent – Oplossingen selecteren en implementeren)

- Hoe wordt de uiteindelijke keuze voor een ontwerp of oplossing gemaakt?
- Welke rol speelt deliberatie bij het valideren of testen van de gekozen oplossing?
- Hoe worden meningsverschillen in deze fase beslecht?

AI

Nu we de huidige deliberatiepraktijken en het ontwerpproces hebben besproken, ben ik benieuwd naar jouw ervaringen en perspectieven op AI en hoe AI deliberatie zou kunnen beïnvloeden.

- Heb jij al ervaring met generatieve AI-tools? Zo ja, wat gebruik je en op welke manier?
- Denk je dat AI deliberatie kan ondersteunen? Waarom wel of niet?
- Denk je dat AI vooral nuttig is in de divergente fasen (ideeën genereren) of de convergente fasen (besluitvorming)?
- Welke technologieën of methoden zie jij als meest veelbelovend om deliberatie en samenwerking te verbeteren?
- Op welke manieren zou AI deliberatie kunnen versnellen of verbeteren?
- Welke specifieke aspecten van deliberatie zouden volgens jou kunnen profiteren van AI?
- Zie je ook negatieve aspecten van AI bij deliberatie? Zijn er risico's dat AI deliberatie verstoort?
- Zijn er specifieke AI tools waarvan je denkt dat ze veel potentie hebben, maar nog niet breed worden toegepast bij NEOO?

Uitdagingen en kansen voor implementatie

AI kan deliberatie ondersteunen, maar er zijn ook uitdagingen en risico's.

- Wat zijn volgens jou de grootste obstakels bij de implementatie van AI in ontwerpteams?
- Zie je risico's in het gebruik van AI bij deliberatie? Bijvoorbeeld dat AI bepaalde argumenten bevoordeelt of de richting van een project stuurt?
- Welke strategieën of stappen zijn volgens jou nodig om AI succesvol te implementeren binnen NEOO?
- Welke ethische risico's zie jij bij het inzetten van AI?

So what?

- Als je één verandering zou kunnen doorvoeren om deliberatie effectiever te maken, wat zou dat dan zijn?
- Wat is een quick win om deliberatie binnen een ontwerpteam te verbeteren?

- Welke veranderingen in workflow zouden nodig zijn om AI daadwerkelijk nuttig te maken binnen ontwerpteams?

Toekomstvisie & afsluiting

Tot slot wil ik vooruitkijken naar de toekomst. Hoe zie jij de rol van AI zich ontwikkelen?

- Hoe denk jij dat AI de vastgoedontwikkeling de komende jaren gaat veranderen?
- Welke technologieën of tools zou je aanraden om verder te onderzoeken voor deliberatieprocessen?
- Is er nog iets wat we niet besproken hebben en dat je zou willen toevoegen over deliberatie, het ontwerpteam en AI?

Heel erg bedankt voor je tijd en waardevolle inzichten. Dit helpt enorm bij mijn onderzoek naar hoe AI deliberatie binnen ontwerpteams kan ondersteunen. Als je na dit gesprek nog aanvullende gedachten hebt, neem dan gerust contact met mij op!

Appendix C: Survey protocol

Beste deelnemer,

Hartelijk dank voor uw interesse in dit onderzoek. Mijn naam is Annefloor Pluut, en ik voer dit onderzoek uit voor mijn masterthesis aan de TU Delft. Dit onderzoek richt zich op de rol van generatieve AI in ontwerpteams binnen de vastgoedontwikkeling. Specifiek verkennen we hoe AI kan bijdragen aan overleggen in deze teams. Uw inzichten over ontwerpbeslissingen, uw ervaringen met AI-tools en uw perspectief op de mogelijke impact van deze technologie zijn waardevol voor zowel de academische kant van het onderzoek als voor praktische aanbevelingen.

Het onderzoek bestaat uit een enquête die ongeveer 5-10 minuten in beslag neemt. Alle gegevens die worden verzameld, worden uitsluitend gebruikt voor academische doeleinden en voor het ontwikkelen van richtlijnen die in de praktijk kunnen worden toegepast. Deelname is volledig vrijwillig, en u bent op geen enkel moment verplicht om door te gaan. U kunt ervoor kiezen om vragen over te slaan of het onderzoek op elk gewenst moment te stoppen, zonder dat dit gevolgen heeft. Als u zich later bedenkt en uw gegevens wilt laten verwijderen, kan dit binnen twee weken na uw verzoek.

Uw privacy staat centraal binnen dit onderzoek. Alle gegevens worden volledig anoniem verwerkt en veilig opgeslagen op de versleutelde systemen van TU Delft. Er worden geen IP-adressen of andere digitale identificatiegegevens opgeslagen.

Mocht u vragen hebben of meer informatie wensen, dan kunt u contact opnemen met mij.

Door verder te gaan, bevestigt u dat u deze informatie heeft gelezen en begrepen en stemt u in met deelname onder de beschreven voorwaarden.

Nogmaals hartelijk dank voor uw tijd en deelname. Uw bijdrage is van grote waarde voor dit onderzoek!

Achtergrondinformatie

1) Wat is uw naam? *(Optioneel – laat dit veld leeg als u anoniem wilt blijven)*
2) Wat is uw e-mailadres? *(Optioneel – laat dit veld leeg als u anoniem wilt blijven)*
3) Bij welk bedrijf bent u werkzaam? *(Optioneel – laat dit veld leeg als u anoniem wilt blijven)*
4) Werkt u regelmatig in een ontwerpteam dat betrokken is bij vastgoedontwikkeling?*
    a. Ja, ik werk regelmatig in een ontwerpteam
    b. Soms, afhankelijk van het project
    c. Nee, ik werk niet in deze sector
5) Wat is uw rol in de vastgoed- of ontwerpsector? *(Meerdere antwoorden mogelijk)**
    a. Architect
    b. Stedenbouwkundige
    c. Projectmanager
    d. Vastgoedontwikkelaar
    e. Aannemer
    f. Adviseur
    g. AI-specialist
    h. Anders:
6) In welke sector werkt u voornamelijk?*
    a. Vastgoedontwikkeling
    b. Gebiedsontwikkeling
    c. Architectuur en ontwerp
    d. Technologische oplossingen
    e. Overheid / beleid
7) Hoe groot is uw organisatie?*
    a. 1 - 10 medewerkers
    b. 11 - 50 medewerkers
    c. 51 - 200 medewerkers

d. Meer dan 200 medewerkers

AI-gebruik in vastgoed & ontwerpteams

1) Hoe bekend bent u met generatieve AI-tools? *(Bijv. ChatGPT, MidJourney, AI-gedreven BIM-tools)**
   a. Zeer bekend en gebruik ze regelmatig
   b. Enigzins bekend, maar gebruik ze zelden
   c. Wel van gehoord, maar nooit gebruikt
   d. Niet bekend
2) Heeft uw organisatie AI-tools geïmplementeerd in de workflows? *
   a. Ja, we gebruiken actief AI-tools in ons werk
   b. Ja, we experimenteren momenteel met AI-tools
   c. Nee, maar we overwegen adoptie in de toekomst
   d. Nee, en we hebben geen plannen om AI-tools te gebruiken
3) Welke generatieve AI-tools gebruikt u in uw ontwerpteam? *(Selecteer alle toepasselijke opties)**
   a. ChatGPT (Tekstgeneratie en automatisering)
   b. DALL·E / MidJourney (Beeld- en ontwerpvisualisatie)
   c. AI-ondersteunde BIM-tools (Bijv. Autodesk AI, Revit AI)
   d. AI-gestuurde simulaties (Bijv. AI-aangedreven wind- of energieanalyses)
   e. AI-tools voor kostenoptimalisatie (Bijv. AI-gestuurde budgettering en planning)
   f. AI voor besluitvormingsondersteuning (Bijv. Predictive analytics, AI voor stakeholdercommunicatie)
   g. Geen AI-tools gebruikt tot nu toe
   h. Anders:
4) Hoe wordt AI momenteel gebruikt om samenwerking en communicatie binnen uw ontwerpteam te ondersteunen? *(Selecteer alle toepasselijke opties)*
   a. AI wordt gebruikt om projectdocumenten en verslagen automatisch te genereren
   b. AI helpt bij het analyseren van eerdere ontwerpbeslissingen om betere keuzes te maken
   c. AI ondersteunt bij het verzamelen en samenvatten van feedback uit verschillende belanghebbenden
   d. AI wordt gebruikt om communicatie met klanten en niet-technische stakeholders te verbeteren
   e. AI wordt momenteel niet specifiek ingezet voor samenwerking
   f. Anders:
5) In welke fasen wordt AI momenteel gebruikt in uw ontwerpteams?*
   a. Initiatie / haalbaarheidsstudies
   b. Conceptontwikkeling en schetsontwerp
   c. Voorlopig / definitief ontwerp
   d. Bouwvoorbereiding en technische uitwerking
   e. Constructie en uitvoering
   f. AI wordt (nog) niet gebruikt in deze processen
6) Voor welke taken zou u graag AI gebruiken in het ontwerpteam?*
   a. Samenvatten en structureren van teamdiscussies
   b. Visualiseren van complexe concepten voor betere besluitvorming
   c. Automatisch genereren van ontwerpvarianten en alternatieven
   d. Ondersteuning bij onderbouwing van ontwerpkeuzes met data en simulaties
   e. Vereenvoudigen van communicatie met niet-technische belanghebbenden
   f. Anders:

Obstakels bij AI-adoptie

1) Wat zijn de grootste obstakels voor AI-gebruik in uw organisatie?*
   a. Gebrek aan AI-expertise binnen het team
   b. Onzekerheid over betrouwbaarheid en foutgevoeligheid van AI
   c. Weerstand binnen het team tegen AI-gebruik
   d. AI-modellen geven soms onduidelijke of moeilijk te interpreteren resultaten
   e. Regelgevende of juridische beperkingen
   f. Tijdsinvestering voor AI-implementatie
   g. Anders:

2) Hoeveel vertrouwen heeft u in AI-gegenereerde inzichten en beslissingen in ontwerpteams?*
   a. Volledig vertrouwen
   b. Grotendeels vertrouwen
   c. Neutraal
   d. Weinig vertrouwen
   e. Geen vertrouwen

Toekomstige AI-behoeften & framework ontwikkeling

1) Welke AI-functionaliteiten zouden samenwerking binnen ontwerpteams kunnen verbeteren? *(Selecteer alle toepasselijke opties)**
   a. AI die automatisch gespreksverslagen en actiepunten genereert
   b. AI die knelpunten in ontwerpkeuzes identificeert
   c. AI die ontwerpbeslissingen uitlegbaar maakt voor alle teamleden
   d. AI die real-time feedback geeft op ontwerpvoorstellen
   e. AI die helpt om discussies en besluitvorming te structureren
   f. Anders:
2) Wat heeft uw organisatie nodig om AI effectief te implementeren? *(Selecteer alle toepasselijke opties)**
   a. Training en workshops over AI-gebruik en toepassingen in ontwerpteams
   b. Duidelijke richtlijnen of een stappenplan voor de implementatie van AI binnen bestaande workflows
   c. Casestudies en best practices uit de sector om succesvolle AI-toepassingen te laten zien
   d. Technische ondersteuning of consultancy bij implementatie en onderhoud van AI
   e. Financiële stimulansen of subsidies voor de implementatie van AI
   f. Meer draagvlak binnen het management om AI-innovaties te ondersteunen
   g. Een overzicht van bestaande AI-tools en hoe ze effectief kunnen worden toegepast in ontwerpteams
   h. Geen van bovenstaande, AI is (nog) niet relevant voor onze organisatie
   i. Anders:
3) Heb je nog aanvullende opmerkingen, inzichten of gedachten over dit onderwerp die je graag met mij wilt delen?

Afsluiting

Enorm bedankt voor uw deelname! Uw inzichten helpen mij enorm bij mijn afstudeeronderzoek!

Appendix D: Codebook development

The interview codebook was developed in two stages. First, deductive codes were derived from the theoretical orientation, ensuring alignment with existing literature on deliberation, design teams, and generative AI. These codes provided a structured framework for analysis, linking theory to empirical findings. Next, inductive codes were added based on surprising or recurring insights from the interviews. Some emerged during coding as new themes surfaced beyond existing literature. This approach balanced predefined theory with real-world perspectives.

Most interesting & most surprising overview

Interview	Most interesting	Most surprising	Inductive codes
Interview 1	The most interesting insight was how he is using AI tools within NEOO, particularly the custom GPT chatbot that integrates project documentation and regulations. This allows design teams to quickly retrieve relevant information during meetings without having to pause discussions to look things up, significantly speeding up deliberation processes and making them more efficient.	The most surprising point was his concern that if everyone starts using the same AI tools, projects might become less distinctive. This highlights a fundamental tension between automation and creativity—AI can accelerate and standardize processes, but how do you ensure that design remains unique and innovative? This paradox is a crucial consideration for the future of AI in real estate development.	AI as a facilitator, Standardization vs. creativity
Interview 2:	His vision for AI's future role in real estate development is particularly intriguing. He believes that in the future, an AI system could generate 80 different fully developed design variations—including structural calculations—within minutes, allowing for significantly faster decision-making. However, he emphasizes that the biggest challenge isn't the technology itself but rather the willingness of people to adapt and change their workflows.	The most surprising point was his view on AI potentially leading to decision overload rather than simplifying choices. He pointed out that AI can generate thousands of design options in seconds, which could actually make decision-making more difficult rather than easier. This contradicts the common assumption that AI will simply make everything more efficient—highlighting the need for AI tools to also help curate and filter options effectively.	AI as a facilitator, Decision overload
Interview 3:	His perspective on AI acting as a mediator in deliberation is particularly fascinating. He sees AI not just as a tool for generating insights but as an active participant that can challenge human biases, highlight conflicting viewpoints, and even "argue" with humans based on its dataset. This shifts AI from a passive support system to a deliberative agent, fundamentally changing the role it could play in stakeholder discussions.	The most surprising insight was his point that AI deliberation must go beyond just "listening" to AI responses. He argues that AI should not simply provide a single answer, as that would shift the balance towards decision-making rather than true deliberation. Instead, AI should facilitate argumentation and reflection—helping humans actively engage in discussions rather than just accepting AI-generated conclusions. This insight challenges a common assumption that AI's role is to streamline decision-making rather than enhance the deliberation process itself.	AI as a participant, Over-reliance on AI
Interview 4:	The insights on value extraction using AI were particularly compelling. He highlighted how AI could be used to identify underlying motivations behind stakeholder choices, rather than just processing explicit requests. For example, if a stakeholder requests a red window frame, AI could interpret this as a preference for aesthetics, helping decision-makers align solutions with stakeholder values. This idea suggests that AI could play a crucial role in uncovering deeper priorities in design deliberation, beyond just surface-level preferences.	The most surprising point was the emphasis on AI's role in regulating information rather than just generating it. He pointed out that AI models, such as large language models (LLMs), are great at creating coherent outputs but lack inherent regulation. He discussed the Retrieval-Augmented Generation (RAG) framework as a way to ensure that AI-generated content is grounded in a verified knowledge base, rather than allowing the AI to produce unchecked outputs. This challenges the assumption that AI should only assist in deliberation by providing insights—it also needs mechanisms to control and verify the information it presents.	AI in value extraction, Lack of trust in AI
Interview 5:	The perspective on the evolution of design teams due to increasing complexity in real estate projects is particularly interesting. He explains how design teams have grown from just a few core roles to a highly specialized network of experts, including sustainability advisors, cost estimators,	The most surprising insight was the emphasis on the lack of trust in AI models within the industry. While AI could theoretically enhance decision-making, professionals are often reluctant to rely on AI-generated recommendations due to issues of accountability and explainability. He gives the	AI influencing power dynamics, Lack of trust in AI

	lifecycle analysts, and AI specialists. This shift illustrates how deliberation is becoming more complex, requiring not just more expertise but also better coordination and communication tools, which AI could potentially facilitate.	example of a predictive AI model for infrastructure, where no one wants to take responsibility if the AI suggests a bridge replacement and it turns out to be incorrect. This highlights a key bottleneck for AI adoption in high-stakes environments—without clear accountability, AI's potential remains largely untapped.	
Interview 6:	Her view on AI as a structural tool for deliberation was particularly compelling. She sees AI primarily as a way to organize and structure discussions, helping teams summarize key arguments, highlight overlooked considerations, and provide structured documentation. She believes AI could be especially valuable in identifying pros and cons that team members might not have considered, making deliberation more thorough and informed.	The most surprising insight was the concern that AI could lead to passive engagement in deliberation. She pointed out that when people manually write things down, they are forced to process and critically engage with the content. However, if AI generates summaries and conclusions for them, people might blindly accept the output without truly reflecting on the discussion. This raises an important challenge: while AI can improve efficiency, it must be designed in a way that keeps humans actively involved in the deliberation process rather than becoming overly reliant on automation.	AI as a facilitator, Over-reliance on AI
Interview 7:	He highlighted how AI could serve as a neutral facilitator in deliberation, ensuring that all perspectives are represented fairly. He mentioned that AI could help summarize standpoints, track key arguments, and even function as an interactive discussion partner—helping teams revisit decisions and refine their reasoning. This suggests that AI could become an active participant in design deliberation rather than just a passive documentation tool.	The most surprising insight was the concern that AI could lead to over-reliance and intellectual passivity. He pointed out that when people let AI summarize or filter information for them, they may engage less critically with the content. This mirrors concerns about AI in education—where students might accept AI-generated responses without deeper reflection. The risk in deliberation is that AI could shape discussions too much, influencing decisions in subtle but significant ways.	AI as a facilitator, Over-reliance on AI
Interview 8:	Her perspective on AI's role in summarizing and structuring discussions was particularly compelling. She sees AI as a useful tool for capturing meeting discussions and generating transcripts, especially to provide a legal record of what was discussed. However, she does not see AI as a major game-changer for the way deliberation currently happens—she views meetings as already efficient when participants are well-prepared.	The most surprising insight was her scepticism about the presence of deliberation in design team meetings. Unlike other interviewees who see deliberation as a structured process within design teams, she does not recognize extended deliberation as a common practice. She believes that meetings should be efficient, with minimal back-and-forth discussions—decisions should be made quickly, and prolonged debate is seen as unnecessary or even inefficient. This challenges the assumption that deliberation naturally occurs in all design discussions.	AI and work pressure, perceived lack of deliberation in design teams
Interview 9:	His strong advocacy for data-driven decision-making stood out the most. He argues that data transparency is essential for successful AI implementation and that organizations should move towards objectively measurable goals rather than subjective decision-making. His example of MiniBIM—a structured, data-driven framework for real estate projects—illustrates how AI and digitalization can enhance stakeholder collaboration and accountability in real estate.	The most surprising insight was his frustration with resistance to change. He highlights how many professionals in real estate actively resist digitalization because they are uncomfortable admitting that their traditional expertise is becoming less relevant. He even suggests that some senior professionals have an incentive to reject AI because it threatens their authority and decision-making power. This aligns with participant 10's insight on power structures but takes it further by identifying ego, fear of change, and personal resistance as core obstacles to AI adoption.	AI as a tool for stakeholder alignment, Resistance to change
Interview 10:	He provided a strong perspective on AI as a structural element in decision-making, not just a tool for efficiency. He sees AI as an orchestration layer in workflows, helping organizations intelligently distribute tasks between humans and AI systems. His vision of AI agents collaborating with humans in deliberation is particularly interesting, as it reframes AI's role from a	The most surprising insight was the belief that AI will fundamentally shift the decision-making power dynamics in organizations. He argues that human biases and power structures currently shape many discussions, and that AI has the potential to introduce more objective, data-driven decision-making. However, this also means that traditional decision-makers might resist AI because it challenges their authority. This introduces a	Resistance to change, AI for bias reduction

	passive tool to an active co-strategist in meetings and decision-making processes.	new socio-political barrier to AI adoption that is not just about technology but about organizational resistance at leadership levels.	

Table 5: Most interesting and surprising interviews (Own work)

Codebook

Code	Description	Example quote	Link to literature
1 - Deliberation	The process of discussion and consideration among stakeholders to reach a decision or consensus.		Forester (2006) highlights deliberation as a process that prioritizes collective reasoning over efficiency.
1 - Deliberation: Challenges	The difficulties encountered in the deliberation process, such as conflicting interests, power dynamics, and communication barriers.	"Small-scale design teams are often dominated by a few individuals, limiting equal input from all stakeholders." – Participant 2	Buhmann & Fieseler (2021) discuss how power imbalances can marginalize voices in deliberation.
1 - Deliberation: Decision-making vs deliberation	The distinction between deliberation (discussion and exploration of perspectives) and decision-making (finalizing a choice or action).	*"Decision making is about efficiency and optimization. Deliberation is about understanding, reflection, and rationality."* – Participant 2	Barabas (2004) differentiates deliberation as a reasoning process and decision-making as the moment of commitment.
1 - Deliberation: Definition	A precise definition of deliberation in the context of stakeholder discussions and decision processes.	*"Deliberation means consideration of reasons for and against certain measures between a group of people."* – Participant 2	Rapanta & Blair (2011) define deliberation as a process of collective reflection rather than just decision-making.
1 - Deliberation: Example	Concrete examples of deliberation in real estate development or other relevant fields.	*"In the design team, we had extensive discussions on how to make a dynamic facade, iterating multiple times before reaching consensus."* – Participant 1	Zhang et al. (2023) highlight how deliberation integrates conflicting interests in decision-making.
1 - Deliberation: Phase	The different phases in a design process, such as initiation, conceptual and definitive design phase.	*"In the early design phase, deliberation is more intensive because stakeholders have different goals, such as reducing costs versus improving sustainability."* – Participant 2	Geiser et al. (2024) discuss the iterative nature of deliberation in design processes.
1 - Deliberation: Success factors	Elements that contribute to effective deliberation, such as inclusivity, transparency, and structured facilitation.	*"A well-structured deliberation process ensures all voices are heard and helps align different perspectives."* – Participant 3	Caluwaerts et al. (2023) emphasize structured facilitation as essential for effective deliberation.
2 - AI in deliberation	The role AI plays in deliberation processes, either as a tool or an active participant.		Karacapilidis et al. (2024) describe AI as a facilitator of structured deliberation.
2 - AI in deliberation: AI as a participant	AI's potential role in actively contributing to discussions, providing insights, or summarizing arguments.	*"AI can listen to your opinions, give you suggestions, and even argue with you based on different datasets."* – Participant 2	Inductive: Based on most surprising / interesting findings from the interviews.
2 - AI in deliberation: Stakeholder alignment	How AI can help align stakeholder views by organizing, analyzing, and presenting data.	*"AI can force people to consider different perspectives and understand why others make different choices."* – Participant 2	Inductive: Based on most surprising / interesting findings from the interviews.
2 - AI in deliberation: AI for bias reduction	The use of AI to counteract human biases in deliberation by offering objective data and alternative perspectives.	*"AI can help us consider what kind of biases we have and reflect on them."* – Participant 2	Inductive: Based on most surprising / interesting findings from the interviews.

2 - AI in deliberation: Benefits	The advantages of using AI in deliberation, such as efficiency, data-driven insights, and improved stakeholder engagement.	*"Generative AI allows us to automate repetitive tasks, freeing up time for creative problem-solving."* – Participant 1	Feuerriegel et al. (2023) highlight efficiency gains from AI in decision-making.
2 - AI in deliberation: Challenges	The obstacles in implementing AI in deliberation, such as trust issues, data privacy concerns, and resistance to adoption.	*"The challenge is getting older generations and experienced professionals to adopt AI-driven processes."* – Participant 1	Kalampokis et al. (2024) discuss AI trust issues and the need for transparency.
2 - AI in deliberation: Decision overload	The risk of AI generating too many options, leading to decision fatigue rather than aiding the deliberation process.	*"AI can generate thousands of options in seconds, which can lead to choice overload."* – Participant 5	Inductive: Based on most surprising / interesting findings from the interviews.
2 - AI in deliberation: Definition AI	A clear definition of AI in the context of deliberation and stakeholder engagement.	*"AI in deliberation is a tool that structures discussions, identifies patterns, and enhances decision-making processes."* – Participant 10	Brown et al. (2020) define AI in collaborative contexts as a cognitive support tool.
2 - AI in deliberation: Negative sides	The potential drawbacks of AI in deliberation, such as loss of human control or increased reliance on technology.	*"A major risk is that people blindly trust AI-generated summaries without critically evaluating them."* – Participant 6	Zhang et al. (2023) warn against over-reliance on AI in deliberative contexts.
2 - AI in deliberation: Personal experience	Real-life examples or reflections on AI use in deliberation from professionals or researchers.	*"I use ChatGPT for deep searches, content generation, and extracting useful insights from large datasets."* – Participant 3	Inductive: Emerging from interview insights on AI's role in deliberation.
2 - AI in deliberation: Potential use for deliberation	Various ways AI can support or enhance deliberation processes.	*"AI engine notifies the mediator to say that this person hasn't been talking at all. Maybe you should give them space to express themselves."* – Participant 3	Inductive: Emerging from interview insights on AI's role in deliberation.
2 - AI in deliberation: Tools	Specific AI tools that can be used in deliberation, such as automated meeting summaries or sentiment analysis.	*"We use custom GPTs to quickly access project documentation and optimize decision-making processes."* – Participant 1	Karacapilidis et al. (2024) discuss how AI tools, such as automated summaries and sentiment analysis, enhance deliberation.
3 - Risks & concerns of AI in deliberation	The potential risks of using AI in deliberation, including ethical concerns and practical challenges.	*"We don't know what happens with the data we input into AI systems, and that remains a fundamental risk."* – Participant 4	Buhmann & Fieseler (2021) discuss ethical concerns related to AI bias.
3 - Risks & concerns of AI in deliberation: Bias & partiality	The risk that AI systems reinforce existing biases due to flawed training data or algorithmic design.	*"AI-generated content is based on existing data, which means it can carry historical biases that we may not even notice."* – Participant 3	Kalampokis et al. (2024) highlight how AI systems can reinforce biases due to limitations in training data and algorithmic design.
3 - Risks & concerns of AI in deliberation: Ethics - trust & responsibility	Concerns regarding trust in AI-driven decisions and the ethical responsibility of its implementation.	*"Who takes responsibility when AI-driven recommendations turn out to be wrong?"* – Participant 4	Feuerriegel et al. (2023) discuss concerns about trust and accountability in AI-driven decision-making, emphasizing the challenge of assigning responsibility.
3 - Risks & concerns of AI in deliberation: Over-reliance	The danger of stakeholders becoming too dependent on AI, potentially reducing critical human oversight.	*"People tend to accept AI-generated information too easily, without checking if it's actually correct."* – Participant 6	Inductive: Based on most surprising / interesting findings from the interviews.
3 - Risks & concerns of AI in deliberation:	Organizational and individual reluctance to adopt AI in deliberation processes.	*"Getting experienced professionals to adopt AI is challenging; they prefer familiar processes."* – Participant 1	Inductive: Based on most surprising / interesting findings from the interviews.

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3 - Risks & concerns of AI in deliberation: Standardization	The risk that AI enforces rigid decision-making structures, limiting creativity and adaptability.	*"If everyone uses the same AI tool for projects, how do you differentiate your work?"* – Participant 1	Kalampokis et al. (2024) highlight the risk of AI-driven standardization, which may constrain flexibility and limit creative problem-solving.
3 - Risks & concerns of AI in deliberation: Support tool, not decision-maker	The perspective that AI should assist rather than replace human decision-making in deliberation.	*"AI should support discussions, not dictate decisions."* – Participant 7	Inductive: Emerging from interview insights on AI's role in deliberation.
4 - Implementation	The process of integrating AI into deliberation practices within organizations.		Karacapilidis et al. (2024) discuss AI implementation challenges and best practices.
4 - Implementation: Challenges	Barriers to AI implementation, such as technical limitations, cost, and workforce adaptation.	*"The biggest challenge is that AI tools don't always work as expected. You try something, and it just doesn't deliver what you need."* – Participant 5	Inductive: Emerging from interview insights on AI's role in deliberation.
4 - Implementation: Change management	Strategies for handling organizational change when implementing AI in deliberation.	*"People say they are open to change, but when it comes down to actually doing things differently, there's a lot of hesitation."* – Participant 9	Inductive: Based on most surprising / interesting findings from the interviews.
4 - Implementation: Potency	The potential effectiveness of AI in deliberation and its long-term impact.	*"I do think AI can make decision-making faster and improve efficiency, but only if we overcome the initial obstacles."* – Participant 5	Inductive: Emerging from interview insights on AI's role in deliberation.
4 - Implementation: Reaction	Stakeholder responses to AI implementation in deliberation, including skepticism or enthusiasm.	*"Everyone is excited when they see AI in action, but making them actually use it in their workflow is a different challenge."* – Participant 1	Inductive: Emerging from interview insights on AI's role in deliberation.
4 - Implementation: Strategies	Methods to successfully introduce AI into deliberation processes.	*"We started by forming a dedicated AI team that regularly asks employees where they see potential for automation."* – Participant 4	Inductive: Emerging from interview insights on AI's role in deliberation.
4 - Implementation: Work pressure	The impact of AI on workload, either as a stress reducer or as an additional burden.	*"AI might help speed up processes, but it also means we're expected to do more in less time, which increases pressure."* – Participant 8	Inductive: Based on most surprising / interesting findings from the interviews.
5 - Design team	The role and composition of design teams in deliberation and decision-making.		Svalestuen et al. (2015) describe the multidisciplinary nature of design teams.
5 - Design team: Conflicts	Conflicts that arise within design teams during deliberation and how they are managed.	*"There is a shared goal, but everyone has their own interests. The architect has different priorities than the financial controller, and at some point, these interests must align."* – Participant 1	Inductive: Emerging from interview insights on AI's role in deliberation.
5 - Design team: Decision-making & implementation (deliver)	How design teams finalize decisions and implement solutions.	*"At some point, you just have to make a choice. If you don't, the project doesn't move forward. And if it turns out to be the wrong choice, you adjust later."* – Participant 7	Linked to the Deliver phase of the Double Diamond model, where design teams converge and finalize solutions (Gustafsson, 2019; Wang et al., 2023).
5 - Design team: Double Diamond Model	The application of the Double Diamond Model in design-related deliberation processes.	*"In many cases, we take a step back and ask: what is the actual problem here? I think many people in this industry tend to rush past this stage."* – Participant 7	Derived from the Double Diamond model, which structures design into four iterative phases of divergent

			and convergent thinking (Gustafsson, 2019).
5 - Design team: Exploring solutions & iteration (develop)	The iterative process of developing and testing solutions in deliberation.	*"Sometimes you need to explore different solutions before arriving at the best one. That means going back, reevaluating, and iterating on previous ideas."* – Participant 9	Geiser et al. (2024) discuss iterative problem-solving in design teams.
5 - Design team: Problem-framing & defining objectives (define)	The initial phase of identifying and structuring the problem in deliberation.	*"You must first think about parameters—measurable objectives—to ensure that your design meets all the necessary requirements."* – Participant 9	Based on the *Define* phase of the Double Diamond model, focused on narrowing down and agreeing on design objectives (Wang et al., 2023).
5 - Design team: Composition	The composition of design teams and how it influences deliberation.	*"A project moves from SO to VO to DO to TO to UO, with each phase involving different experts and levels of detail."* – Participant 1	Inductive: Emerging from interview insights on AI's role in deliberation.
5 - Design team: Understanding stakeholder needs & research (discover)	The research phase focused on gathering insights from stakeholders to inform deliberation.	*"Stakeholder involvement is crucial. You want to map out the entire stakeholder field and make sure their needs are considered."* – Participant 9	Grounded in the *Discover* phase of the Double Diamond model, where teams explore user needs through open-ended research (Gustafsson, 2019).

Table 6: Codebook (Own work)

Appendix E: Consent form

Opening statement

Text
You are being invited to participate in a research study titled *Generative AI for deliberation in design teams*. This study is being done by *A.S. (Annefloor) Pluut* from the TU Delft *in collaboration with NEOO, the internship provider and supporting organization*. The purpose of this research study is *to explore how generative AI tools can support deliberation within design teams in real estate development* and will take you approximately *60* minutes to complete. The data will be used for *providing academic purposes, including a master's thesis, and to develop practical recommendations for NEOO*. We will be asking you to *provide share insights about your experiences with deliberation processes, your familiarity with AI tools, and your perspectives on how such tools could influence collaboration and decision-making*. As with any online activity the risk of a breach is always possible. To the best of our ability your answers in this study will remain confidential. We will minimize any risks by *be storing all collected data on TU Delft's encrypted systems, anonymizing all interview transcripts, and limiting access to authorized personnel only. No IP addresses or other identifiable digital footprints will be collected*. Your participation in this study is entirely voluntary **and you can withdraw at any time.** You are free to omit any questions. *If you choose to withdraw, any identifiable data you have provided will be permanently deleted within **two weeks** of your request.* *If you have any questions about this study or require further clarification, please feel free to contact:* - ***Researcher:** A.S. (Annefloor) Pluut (A.S.Pluut@student.tudelft.nl)* - ***Responsible researcher:** Dr. Aksel Ersoy (A.Ersoy@tudelft.nl)* *For online surveys, by clicking "Next" to proceed, you confirm that you have read and understood this information, and you agree to participate under the conditions described.* *For real-life interviews, you will be asked to sign a consent form before the interview begins to confirm your understanding and agreement to participate.*

Explicit consent points

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
A: GENERAL AGREEMENT – RESEARCH GOALS, PARTICPANT TASKS AND VOLUNTARY PARTICIPATION		
1. I have read and understood the study information dated *21-01-2025*, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	☐	☐
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	☐	☐
3. I understand that taking part in the study involves: - *An **audio-recorded interview** conducted in person or online, where I will discuss topics related to deliberation processes, AI tools, and their influence on collaboration and decision-making; OR* - *An **online survey** where I will answer similar questions designed to capture my insights on the same topics.points below*	☐	☐
B: POTENTIAL RISKS OF PARTICIPATING (INCLUDING DATA PROTECTION)		

PLEASE TICK THE APPROPRIATE BOXES	Yes	No
6. I understand that taking part in the study involves the following risks: *taking part in this study may involve mild discomfort or hesitation in sharing professional views, particularly for participants who work at NEOO and may be in a subordinate position to the researcher. Additionally, there may be a risk of misunderstanding or miscommunication during discussions about complex topics such as AI and deliberation processes.* I understand that these will be mitigated by *ensuring that participation in the study is entirely voluntary and that participants are informed of their right to skip any question or stop the interview at any time without providing a reason. All interviews will be conducted in a neutral, private setting to ensure participant comfort, and participants will be encouraged to communicate any concerns during the process.*	☐	☐
7. I understand that taking part in the study also involves collecting specific personally identifiable information (PII) including your name, role, and contact details, which will only be used for scheduling and follow-up communication and associated personally identifiable research data (PIRD) in the form of professional views shared with the potential risk of my identity being revealed if specific professional views are attributed to identifiable participants within the organization.	☐	☐
9. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach: the data collected will be pseudonymized during transcription and analysis, with personal identifiers removed. All data will be securely stored on TU Delft's encrypted servers with access limited to the research team. Audio recordings will be deleted immediately after transcription and anonymization. Additionally, the anonymized data will only be accessible to authorized personnel, and any breach will be handled in compliance with TU Delft's data protection policies.	☐	☐
10. I understand that personal information collected about me that can identify me, such as *my name or where I work*] will not be shared beyond the study team.	☐	☐
11. I understand that the (identifiable) personal data I provide will be destroyed within two weeks of the study's conclusion or upon the participant's request to withdraw from the study. Anonymized transcripts will be securely stored for five years for auditing purposes and will then be permanently deleted.	☐	☐
C: RESEARCH PUBLICATION, DISSEMINATION AND APPLICATION		
12. I understand that after the research study the de-identified information, I provide will be used for *the master's thesis publication in the TU Delft repository. Additionally, the data may be used for academic dissemination, including journal articles, conference presentations, or reports.*	☐	☐
13. I agree that my responses, views or other input can be quoted anonymously in research outputs.	☐	☐
14. I agree that my real name can be used for quotes in research outputs	☐	☐
D: (LONGTERM) DATA STORAGE, ACCESS AND REUSE		
16. I give permission for the de-identified *interview transcripts or survey responses* that I provide to be archived in *TU Delft* repository so it can be used for future research and learning.	☐	☐
17. I understand that access to this repository is *open.*	☐	☐

Signatures

_____ _____ _____

Name of participant [printed] Signature Date

I, as researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands to what they are freely consenting.

_Annefloor Pluut_____ _____ _____

Researcher name [printed] Signature Date

Study contact details for further information:

Annefloor Pluut

+31 6 83 01 96 30

a.s.pluut@student.tudelft.nl

Appendix F: Survey analysis & calculation

Descriptive analysis

The descriptive analysis explores how respondents engage with AI, which tools they use, and what obstacles they face in adopting AI within their organizations.

Participation and professional roles

A key objective of the survey was to understand how frequently professionals engage in design teams. The findings indicate that 52% of respondents regularly work in design teams, while 32% occasionally engage in them, and 16% are not directly involved. This distribution ensures that the responses capture perspectives from both frequent and occasional participants in deliberation processes.

Regarding professional roles, the most common roles among respondents include real estate developers (48%), project managers (28%), and advisors (24%). Since these roles often involve structuring agreements and navigating stakeholder interests, their engagement with AI provides valuable insights into its potential to support deliberation.

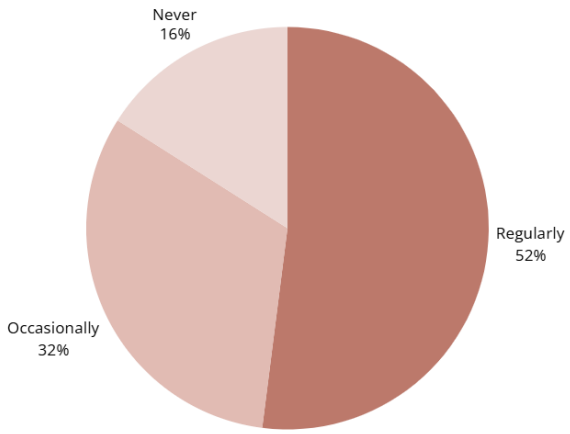


Figure 19: Involvement in design teams (Own work)

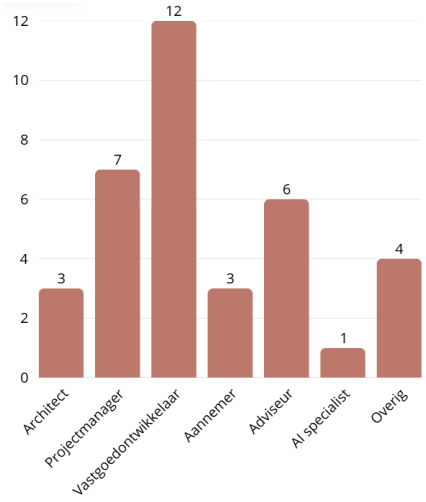


Figure 20: Roles within the real estate sector (Own work)

These findings suggest that AI discussions are not limited to technical specialists—a variety of professionals are considering AI to facilitate agreement-building and collaborative discussions.

Familiarity with AI and implementation in workflows

When asked about their familiarity with generative AI tools, responses varied. 56% of participants reported using AI regularly, while 32% were somewhat familiar, and 12% had little knowledge of AI. This suggests that AI awareness is widespread, yet not all professionals actively use AI tools to support collaboration and deliberation.

The survey also explored whether organizations have integrated AI into their workflows. While 12% of organizations actively use AI, the majority (56%) are still experimenting, and 28% have yet to adopt AI but are considering it. These findings reveal a gap between individual AI engagement and formal organizational integration.

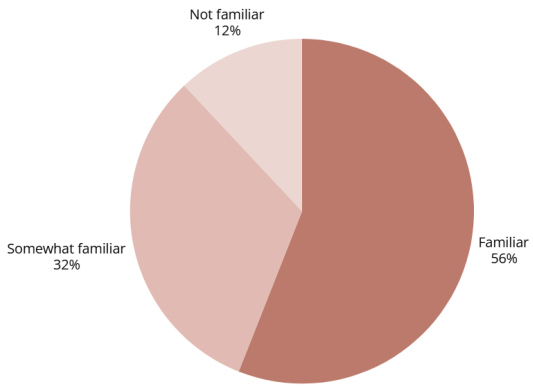


Figure 21: AI familiarity (Own work)

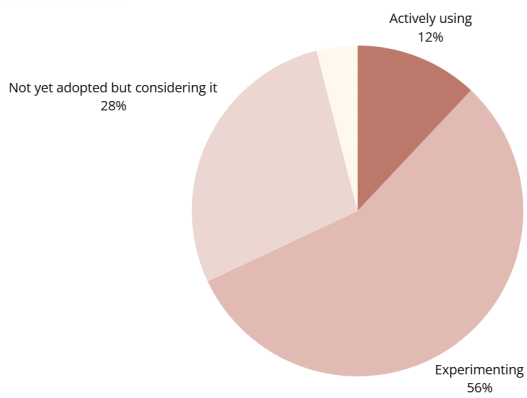


Figure 22: AI implementation levels (Own work)

This pattern reflects a broader industry trend in which AI is often explored informally by individuals before organizations implement structured AI-supported processes.

AI tools and desired applications

Among the AI tools currently in use, ChatGPT is by far the most widely adopted, with 88% of respondents using it. Other commonly used tools include DALL-E/MidJourney (24%) for visualization and AI-supported BIM tools (24%) for assisting with architectural and technical workflows.

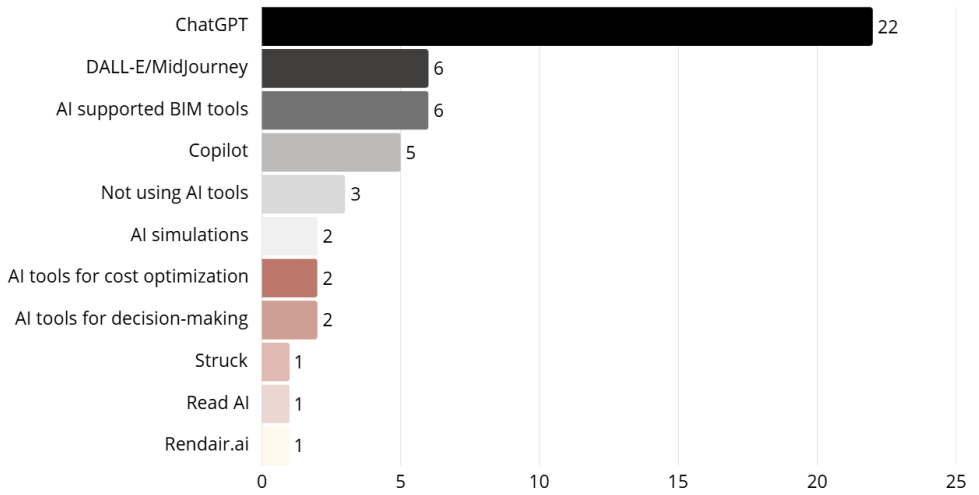


Figure 23: AI tool usage (Own work)

This indicates that generative AI is primarily used for documentation, structuring discussions, and automating routine tasks, while its role in facilitating stakeholder deliberation and agreement-building is still developing.

Looking ahead, respondents expressed interest in AI tools that go beyond automation and actively support structuring deliberation and stakeholder engagement. The most desired AI functionalities include:

- Automated design generation (64%)
- AI-supported deliberation structuring (52%)
- Real-time AI-assisted feedback in discussions (48%)

These findings suggest that professionals want AI to help organize, refine, and support stakeholder deliberation, rather than just process information passively.

Barriers to AI adoption and future implementation needs

Despite growing interest, several barriers hinder widespread AI adoption. The most commonly cited challenges include:

- Lack of expertise (60%)
- Concerns over AI reliability (40%)
- Regulatory uncertainty (28%)

These concerns highlight the need for clear implementation strategies, training, and trust-building initiatives to ensure AI is used effectively in deliberation processes.

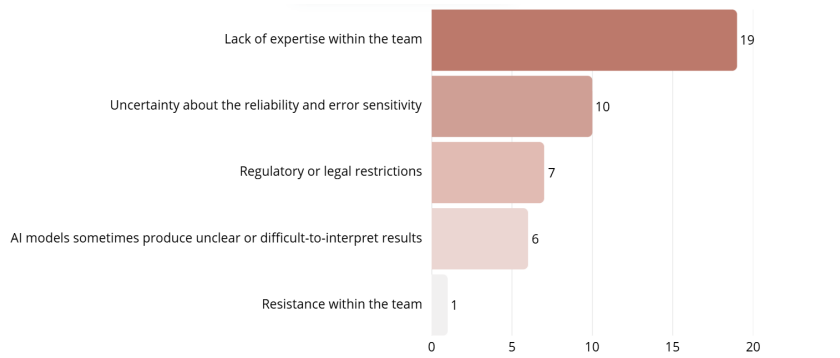


Figure 24: Frequency of AI adoption barriers (Own work)

When asked what would help facilitate AI adoption, respondents identified training programs (60%), case studies showcasing successful AI applications (52%), and implementation roadmaps (48%) as the most critical enablers.

These findings suggest that AI adoption will require structured industry-wide support, rather than relying solely on individual experimentation.

Statistical analysis

The statistical analysis examines relationships between key variables, such as AI familiarity, organizational adoption, and attitudes toward AI-supported deliberation. The detailed statistical tests, calculations, and data tables are available in Appendix C for further reference.

AI familiarity across organization sizes (ANOVA Test)

A one-way ANOVA test was conducted to determine whether familiarity with AI differs across organization sizes. The results ($F = 1.58$, $p = 0.228$) indicate no significant difference, suggesting that AI familiarity is not dependent on company size.

This finding challenges the assumption that larger organizations are more advanced in AI adoption, instead suggesting that AI engagement is driven by individual curiosity and professional role rather than organizational scale.

Trust in AI among organizations with and without AI implementation (T-Test)

A T-test comparing trust in AI among organizations that have adopted AI and those that have not revealed no statistically significant difference ($T = -0.1301$, $p = 0.4481$).

This suggests that trust in AI is shaped by factors beyond direct implementation, such as past experiences, industry norms, and the perceived reliability of AI tools.

Correlation between AI familiarity and implementation

A correlation analysis found a weak positive correlation ($r = 0.187$) between AI familiarity and implementation. While familiarity may slightly encourage AI adoption, it is not a strong predictor, indicating that organizational strategies and leadership decisions play a more crucial role in AI integration.

Influence of professional role on trust in AI (ANOVA Test)

Another ANOVA test examined whether trust in AI varies by professional role, but no significant differences were found ($F = 0.439$, $p = 0.843$). This suggests that trust in AI is influenced more by individual experiences and organizational culture than by specific professional backgrounds.

Survey conclusion

The findings indicate that while AI usage in real estate design teams is increasing, full-scale adoption remains inconsistent. Professionals see value in AI for structuring deliberation, supporting stakeholder discussions, and facilitating agreements, yet many organizations remain cautious.

Key insights include:

- AI is primarily used for documentation and automation, but there is growing demand for AI that supports structured deliberation and agreement-building.
- Barriers such as lack of expertise, reliability concerns, and regulatory uncertainty continue to slow adoption.
- Training, case studies, and implementation strategies are essential to encourage broader AI integration.
- Trust in AI is not significantly higher among those who have implemented AI, suggesting that confidence in AI requires more than direct exposure.

Statistical analysis

ANOVA: AI familiarity across organisation sizes

A one-way analysis of variance (ANOVA) was conducted to assess whether familiarity with AI significantly differs based on organization size. The results indicate no statistically significant difference between the groups ($F = 1.58$, $p = 0.228$), as the p-value is above the standard significance threshold of 0.05.

- The mean AI familiarity score for small organizations was 3.42 with a variance of 0.59.
- The mean AI familiarity score for medium organizations was 3.00 with a variance of 0.00.
- The mean AI familiarity score for large organizations was 4.00 with a variance of 0.00.

These values were derived by converting survey responses into a numerical scale (1–4), grouping them by organization size (small, medium, large), and then calculating the average (mean) and variance for each group based on individual responses.

These findings suggest that organizational size does not significantly impact AI familiarity among professionals. While larger firms may have more resources for AI adoption, the level of personal AI familiarity appears to be relatively stable across different organization sizes.

T-Test: Trust in AI between organisations with and without AI implementation

A T-test was conducted to compare the level of trust in AI-generated insights between organizations that have implemented AI and those that have not. The results yielded a T-statistic of -0.1301 and a p-value of 0.4481, indicating no statistically significant difference between the two groups.

- The mean trust score for organizations without AI implementation was 3.375.
- The mean trust score for organizations with AI implementation was 3.412.
- The standard deviation for organizations without AI was 0.554 and for organizations with AI was 0.382.

These values were obtained by grouping survey responses based on AI implementation (Yes/No) and calculating the mean and standard deviation of trust scores (on a 1–5 scale) for each group.

These results suggest that AI implementation does not necessarily influence professionals' trust in AI-driven decision-making. Other factors, such as past experiences with AI errors, organizational culture, and personal exposure to AI, may have a more substantial impact on trust levels.

Correlation between AI familiarity and implementation

A correlation analysis was conducted to assess whether familiarity with AI tools is linked to their implementation in organizations. The results indicate a weak positive correlation ($r = 0.187$) between AI familiarity and AI implementation. This suggests that while familiarity with AI tools may slightly encourage adoption, additional factors such as leadership decisions, regulatory concerns, and cost considerations also play a role in whether AI tools are formally integrated into workflows.

To obtain these values, the survey responses regarding AI familiarity were first converted into numerical values on a scale from 1 to 4, representing increasing levels of familiarity (e.g., "Not familiar" = 1, "Very familiar" = 4). Similarly, AI implementation was coded as 1 for organizations that have implemented AI and 0 for those that have not. These numerical values were then used to compute the Pearson correlation coefficient, which measures the strength and direction of the relationship between the two variables. The resulting correlation of 0.187 indicates that while there is a slight positive association between AI familiarity and implementation, the effect is weak and not strongly predictive.

The influence of professional roles on trust in AI

A one-way analysis of variance (ANOVA) was conducted to examine whether professionals in different roles exhibit significant differences in their level of trust in AI-generated insights. The responses were first reformatted by assigning each respondent's Trust in AI score to a column corresponding to their professional role, ensuring that each respondent's score was only counted once under their primary role. This restructuring allowed for a direct comparison of average trust scores across different roles.

The analysis revealed no statistically significant difference between roles ($F = 0.439$, $p = 0.843$), indicating that trust in AI does not vary meaningfully between professions. The mean trust scores for each role ranged from 3.22 to 3.67, with some roles showing higher variance than others. Notably, certain roles, such as AI specialists and real estate developers, had a single or very small number of responses, leading to missing variance calculations in some cases. While the results suggest that professional background does not play a decisive role in shaping trust in AI, it is important to acknowledge the relatively small sample sizes within some roles, which may limit the robustness of this conclusion.

Survey conclusion

The findings suggest that while AI adoption in real estate design teams is progressing, it remains inconsistent and highly dependent on contextual factors. AI familiarity is relatively widespread among professionals, yet full-scale implementation is limited due to various challenges, including organizational constraints, technical barriers, and scepticism about AI's reliability. Although a majority of respondents indicated some level of experience with AI tools, actual integration into workflows remains fragmented, with many organizations still in the experimental phase.

Statistical analyses revealed that organizational size does not significantly influence AI familiarity, suggesting that knowledge and exposure to AI tools are distributed relatively evenly across companies, regardless of their scale. Similarly, trust in AI-generated insights is not significantly affected by whether an organization has implemented AI tools, implying that trust is shaped more by individual experiences, industry norms, and perceived risks rather than direct exposure through workplace implementation. The analysis of professional roles demonstrated no significant variation in AI trust levels across different functions within real estate design teams. This indicates that scepticism or confidence in AI tools is not necessarily tied to a professional's specific role.

A weak positive correlation was found between AI familiarity and its implementation, suggesting that while those more knowledgeable about AI are slightly more inclined to see its adoption, familiarity alone does not drive implementation. This highlights the need for structured support, including training programs, clear implementation strategies, and case studies showcasing successful AI integration, to bridge the gap between awareness and effective application.

Overall, while interest in AI is evident, achieving its full potential in real estate design teams requires strategic alignment, investment in skills development, and efforts to foster trust in AI-driven decision-making. Organizations must move beyond experimentation and address barriers to adoption that promote the responsible and effective use of AI in the sector.

Calculations

ANOVA AI & Familiarity

Unifactoriële variantie-analyse

SAMENVATTING

Groepen	*Aantal*	*Som*	*Gemiddelde*	*Variantie*
Small	19	65	3,421052632	0,590643
Medium	3	9	3	0
Large	3	12	4	0

Variantie-analyse

Bron van variatie	*Kwadratensom*	*Vrijheidsgraden*	*Gemiddelde kwadraten*	*F*	*P-waarde*	*gebied van F-toets*
Tussen groepen	1,528421053	2	0,764210526	1,581386	0,228195	3,443357
Binnen groepen	10,63157895	22	0,483253589			
Totaal	12,16	24				

Figure 25: ANOVA AI & Familiarity calculation (Own work)

T-Test Implementation & Trust

T-toets: twee steekproeven met gelijke varianties

	No	Yes
	Variabele 1	*Variabele 2*
Gemiddelde	3,375	3,411764706
Variantie	0,553571429	0,382352941
Waarnemingen	8	17
Gepaarde variatie	0,434462916	
Schatting van verschil tussen gemiddelden	0	
Vrijheidsgraden	23	
T- statistische gegevens	-0,130093078	
P(T<=t) eenzijdig	0,448811942	
Kritiek gebied van T-toets: eenzijdig	1,713871528	
P(T<=t) tweezijdig	0,897623883	
Kritiek gebied van T-toets: tweezijdig	2,06865761	

	Mean trust score	Standard deviation
No (0)	3,375	0,554
Yes (1)	3,412	0,382

Figure 26: T-test Implementation & Trust calculation (Own work)

Correlation Implementation & Familiarity

	AI_Familiarity_Score	*AI_Implementation*
AI_Familiarity_Score	1	
AI_Implementation	0,18688625	1

Figure 27: Correlation Implementation & Familiarity calculation (Own work)

T-test Roles & Trust

SAMENVATTING

Groepen	*Aantal*	*Som*	*Gemiddelde*	*Variantie*
AI-specialist	1	3	3	-
Adviseur	4	14	3,5	1
Conceptontwikkelaar	1	4	4	-
Vastgoedontwikkelaar	9	29	3,222222222	0,194444444
Architect	3	11	3,666666667	0,333333333
Projectmanager	6	21	3,5	0,7
Aannemer	1	3	3	-

Variantie-analyse

Bron van variatie	*Kwadratensom*	*Vrijheidsgraden*	*Gemiddelde kwadraten*	*F*	*P-waarde*	*Kritische gebied van F-toets*
Tussen groepen	1,277777778	6	0,212962963	0,439490446	0,84285	2,661304523
Binnen groepen	8,722222222	18	0,484567901			
Totaal	10	24				

Figure 28: T-test Roles & Trust calculation (Own work)

Appendix G: Interview analysis

Deliberation

Definition of deliberation

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Deliberation: Decision-making vs deliberation	*"Well, I won't say deliberation is part of the decision-making process. It's totally different... Deliberation is more about understanding, reflection, and rationality."* - Participant 2	Understanding – Reflection – Process	Deliberation is a reflective process that fosters deeper understanding before reaching conclusions, rather than immediate decision-making.	Definition
Deliberation: Decision-making vs deliberation / Deliberation: Definition	*"But for me, the most important definition of deliberation, different from decision making, is that it has very strong epistemic implication... more about argumentation with each other... more rational, more acceptable."* - Participant 2	Rationality – Argumentation - Depth	Deliberation is characterized by structured reasoning and deeper engagement with different perspectives, rather than simply optimizing for efficiency.	Definition
Deliberation: Definition	*"So there is always the tension of different goals... I think that's the deliberation."* - Participant 2	Tensions – Trade-offs	Deliberation balances conflicting interests by acknowledging tensions and working towards integrated solutions.	Multiple perspectives
Deliberation: Definition	*"Decision making is more information and individual based. In deliberation, you have also interpersonal discussions where the physical presence might play a big role."* – Participant 3	Information – Presence – Social influence	The deliberation process is distinct from individual decision-making because it involves interpersonal dialogue, where different stakeholders' interactions shape the outcome.	Social dimension
Deliberation: Definition	*"You try to bring people together to discuss about the reasons behind different measures and try to make them understand each other. And also it requires the equal participation of different stakeholders so that people have equal saying in that."* - Participant 2	Inclusivity – Participation	Deliberation ensures equal involvement of all stakeholders, recognizing their perspectives as essential rather than instrumental.	Equality & Integration
Deliberation: Definition	*"Even if some people said deliberation doesn't need to form agreement, but still you need a collective issue to start with it and somehow you want to achieve some mutual understanding."* – Participant 2	Collective issue – Mutual understanding	While deliberation does not always require consensus, it aims to establish mutual understanding as a foundation for future discussions.	Goal orientation

Table 7: Definition of deliberation (Own work)

Phase of deliberation in the design team

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Deliberation: Phase	*"For the design team, I think deliberation mostly happens in the early design phase. People really have different goals... The tenants want better living quality, the housing company wants lower cost."* – Participant 2	Early-stage – Stakeholder goals – Trade-offs	Deliberation in design teams is most prominent in the early phases, where stakeholder needs and trade-offs are negotiated before final decisions.	Early-phase engagement
Deliberation: Phase	*"If you want to look into more like the specific contributions from deliberation theory, then I think the early design phase is more."* – Participant 2	Specific contributions - Early design phase	The early design phase involves more iterative deliberation since design options remain open-ended, allowing for greater exploration and negotiation.	Early design phase
Deliberation: Phase	*"In the early design phase, there are many options. Over time, these are refined, but early deliberation determines the overall direction."* – Participant 1 *A project of SO to VO to DO, to TO, to UO—choices become fewer, and deliberation happens more in early stages."* – Participant 1	Iteration – Refinement – Long-term impact	Initial deliberation influences long-term project development by defining the overall design approach.	Decision-shaping in early phases

Table 8: Deliberation in the design team (Own work)

Challenges in deliberation

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Deliberation: Challenges	*"A lot of people, they don't have the equal capability to express their reasons."* – Participant 2	Unequal expression – Communication gaps	Not all stakeholders have the same capacity to contribute effectively due to background, expertise, or communication skills.	Inequality in participation
Deliberation: Challenges	*"It requires a lot of energy, requires a lot of participation and people have their own lives, so it's hard to organize those kinds of deliberation."* – Participant 2	Time constraints – Effort – Participation burden	Organizing deliberation requires extensive effort, making it difficult to maintain stakeholder engagement.	Logistical barriers
Deliberation: Challenges	*"Well, if you talk about design teams in a small scale, I would say it's usually dominated by some person."* – Participant 2	Dominance – Power dynamics	Certain individuals or experts tend to dominate discussions, reducing the ability of others to contribute meaningfully.	Power imbalances
Deliberation: Challenges	*"Sometimes not all information is available, so discussions must be delayed until more data is collected."* – Participant 6	Lack of information – Process delays	Deliberation is disrupted when key information is missing, leading to delays in getting to agreements.	Information barriers

Table 9: Challenges in deliberation (Own work)

Succes factors for effective deliberation

First-order construct	Quote	Second-order construct	Explanation	Third-order construct

Deliberation: Success-factors	*"I think that it is important that people are prepared, so that there is a clear agenda in advance."* – Participant 6	Agenda setting – Structured meetings	Effective deliberation benefits from structured meeting formats that ensure participants come prepared.	Preparation
Deliberation: Success-factors	*"So that AI engine notifies the mediator to say that look, this person hasn't been talking at all. Maybe you should give them a space to express themselves."* – Participant 3	AI support – Inclusion strategies	AI or human facilitation can enhance deliberation by ensuring all voices are heard and reducing dominance by specific individuals.	Facilitation
Deliberation: Success-factors	*"Good communication skills, patience, and motivation to understand others' viewpoints."* – Participant 4	Communication strategies – Empathy – Active listening	Successful deliberation requires participants to engage in active listening and remain open to diverse viewpoints.	Effective communication
Deliberation: Success-factors	*"An informed deliberation process requires multiple perspectives and access to information."* – Participant 4	Multi-perspective – Information access	Effective deliberation relies on diverse inputs and evidence-based discussions.	Knowledge of diverse perspectives
Deliberation: Success-factors	*"Clear facilitation of discussions helps avoid dominance by one party and ensures all voices are heard."* – Participant 7	Structured facilitation – Balance – Open discussion	The role of a facilitator is crucial in managing power dynamics and encouraging all stakeholders to participate.	Equitable facilitation

Table 10: Succes factors for effective deliberation (Own work)

AI in deliberation

AI tools in deliberation

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
AI in deliberation: Tools	*"What I often do in projects is create a kind of knowledge chatbot..."* – Participant 1	Knowledge retrieval – Custom AI models	AI tools such as custom GPTs help store and retrieve project-specific knowledge efficiently.	Information management
AI in deliberation: Tools	*"ChatGPT, Copilot, Bing Images..."* – Participant 6	Tools	AI is widely used for quick access to general and project-specific information.	Digital assistance
AI in deliberation: Tools	*"At the moment, ChatGPT is by far the best AI tool."* – Participant 7	AI preference – Performance evaluation	Some AI tools, such as ChatGPT, are perceived as the most effective for deliberation.	AI usability

Table 11: AI in deliberation (Own work)

Potential uses of AI in deliberation

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
AI in deliberation: Potential use for deliberation	*"I frequently create a knowledge chatbot for projects... It speeds up deliberation processes significantly."* – Participant 1	Efficiency – Task automation	AI can centralize project-related knowledge, reducing the need for extensive research during meetings.	Information hub
AI in deliberation: Potential use for deliberation	*"AI can transcribe and summarize meetings instantly."* – Participant 5	Documentation – Meeting summarization	AI can improve record-keeping and streamline follow-ups on deliberations.	Note-taker
AI in deliberation: Potential use for deliberation	*"If you ask me for ten ideas for facades, and then ask again, ChatGPT can generate them*	Brainstorm - Creativity – Ideation support	AI can rapidly generate creative alternatives, fostering ideation during deliberations.	Creative assistant

	15 times faster than a human." – Participant 1			
AI in deliberation: Potential use for deliberation	*"Some stakeholders dominate discussions. AI can ensure that everyone's opinions are acknowledged."* – Participant 2	Power balance – Inclusion strategies	AI can balance power dynamics by prompting engagement from quieter participants.	Discussion facilitator
AI in deliberation: Potential use for deliberation	*"AI can extract opinions from social media and bring them into the deliberation process."* – Participant 2	Diverse input – Perspective gathering	AI can gather diverse viewpoints, ensuring a more inclusive deliberative process.	Opinion mediator
AI in deliberation: Potency of AI in deliberation	*"AI is very good at quickly generating things. Especially generative AI, which allows us to focus more on the creative aspects of a project."* – Participant 1	Process acceleration – Focus shift	AI enables teams to shift focus from repetitive tasks to higher-value creative agreements.	Productivity booster
AI in deliberation: Potency of AI in deliberation	*"I think many processes will become automated—process management, report writing, calculations, drawing plans. Essentially, all the repetitive work. AI will help automate these tasks more intelligently."* – Participant 6	Automation – Repetitive task reduction	AI reduces workload by handling routine processes, allowing teams to focus on strategic work.	Process automation
AI in deliberation: Potential use for deliberation	*"I use AI to create agenda templates based on prior emails."* – Participant 6	Workflow automation – Meeting structuring	AI can automate meeting structures for more efficient deliberation.	Organizer
AI in deliberation: Potential use for deliberation	*"AI can present multiple layout options based on user-defined criteria."* – Participant 1	Design generation – Multiple options	AI can generate and refine spatial planning options quickly.	Design optimizer
AI in deliberation: Potency of AI in deliberation	*"I think that ultimately, an entire design process can be completed much faster. But there are still obstacles to overcome before we get there."* – Participant 5	Workflow optimization – Speed & efficiency	AI streamlines processes, reducing delays in deliberation.	Process accelerator

Table 12: Potential uses of AI for deliberation (Own work)

Challenges of AI in deliberation

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
AI in deliberation: Challenges	*"Do we get the older generations on board?"* – Participant 1	Adoption barriers – Inclusivity	AI adoption depends on users' adaptability and digital literacy.	User acceptance
AI in deliberation: Challenges	*"Bias comes from psychology... we have confirmation bias."* – Participant 2	AI bias	AI models can reinforce biases based on training data.	Ethical risks

Table 13: Challenges of AI in deliberation (Own work)

Risks & concerns of AI in deliberation

Bias & reinforcement of existing assumptions

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Risks & concerns of AI in	*"AI also has bias. Who should be in control?"* - Participant 1	Bias - control	AI models don't have an owner, which makes it unclear who is in control.	Control concerns

deliberation: Bias & partiality				
Risks & concerns of AI in deliberation: Bias & partiality	*"AI does not have any values... The information is based on outdated sources."* – Participant 3	No values - Bias in training data	AI models reflect historical biases, which may limit innovation in deliberation.	Outdated information

Table 14: Bias & reinforcement of existing assumptions (Own work)

Over-reliance on AI & reduced critical thinking

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Risks & concerns of AI in deliberation: Over-reliance	*"AI-generated outputs are not always correct, yet people assume they are."* – Participant 1	Trust in AI – Accepting risk	Over-reliance on AI can lead to reduced critical thinking in getting towards agreements.	Accuracy risks
Risks & concerns of AI in deliberation: Over-reliance	*"We need to deliberate with AI, not listen to AI."* – Participant 2	Human thinking – AI thinking	AI should enhance rather than replace human-led discussions.	Support tool, not decision-maker
Risks & concerns of AI in deliberation: Over-reliance	*"People assume AI is neutral, but its recommendations may be biased."* – Participant 3	Over-dependence	Users may blindly trust AI outputs without questioning their accuracy.	Risk of overreliance

Table 15: Over-reliance on AI & reduced critical thinking (Own work)

Regulatory and ethical uncertainties

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Risks & concerns of AI in deliberation: Ethics - trust & responsibility	*"Who is responsible when AI-driven decisions go wrong?" – Participant 4*	Accountability - Responsibility	Unclear legal frameworks make AI-driven deliberation difficult to regulate.	Governance challenges
Risks & concerns of AI in deliberation: Ethics - trust & responsibility	*"AI-generated insights raise privacy concerns." – Participant 6*	Data security – Privacy concerns	Uncertainty over how AI processes sensitive information.	Trust & transparency
Risks & concerns of AI in deliberation: Ethics - trust & responsibility	*"We don't know what happens to our data when using external AI tools." – Participant 7*	Unknown data management	Lack of transparency in AI tools raises concerns about intellectual property and security.	Privacy risks

Table 16: Regulatory and ethical uncertainties (Own work)

AI as a support tool, not a decision-maker

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Risks & concerns of AI in deliberation: Support tool, not decision-maker	*"We need to deliberate with AI instead of listening to AI."* – Participant 2	Assistive tool – Human-in-the-loop approach	AI should provide input without making final decisions.	AI-human collaboration
Risks & concerns of AI in deliberation:	*"What AI produces is not always correct. There is a risk that people accept something*	Misleading outputs	AI's insights should always be critically evaluated by humans.	AI oversight

Support tool, not decision-maker	*as the truth when it is not necessarily accurate."* – Participant 1			
Risks & concerns of AI in deliberation: Support tool, not decision-maker	*"An architect's job will never be replaced, but you need to be able to think deeply about what suits a particular place and how it will truly transform it. AI might develop to assist in this process, but automating everything is ultimately just coding."* – Participant 1	Contextual awareness – Creative aid	While AI can generate variations, human creativity and expertise remain essential.	Human expertise
Importance of human oversight	*"It is always important to keep humans involved. There should always be a critical review of AI-generated content."* – Participant 6	Involvement humans – Critical review	Keeping humans involved ensures ethical and well-informed agreements.	Human involved decisions

Table 17: AI as a support tool, not a decision-maker (Own work)

Implementation of AI in deliberation

Initial reactions to AI adoption

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
AI in deliberation: Reaction	*"Everyone is excited. You show something, and people think, 'Wow, this can also be done, holy shit!'"* – Participant 1	Initial enthusiasm – Curiosity	AI adoption is initially met with enthusiasm, but long-term engagement depends on structured learning and application.	Exploration
AI in deliberation: Reaction	*"Some colleagues are eager to explore AI, while others just let it happen to them."* – Participant 6	Diverse adoption attitudes – Passive vs. active users	Different employees exhibit varying levels of engagement with AI—some actively experiment, while others wait for guidance.	Adoption trends
AI in deliberation: Reaction	*"People want to join the AI hype."* – Participant 7	Trend-driven adoption – AI hype effect	AI adoption is sometimes driven by external trends rather than practical needs, leading to inconsistent engagement.	Technology enthusiasm

Table 18: Initial reaction to AI adoption (Own work)

Strategies for AI integration

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
AI in deliberation: Strategies	*"We have an AI team to explore implementation."* – Participant 1	AI taskforce – Internal AI team	A dedicated team ensures that AI adoption is strategically aligned with company goals and effectively managed.	Organizational readiness
AI in deliberation: Strategies	*"We started with company-wide sessions to introduce AI and show what it can do."* – Participant 6	Training sessions – Organizational learning – AI literacy	Educational initiatives help employees understand AI's capabilities and encourage wider adoption.	AI readiness
AI in deliberation: Strategies	*"The fastest way to innovation is through education."* – Participant 4	AI training – Knowledge development	AI training accelerates adoption by equipping employees with the necessary knowledge and confidence to use AI effectively.	Learning & development
AI in deliberation: Strategies	*"You need people who champion AI within the company."* – Participant 9	AI change agents – Leadership	Designating internal AI champions helps drive	Change management

		advocacy – Role models	company-wide adoption and cultural acceptance of AI.	
AI in deliberation: Strategies	*"We need to define AI use cases—what do we actually need and want? Then take incremental steps with a team that works on this consistently."* – Participant 1	Incremental implementation - Internal AI team	AI adoption benefits from a structured approach where needs are defined first, followed by gradual implementation.	Strategic alignment
AI in deliberation: Strategies	*"We organized pilot tests in smaller teams before rolling AI tools out to the whole company."* – Participant 6	Pilot testing – Experimental learning	Small-scale pilots allow teams to evaluate AI's effectiveness before broader implementation	Controlled adoption
AI in deliberation: Strategies	*"An AI task force would make sense, but we are still real estate developers, not AI experts. Maybe we need external expertise to guide us."* – Participant 1	External expertise – AI consultants – Cross-industry learning	Companies may benefit from external specialists to integrate AI effectively within their field.	Expert-driven integration
AI in deliberation: Strategies	*"We made guidelines on how to use AI, including privacy concerns like not uploading sensitive documents to ChatGPT."* – Participant 6	AI governance – Ethical use – Privacy protection	Clear guidelines ensure responsible AI use, addressing security and ethical concerns.	Ethical AI adoption
AI in deliberation: Strategies	*"Change must come from leadership. AI adoption will fail if it's only grassroots without management support."* – Participant 9	Leadership-driven AI change – Cultural transformation	Strong leadership support is critical for sustained AI integration.	Executive-led AI strategy

Table 19: Strategies for AI integration (Own work)

Challenges in AI implementation

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
AI in deliberation: Challenges	*"The biggest obstacle is that we still don't know how to use it effectively."* – Participant 5	Uncertainty – Lack of practical knowledge – Implementation barriers	Employees often struggle with identifying effective use cases for AI, slowing down adoption.	Adoption barriers
AI in deliberation: Challenges	*"AI outputs sometimes don't work well, so people give up quickly."* – Participant 6	Frustration – System limitations	Early experiences with imperfect AI outputs can discourage further experimentation and adoption.	Resistance to change
AI in deliberation: Challenges	*"We see a huge proliferation of AI tools, making it hard to choose the right one."* – Participant 7	AI tool overload – Decision fatigue – Market saturation	The abundance of AI tools can overwhelm organizations, making it difficult to select the best solution.	Technology selection challenges

Table 20: Challenges in AI integration (Own work)

AI's influence on work pressure

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
AI in deliberation: Work Pressure	*"AI allows us to focus on creative work, reducing manual tasks."* – Participant 1	Task automation – Focus shift	AI frees employees from repetitive tasks, allowing them to dedicate time to higher-value activities.	Productivity gains
AI in deliberation: Work Pressure	*"As automation increases, work expectations rise, creating more stress."* – Participant 8	Increased pace – Workflow acceleration	AI speeds up work processes, sometimes leading to unrealistic expectations for rapid output.	Workplace stress
AI in deliberation: Work Pressure	*"People won't necessarily earn more or gain more freedom—*	Redistribution of tasks – Workload shift	AI changes the nature of work but does not always reduce overall workload.	Reshaping workloads

	workload will just shift." – Participant 8			

Table 21: AI's influence on work pressure (Own work)

Design team

Composition of the design team

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Design Team: Composition	"There is always a project manager at the table. The project manager takes more of a leading role around the VO/DO stage." – Participant 1	Leadership – Project management	The role of project managers in design teams becomes more prominent as the project progresses.	Leadership & coordination
Design Team: Composition	"The architect is usually the lead in a design team, as they need to make design decisions, with advisors contributing their expertise." – Participant 8	Design leadership – Collaborative input	Architects typically take the lead in design teams, guiding the process while integrating input from other disciplines.	Design team leadership
Design Team: Composition	"In a real estate development, you have the investors, the architects, engineers, and urban planners, who all have different roles." – Participant 3	Stakeholder roles – Functional specialization	Design teams consist of various stakeholders who contribute based on their expertise and priorities.	Multidisciplinary collaboration

Table 22: Composition of the design team (Own work)

Conflicts in priorities

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Design team: Conflicts	*"There is a shared goal, but everyone has their own interests. An architect has a different priority than someone focused on financial feasibility."* – Participant 1	Conflicting priorities – Interest alignment	Stakeholders bring different priorities to the table, requiring negotiation to align interests.	Balancing interests
Design team: Conflicts	*"Some people want to dominate the process, while others' opinions are ignored."* – Participant 2	Power dynamics – Decision control	Power imbalances in deliberation can lead to certain voices being overshadowed.	Managing stakeholder influence
Design team: Conflicts	*"In the end, the investor decides, even on aspects like the colour of the building, which has nothing to do with technical feasibility."* – Participant 3	Deliberation authority	Investors often have the final say, sometimes overriding technical recommendations.	Deliberation power

Table 23: Conflicts in priorities (Own work)

Exploring solutions and iteration in the design process

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Design team: Understanding stakeholder needs &	*"We try to give everyone a voice in our regular design team meetings."* – Participant 7	Inclusivity - Participation management	Structured meetings help prevent dominant stakeholders from overshadowing others.	Inclusive collaboration

research (discover)				
Design team: Exploring solutions & iteration (develop)	*"Sometimes you need to take a step back and reassess the real problem before moving forward."* – Participant 8	Problem reassessment – Root cause analysis	Design teams often revisit the core problem to refine solutions.	Iterative problem-solving
Design team: Exploring solutions & iteration (develop)	*"Some things would never be considered in a traditional design process, but AI opens up new possibilities."* – Participant 7	Alternative solutions – Expanding possibilities	Emerging technologies enable the exploration of alternative solutions.	Exploring new design solutions

Table 24: Exploring solutions and iterations in the design process (Own work)

Decision-making in the design process

First-order construct	Quote	Second-order construct	Explanation	Third-order construct
Design team: Decision-making & implementation (deliver)	*"You have to make choices. No decision is also a decision, but then the project won't move forward."* – Participant 8	Decision-making urgency	Deliberation must lead to concrete decisions to maintain project momentum.	Momentum in decision-making
Design team: Decision-making & implementation (deliver)	*"If you don't meet the requirements of all stakeholders, the project won't succeed."* – Participant 9	Stakeholder requirements – Project success	Successful projects depend on aligning with stakeholder expectations.	Stakeholder-driven decision-making
Design team: Decision-making & implementation (deliver)	*"In early phases, many options are considered, but as we move forward, choices become more constrained."* – Participant 1	Decision-making constraints – Option narrowing	The decision-making process limits choices over time, focusing on feasibility.	Structuring decision-making

Table 25: Decision-making in the design process (Own work)

Appendix H: First version framework & Implementation strategy

AI-supported deliberation framework

The framework is grounded in this research's empirical findings and translates the identified deliberative modes and analytical themes into a practical format for use in design teams.

From the interviews and case data, three distinct deliberative modes emerged that describe how stakeholder interaction and collaborative reasoning unfold across different stages of a project. These are Exploratory Deliberation, Convergent Deliberation, and Operational Deliberation. They align broadly with the project stages used in the Dutch real estate sector, yet they are not meant to be rigid phases. Instead, each mode reflects a particular character of deliberation, shaped by the goals, constraints, and team dynamics at that moment in the project.

Exploratory Deliberation dominates the early design phases (SO and VO), where open-ended dialogue, divergent thinking, and perspective gathering are central. Teams explore possibilities, surface ambitions, and attempt to align visions across stakeholders. Generative AI supports this mode by enhancing idea generation, enabling rapid visual exploration, and helping structure discussions. Participants commonly used ChatGPT, MidJourney, and NotebookLM tools to facilitate brainstorming, structure perspectives, and enhance creativity. This phase is particularly marked by the need to promote inclusive conversations, augment creative thinking, and ensure broad participation from the outset.

In the Convergent Deliberation mode, standard in DO and TO phases, deliberation shifts towards evaluating trade-offs, integrating technical constraints, and reaching justified agreements. AI simulates design scenarios, identifies stakeholder sentiment, and ensures compliance with regulations. Tools such as Planalogic, Open Red, and Bremial assist teams in structuring evidence-based reasoning and aligning priorities. Here, AI is crucial in improving workflow efficiency, providing structured facilitation, and helping ensure alignment across stakeholder interests.

Finally, in the Operational Deliberation mode, most relevant during TO and UO, teams reflect on past decisions, validate final agreements, and coordinate for implementation. AI tools support transcription, decision documentation, and risk identification, contributing to improved accountability and coordination. Tools like Fireflies.ai, Read AI, and Dembrane Echo help record discussions and organise stakeholder inputs into clear execution plans. In this phase, AI reinforces efficient handover, documentation facilitation, and the inclusion of all voices in the final alignment.

Four overarching themes support these three deliberative modes: facilitation, augmentation, efficiency, and inclusion. These themes emerged directly from the interview analysis and describe how AI influences deliberation across all stages rather than being tied to a specific phase.

The framework also accounts for the challenges identified. These are integrated into the model as “advantages & challenges” per mode, ensuring that teams know potential trade-offs. This section will present an implementation strategy to help translate these insights into concrete steps for real estate organisations.

Sketch design (SO)

Concept design (VO)

Definitive design (DO)

Technical design (TO)

Execution-ready design (UO)

Exploratory deliberation

IDEA GENERATION & STRUCTURING

Characteristics

Open-ended discussions
Broad, unrestricted conversations where stakeholders freely share ideas and concerns.

Divergent thinking
Exploration of multiple possibilities, fostering creativity and innovation.

Inclusivity & perspective gathering
Ensuring all stakeholders contribute, preventing early-stage biases.

AI tools

AI-driven brainstorming
Suggests alternative ideas based on project context.
ChatGPT, Copilot

AI visualization tools
Created rapid design variations to explore possibilities.
DALL-E, MidJourney, Rendair.ai

AI-supported argument structuring
Categorizes perspectives and organizes discussions.
Dembrane Echo, Notebook LM

Advantages & Challenges

Creativity, inclusivity & organization | Standardized ideas, introduce bias, or lack context

Facilitation
Structuring dialogue

Augmentation
Idea generation support

Inclusivity
Ensuring broad stakeholder input

Convergent deliberation

SELECTING & PRIORITIZING

Characteristics

Evaluating trade-off
Stakeholders assess and prioritize competing criteria.

Convergent focus
The broad set of explored ideas is refined into feasible design directions.

Structured justification
Choices require clear reasoning, balancing creative ambitions with practical constraints.

AI tools

AI-assisted scenario analysis
Simulates different design alternatives and forecasts long-term impacts.
Planalogic, Open Red

AI stakeholder sentiment analysis
Identifies trends, concerns, and consensus patterns in discussions.
ChatGPT, Copilot*

AI compliance verification
Ensures adherence to regulatory and technical requirements
Struck, Bremial

Advantages & Challenges

Transparent arguments, improved trade-off evaluation | Over-reliance, limited human creativity, accuracy depends

Facilitation
Prioritizing reasoning

Augmentation
Scenario evaluation

Efficiency
Workflow structuring

Inclusivity
Stakeholder alignment

Operational deliberation

REFLECTION & DOCUMENTATION

Characteristics

Final choices validation
Ensuring all key choices are justified and alligned for execution.

Execution allignment
Clarifying final roles, responsibilities, and design intentions to prevent miscommunication during construction

Risk identification & handover
Ensuring transparency on why decisions were made and identifying potential risks before implementation.

AI tools

AI transcription & documentation
Records and summarizes key discussions.
Fireflies.ai, Read AI

AI-supported execution allignment
Organizes final decisions and ensures structured stakeholder agreements.
NotebookLM, Dembrane Echo

AI-driven risk assessment
Assesses past project data to identify potential risks and optimize workflows.
ChatGPT, Copilot

Advantages & Challenges

Structured handover and execution allignment, justification, risk reduction | Over-reliance, data privacy, context gaps

Facilitation
Documenting decisions

Augmentation
Risk review support

Efficiency
Handover streamlining

Inclusivity
Aligning all voices in execution

*Experimental/ emerging AI tools, not yet widely adopted

Figure 29: AI deliberation framework (Own work)

Implementation strategy

This section shifts the focus from the analytical framework to its practical implementation. It outlines how organisations, particularly real estate developers such as NEOO, can embed generative AI into daily operations. Building on the structure of the framework and its underlying principles, a step-by-step adoption strategy has been developed to support organisations in implementing generative AI in deliberative processes in a structured and manageable manner. A set informs this strategy of guiding principles that form the foundation for responsible and effective adoption.

AI as a deliberative aid, not a decision-maker
AI should support knowledge structuring, trade-off analysis, and documentation, while final decisions remain human-driven.

Incremental and needs-driven implementation
AI adoption should begin with low-risk applications and expand progressively based on demonstrated benefits.

Transparency, oversight, and governance
AI-generated insights must be interpreted, validated, and transparently communicated within teams to ensure credibility.

Building internal AI capacity
Organizations must invest in training programs and governance structures to improve AI literacy and ensure informed decision-making.

Continuous monitoring and adaptation
AI strategies must remain flexible, with ongoing evaluation to assess AI's impact on deliberation quality and decision workflows.

Figure 30: Guiding principles (Own work)

Rather than following a linear sequence of steps, this research adopts a concentric circle model to reflect organisational transformation's layered and iterative nature. In this model, AI adoption unfolds through reinforcing phases: foundational principles remain at the centre and are continuously revisited as outer layers build upon them. Each layer reflects a stage of organisational maturity, guiding how AI use in deliberation can expand, deepen, and institutionalise over time.

Figure 31: Implementation strategy (Own work)

The model's foundation lies at its centre: establishing awareness and leadership engagement. Implementation begins by training executive leaders and project managers on the opportunities and limitations of generative AI in deliberative processes. Organising awareness sessions and presenting illustrative case studies help develop a shared vision of AI's role as a decision-making facilitator rather than a

driver. This foundation fosters top-down support, organisational trust, and clarity about AI's contribution to inclusive and structured reasoning within design teams.

Once awareness is established, organisations are encouraged to form a dedicated AI task force to define internal governance structures. These structures address ethical deployment, transparency, and scope definition. The governance framework should ensure that AI tools are used as deliberative aids, not autonomous decision-makers, aligning adoption with organisational values and reducing risks related to bias, privacy, and control.

With foundational readiness in place, AI adoption can begin through low-risk experimentation. This involves identifying manageable applications that offer immediate value without disrupting workflows. Pilot initiatives might include using tools like Fireflies.ai or Read AI for meeting summaries or DALL·E and MidJourney for visualisation support. These early pilots enable teams to test AI tools in real deliberative settings and build credibility while learning how to integrate them effectively. The outcome of this layer is a growing base of internal champions and validated use cases that support further adoption.

As confidence increases, AI tools can be introduced into more complex deliberative functions, particularly those involving structured trade-off evaluation. This aligns with the convergent deliberation mode and includes tools such as Dembrane Echo and NotebookLM, which support structured reasoning and stakeholder sentiment analysis. Teams must be trained to critically assess AI-generated insights, maintaining human oversight and ensuring the process remains grounded in collective reasoning rather than automated logic.

Once AI has demonstrated its value, organisations can begin embedding it into routine workflows. This includes defining integration points in which AI supports compliance verification, coordination, and transparency between teams. Tools such as Struck and Bremial can streamline regulatory processes. At this stage, AI becomes an integrated component of structured decision-making, helping to ensure traceability, alignment, and consistency in complex design environments.

In the outermost layer, the strategy turns toward long-term institutionalisation. This involves establishing ongoing monitoring mechanisms to evaluate AI's performance, organising regular training sessions to update employees on emerging technologies, and maintaining active engagement with academic and industry partners. These efforts ensure that AI use remains current, ethically aligned, and responsive to the organisation's evolving needs. More importantly, they reinforce a culture of continuous learning, helping to sustain trust in AI-supported deliberation as the organisation grows and adapts.

This concentric model offers a more adaptive and realistic perspective than a linear implementation plan. It recognises that AI adoption is not a simple progression through predefined steps but a dynamic maturation process in which foundational values must remain central. Each layer builds upon the previous, but organisations may revisit earlier phases, expand outward unevenly, or adjust the emphasis depending on context. This model supports a more resilient and context-sensitive integration of AI into deliberative processes in real estate development.

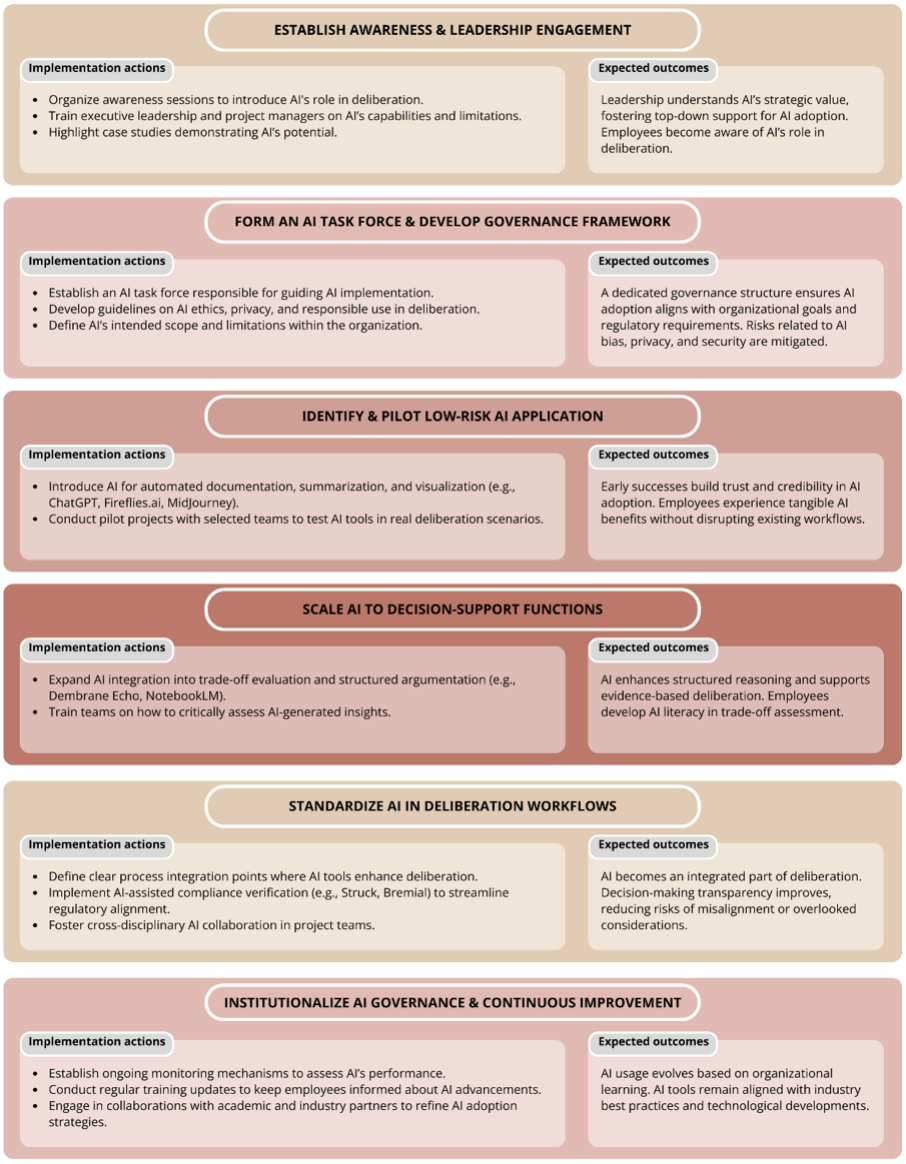


Figure 32: Strategy steps from inside to outside of the concentric model (Own work)

However, the adoption of AI in deliberation is not without its challenges. While the model provides a structured and adaptable approach, successful implementation also requires addressing critical barriers that may hinder progress. These include digital literacy gaps, resistance to change, ethical concerns, and the potential for over-reliance on AI-generated outputs. To navigate these obstacles effectively, a structured mitigation strategy has been developed, offering practical guidance to support responsible and inclusive AI integration.

Challenge	Mitigation strategy
Lack of AI Awareness & Digital Skills Gaps	Implement structured AI training programs with practical use-case demonstrations. Develop an internal AI knowledge hub.
Resistance to AI Adoption	Identify and empower AI champions within teams who actively promote AI's benefits and assist colleagues in adoption.
Over-Reliance on AI Outputs	Train employees to **critically assess AI-generated insights** and maintain human oversight in deliberative reasoning.
Concerns Over AI Ethics & Transparency	Develop clear AI governance policies emphasizing responsible AI use, transparency, and data privacy protections.
Selection of Appropriate AI Tools	Conduct **pilot testing and iterative evaluation** to determine the most effective AI tools for deliberation.
Unrealistic Expectations & Workload Redistribution	Set **realistic goals** for AI adoption, clarifying that AI is an **enhancement tool** rather than a replacement for professional expertise.

Figure 33: Mitigation strategy (Own work)

Appendix I: Workshop

Datum	9 april 2025
Duur	2 uur
Deelnemers	1x Project manager 1x Constructie manager 1x Commercieel ontwikkelaar
Workshop doelen	– Het AI-deliberatieframework valideren en verfijnen op basis van praktijkervaringen. – De AI-implementatiestrategie verbeteren door de stappen kritisch te testen. – Controleren of deelnemers het framework en de strategie begrijpen of dat vereenvoudiging nodig is.

Table 26: Workshop time plan (Own work)

Context van de deelnemers

Naam: -
Rol: Project Manager
Project waaraan zij momenteel werkt: Herontwikkeling V&D Leiden
Huidige projectfase: DO
Actief in een ontwerpteam? (Ja/nee): Ja

Naam: -
Rol: Constructiemanager
Project waaraan zij momenteel werkt: Rotta Nova
Huidige projectfase: Constructie
Actief in een ontwerpteam? (Ja/nee): Nee

Naam: -
Rol: Commercieel ontwikkelaar
Project waaraan zij momenteel werkt: Legmeer
Huidige projectfase: SO
Actief in een ontwerpteam? (Ja/nee): Ja

Introductie + uitleg afstudeeronderzoek (15 min)

"Welkom allemaal, fijn dat jullie erbij zijn! Vandaag gaan we samen kijken naar hoe AI ontwerpteams zou kunnen ondersteunen in het maken van gezamenlijke afwegingen. We gaan niet alleen kijken naar mijn onderzoek, maar vooral jullie praktijkervaring gebruiken om mijn ideeën te toetsen en verbeteren.

In vastgoedprojecten zie je veel verschillende experts samenwerken. En juist omdat iedereen vanuit een ander perspectief werkt, verloopt overleg soms rommelig of ongestructureerd. Mijn onderzoek richt zich op deliberatie – dat is het moment vóór de beslissing, waarin je samen afwegingen maakt. Ik onderzoek of en hoe generatieve AI daar op een zinvolle manier bij kan helpen."

Deel 1: Feedback geven op het AI-deliberatie framework (60 min)

Focus:

- Sluit het AI-deliberatieframework aan op de werkelijke praktijk?
- Zijn er opvallende verschillen tussen de onderzoeksresultaten en de ervaring van deelnemers?
- Is het framework duidelijk en begrijpelijk voor professionals bij NEOO?

Benodigdheden:

- Presentatie met een korte introductie van het framework
- 3x AI-deliberatieframework (A3-afdrukken) → op de tafels leggen
- Plaknotities in vier kleuren (geel, roze, groen, blauw)
- Pennen om op de plaknotities te schrijven

Activiteit: Beoordeling en verbetering van het framework

1. Introductie (10 min)
    - Korte presentatie van het AI-deliberatieframework, met uitleg van de drie fasen (Exploratief, Convergent, Operationeel)
    - Uitleg van het kleurensysteem voor de plaknotities
2. Individuele beoordeling met plaknotities (10 minuten)
    - Elke deelnemer bekijkt het framework zelfstandig en schrijft observaties op de plaknotities, die op het A2-framework worden geplakt
    - Vragen (op de slide benoemen):
        - Geel (Onduidelijk):
            - “Welke termen, stappen of tools zijn onduidelijk?”
            - “Zijn er onderdelen te technisch of academisch?”
            - “Waar is extra uitleg nodig?”
        - Roze (Onrealistisch):
            - “Welke AI-tools of processen lijken niet haalbaar voor NEOO?”
            - “Zijn er stappen die te ingewikkeld of onrealistisch zijn?”
        - Groen (Ontbrekend):
            - “Welke stappen ontbreken?”
            - “Gebruik je al tools of werkwijzen die hier niet in staan?”
        - Blauw (Algemene opmerkingen):
            - “Wat vind je goed of minder goed aan deze structuur?”
            - “Sluit dit aan bij hoe deliberatie echt verloopt bij NEOO?”
3. Groepsdiscussie (10 min)
    - "Laten we samen reflecteren op wat naar voren is gekomen. Verschillende perspectieven zijn welkom."
    - Ga per onderdeel door de geplakte opmerkingen
    - Stel vragen als:
        - “Welke patronen zien we?”
        - “Zijn jullie het eens met wat ontbreekt of onduidelijk is?”
        - “Als we één ding veranderen, wat zou dat zijn?”
        - “Zou dit framework bruikbaar zijn voor iemand bij NEOO, of is het te ingewikkeld?”
4. Reflectie op aannames (5 min)
    - "Welke aannames denk je dat in dit framework zijn ingebouwd?"
    - De aannames in een groepsgesprek bespreken.

Output:

- Een geannoteerd framework met feedback van deelnemers
- Een lijst met verbeterpunten vanuit de praktijk
- Inzicht in de begrijpelijkheid van het framework
- Aannames die mogelijk explicieter gemaakt moeten worden

Deel 2: Testen van de implementatiestrategie (40 min)

Focus:

- Zijn de stappen realistisch en uitvoerbaar?
- Waar liggen de grootste risico's?
- Is de strategie begrijpelijk of te complex?

Benodigdheden:

- Presentatie met toelichting op de strategie
- 3x Implementatiestrategie (A3-afdrukken)
- Rode en groene plaknotities

Activiteit: Strategie-analyse en stresstest

1. Beoordeling per stap (10 min)
    - Deelnemers bekijken zelfstandig de strategie en plakken:
        - Groen op stappen die realistisch en waardevol lijken
        - Rood op stappen die problematisch zijn of bijstelling nodig hebben
        - Voeg een korte toelichting toe op elke plaknotitie
2. Discussie en aanpassingen (5 min)
    - Loop samen alle stappen van de strategie door
    - Stel vragen als:
        - "Welke stappen zijn cruciaal voor succesvolle AI-integratie?"
        - "Wat zou je aanpassen om het proces soepeler te laten verlopen?"
        - "Ontbreken er stappen?"
        - Aannames:
            - "Welke aannames liggen ten grondslag aan deze strategie, en kloppen deze voor NEOO?"
        - "Zijn er stappen die uitgaan van meer gereedheid of middelen dan realistisch is?"
    - Laatste check: "Is deze strategie bruikbaar voor iemand nieuw bij NEOO, of te complext?"

Output:

- Aangescherpte implementatiestrategie met praktische aanpassingen
- Inzicht in risico's en oplossingen voor AI-adoptie bij NEOO
- Duidelijkheid over de begrijpelijkheid van de strategie
- Inzicht in organisatorische aannames (leiderschap, cultuur, middelen, gereedheid)

Workshop wrap-up (5 min)

Bedank de deelnemers!

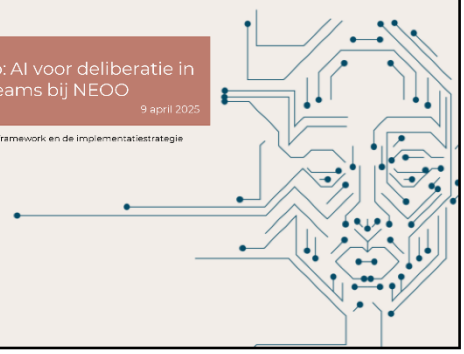
Workshop presentation

NEOO TU Delft

Workshop: AI voor deliberatie in ontwerpteams bij NEOO

9 april 2025

Validatie van het framework en de implementatiestrategie



Mijn afstudeeronderzoek in het kort

- In vastgoedprojecten werken veel mensen samen: architecten, constructeurs, projectmanagers, ontwikkelaars.
- Samen keuzes maken is lastig: veel meningen, weinig structuur.

- Mijn onderzoek focust binnen de samenwerking specifiek op **deliberatie**: het gestructureerd bespreken van afwegingen binnen het ontwerpteam. Deliberatie is niet het nemen van de beslissing zelf, maar het samen nadenken, perspectieven delen en opties afwegen.
- Mijn onderzoek focust zich op hoe AI dit proces zou kunnen verbeteren.

Mijn afstudeeronderzoek

Onderzoeksvraag

Hoe kan generatieve AI deliberatie in ontwerpteams ondersteunen binnen de vastgoedontwikkeling?

Onderzoeksvraag

Sub-vragen

1. **Wat is deliberatie binnen ontwerpteams in vastgoedprojecten? En wanneer is het het belangrijkst?**
2. **Welke generatieve AI-tools worden nu al gebruikt om deliberatie te ondersteunen?**
3. **Hoe kunnen kansen en belemmeringen van AI worden meegenomen in deliberatieve processen?**

Sub-vragen

Aanpak

1. Literatuuronderzoek
2. Interviews en survey met professionals
3. Ontwikkeling van framework en implementatie strategie
4. Validatie: deze workshop!

Aanpak

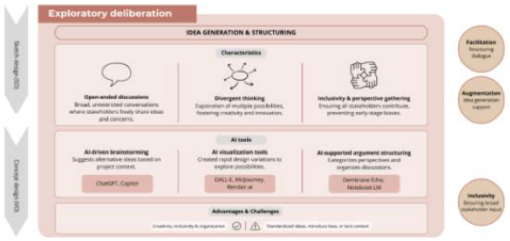
Doel van de workshop

- Feedback ophalen op het AI-deliberatieframework
- Testen of de implementatiestrategie begrijpelijk en haalbaar is
- Aannames expliciet maken: Kloppen deze voor NEOO?
- Input verzamelen voor verbetering → praktische toepasbaarheid vergroten

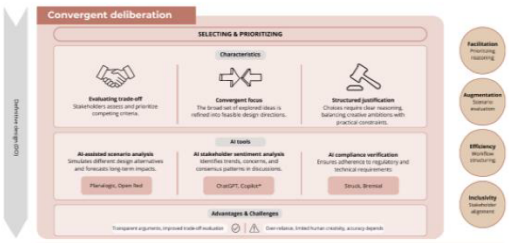
Doel

Deel 1: AI- deliberatieframework

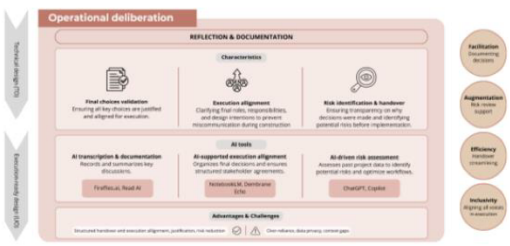
Framework



Framework



Framework



Individuele feedback met post-its

Elke deelnemer bekijkt het framework zelfstandig en schrijft observaties op post-its die vervolgens bij het framework worden geplakt.

Onduidelijk: Termen of onderdelen die niet helder zijn	Onrealistisch: Wat werkt niet in de praktijk?
Ontbrekend: Welke stappen of tools mis je?	Algemene opmerkingen: Wat valt je verder op?

Schrijf op de post-it kort op waarom je dit vindt of wat je bedoelt.

Reflectie op aannames

Welke aannames zitten er in dit framework?

Denk bijvoorbeeld aan:

- Welke kennis, vaardigheden of tools veronderstelt het framework?
- Wat wordt als 'normaal' gezien in een ontwerpteam?
- Waar gaat het framework misschien té veel van uit?

Schrijf jouw ideeën op het invulblad!

Afsluiting deel 1

Bedankt voor het invullen en nadenken over het framework.

Laten we kort bespreken:

- Wat viel jullie op?
- Waren er veel dingen onduidelijk, onrealistisch of ontbrekend?
- Zou dit framework bruikbaar zijn voor iemand bij NEOO?
- Of is het te ingewikkeld – en waarom dan precies?

Deel 2: Implementatiestrategie

Strategie

Dit groeimodel bestaat uit zes lagen (van binnen naar buiten)

- **Bewustwording & Leiderschap:**
  Train projectleiders en managers. Bouw vertrouwen. Start met voorbeelden.
- **Structuur & governance:**
  Stel een AI-taakgroep op. Bespreek ethiek, privacy en rolverdeling.
- **Experimenteren in kleine stappen:**
  Begin met laagdrempelige tools.
- **AI inzetten bij afwegingen:**
  Gebruik tools die argumenten ordenen en scenario's analyseren.
- **AI standaardiseren bij deliberatie:**
  AI integreren in standaardprocessen.
- **Verankeren en verbeteren:**
  Monitoren, trainen, leren.

Geen stappenplan, maar een groeimodel: flexibel in volgorde, tempo en invulling.

Individuele feedback met post-its

Bekijk de strategie en plak je post-its.

Stappen die realistisch en waardevol lijken.	Stappen die problematisch zijn of bijstelling nodig hebben

Schrijf op elke rode post-it ook waarom je die stap lastig vindt of wat er beter zou kunnen.

Groepsdiscussie – reflectie op de strategie

- Wat zou jij aanpassen aan deze strategie?
- Ontbreken er stappen of onderdelen?
- Welke aannames zitten er in de strategie?
- Is deze strategie bruikbaar voor NEOO?
- Zo nee: wat zou er anders moeten?

NEOO TUDelft

Dankjewel!

Workshop feedback op post its
Framework

Participant 1	Geel	Roze	Groen	Blauw
Exploratory deliberation	Word nu weinig vastgelegd. Neem je alle overleggen op en transcript je deze? Kun je geen prompt in chat schrijven om divergentie denken te doen? Hoe draagt DALL-E bij aan divergent denken? Hoe haal je data op bij stakeholders?			SO & VO lopen meer in elkaar over
Convergent deliberation	Waarom TO niet hier? Stakeholder assess and prioritize competing criteria?		En wat hebben de keuzes integraal voor impact op elkaar? En wat doe je hiermee als je het hebt vastgesteld?	
Operational deliberation		Deze fase is juist checken of het coldoet aan alle uitgangspunten, keuzes zijn gemaakt, let betreft uitwerken waar je tegen punten/ realisatie problematiek tegekomt. Execution allignment: rollen worden bij start gedefinieerd. Risk identification: waarom in deze fase? Risico start je juist mee.		

Table 27: Framework feedback participant 1 (Own work)

Participant 2	Geel	Roze	Groen	Blauw
Exploratory deliberation			Ergens zit ook de bouwaanvraag fase in. Hoe valt deze binnen het framework?	Wanneer moment om PvE op te bouwen. In welke fase ontstaat deze?
Convergent deliberation			Zelfde als voor exploratory deliberation	
Operational deliberation			Finale check of alle facetten geraakt zijn. Voor de risk assessment op project data moet een database beschikbaar zijn, hoe werkt dat?	

Table 28: Framework feedback participant 2 (Own work)

Participant 3	Geel	Roze	Groen	Blauw
Exploratory deliberation	Wat zijn de cirkels? Uitleg nodig.	VO gaat ook over naar convergent, de ideeën zijn niet meer geheel zonder rem.	Notules? – Fireflies – MsTeams – CoPilot	Wordt DALL-E, etc. echt gebruikt voor visualisaties?
Convergent deliberation	Wat bedoel je met AI stakeholder sentiment analysis?	De characteristics hier gebeuren vooral in het VO.	Co-Pilot? Fireflies?	Bij de tools altijd i.e. voorzetten, zijn veel meer tools beschikbaar.

	Feasible moet je definiëren			
Operational deliberation	Wat bedoel je met agreements? (onder AI-supported execution alignment)	Over execution alignment: de rollen zijn inmiddels wel duidelijk Risico analyse vindt in elke fase plaats		Risk assessment vindt eerder plaats.Voorkennis zit in vroege fase.

Table 29: Framework feedback participant 3 (Own work)

Strategy

	Groen	Rood
Participant 1		Change management van Kotter (Harvard) → mensenwerk i.p.v. tool Urgency is nog niet duidelijk Titel naar "het verandermodel voor implementeren van AI"
Participant 2		Waarom komen de kleuren niet overeen? Dit is nu verwarrend. Waar updates implementeren als er bijvoorbeeld een nieuwe AI tool beschikbaar is? → en ondervangen dat het niet te veel in een cirkel blijft lopen.
Participant 3	Stappen zijn top! Stap 1 is een goede stap, je moet vooral enthousiaste mensen hebben!	Toelichting geven bij de cirkels van de strategie. Van binnen naar buiten van wat? Je organisatie? Het project?

Table 30: Strategy feedback (Own work)

Revisions made to the framework and the strategy

Refined framework

Following the validation workshop at NEOO on April 9th, 2025, several changes were made to the AI-deliberation framework to enhance its clarity, relevance, and usability in real-world project settings. These revisions were based on practical feedback from professionals involved in various stages of the real estate development process.

Key changes to the visual and structural design:

- The original timeline with hard phase separations (SO, VO, DO, TO, UO) was replaced by a continuous flow that better reflects the overlapping and iterative nature of design processes.
- Milestones (such as PvE, building permit application, execution drawing set) were added to clarify what each phase typically delivers.
- The deliberation mode "Exploratory" was renamed to "Divergent" to align more clearly with the double diamond model.
- A general function layer was introduced below the main framework to highlight functions that apply across all phases, including:
  - Transcription and minute-taking
  - Stakeholder alignment
  - Risk monitoring and analysis
- The circular visualisation of the four AI themes (Facilitation, Augmentation, Efficiency, Inclusivity) was removed from the main framework to avoid confusion. These themes are now only explained in the accompanying table.
- Lines connecting AI tools to characteristics were removed, as they gave a misleading impression of fixed relationships.

Key content improvements:

- Terminology across the framework was simplified to increase accessibility. For example:
  - “Stakeholder sentiment analysis” → “Analysis of opinions and concerns”
  - “Feasible design directions” → “Viable design options”
  - “AI-supported execution alignment” → “Agreement tracking through AI”
- For each deliberative mode, the objective is now explicitly defined:
  - Divergent deliberation focuses on idea generation and expanding the design space.
  - Convergent deliberation helps to evaluate, compare, and narrow down options.
  - Operational deliberation ensures the translation of decisions into implementation and monitors execution.
- Characteristics that were misaligned with their corresponding design phases were revised. These now reflect both the specific nature of stakeholder dialogue and the actual project dynamics, as confirmed during the workshop.

Revisions to AI tools and their presentation:

- The tools listed were critically reassessed and updated to match the revised characteristics.
- Each tool is now listed in a separate table, including:
  - Functionality
  - Phase of use
  - Type of output
  - Related AI theme
- Tools are clearly marked as examples (e.g., ChatGPT, Fireflies.ai), to show they are illustrative, not exhaustive.
- New tools such as OpenSpace and Woub were added to represent AI capabilities in execution tracking.

Practical application of the framework:

- A new section, “How to use the framework,” was added to explain:
  - How teams can use the framework throughout project phases
  - What it helps them achieve (better decisions, more structure, improved documentation)
  - Why it adds value to real estate development projects

- Data collection practices were integrated into the explanation. AI tools such as Fireflies.ai or Read AI can be used during meetings to capture decisions and stakeholder input. Data points (transcripts, alternatives, summaries) support transparency and learning across phases.

This refined framework moves beyond a static or phase-based depiction of project workflows. By explicitly recognising the iterative and overlapping nature of design processes, and by embedding AI tools into deliberative modes rather than rigid phases, the framework captures the dynamic and often non-linear character of real estate development. It supports teams in navigating complexity through structured yet flexible collaboration, aided by AI functionalities that enhance creativity, coordination, and decision-making. In doing so, the framework promotes not only technological integration, but also a cultural shift toward more reflective, inclusive, and evidence-informed design practices.

Refined implementation strategy

The implementation strategy was revised to improve alignment with organisational dynamics and behavioural change. While the original version proposed a six-phase growth model, it has now been reformulated based on Kotter's 8-Step Change Model to better reflect how innovation adoption unfolds in practice.

Key revisions based on workshop feedback:

- The colours of the strategy steps were updated to match the ripple-based visual model for consistency.
- The title was changed to "Change Model for Implementing AI" to better reflect its organisational purpose.
- The sequence and content of the steps were aligned with Kotter's framework for leading change.
- Continuous innovation was built into the final layers, enabling teams to regularly assess and integrate new AI tools as they emerge.

Strategic reformulation based on Kotter's 8 Steps:

In the original model, the strategy focused on what to implement, moving from awareness to full institutionalisation. However, feedback revealed that this approach lacked attention to the how of behavioural change. The new version follows Kotter's 8 steps, shifting focus from static implementation to a dynamic change process. Key changes include:

- Step 1: Creating urgency. A new starting point was added to build momentum and awareness of AI as a timely and necessary innovation.
- Step 2: Forming a guiding coalition. The AI task force was repositioned here to highlight the importance of leadership and shared responsibility early on.
- Step 3: Developing and communicating a vision. Leadership engagement and awareness-building were merged into a step focused on forming a collective understanding of AI's purpose.
- Steps 4–6: Piloting, empowering, and generating wins. These steps focus on small-scale experimentation with low-risk AI tools, building trust before expanding.
- Steps 7–8: Anchoring new approaches in culture. The final stages now emphasise learning loops, cultural acceptance, and continuous evaluation—not just formal structures.

This reformulated strategy thus goes beyond a linear sequence and incorporates the human dynamics of organisational transformation. It encourages AI adoption as a process of gradual cultural embedding, supported by leadership, shared learning, and evolving governance.

Appendix J: Expert panel

Expert panel 1: PhD researcher TU Delft

Date: April 28, 2025
Time: 10.30–11.30
Location: Online (Microsoft Teams)
Participant: External academic expert in generative AI and deliberation (PhD researcher, TU Delft)
Facilitator: Annefloor Pluut (researcher)

Purpose

The aim of this expert session was to critically reflect on the two main deliverables of the research: the AI-supported deliberation framework and the accompanying implementation strategy. The conversation focused on four aspects: conceptual clarity, scientific relevance, practical applicability, and theoretical reflection. Additionally, broader implications of AI in stakeholder deliberation were explored.

Session structure and main topics

1. Presentation of deliverables

The session began with a brief presentation of the two research outputs. The expert confirmed the practical relevance and clarity of the framework, while also posing reflection questions to strengthen its academic foundation.

2. Feedback on the framework
    - The expert affirmed the structure of the framework and its distinction between three deliberation modes (divergent, convergent, operational) linked to the design process.
    - The terminology should be revised to consistently refer to generative AI tools where applicable.
    - The inclusion of a general functions layer was appreciated, but the expert advised to move "reflection" to this cross-phase layer, as it is a continuous activity.
    - The process of deliberation was discussed as non-linear and cyclical rather than sequential. The expert highlighted the importance of feedback loops, learning, and revisiting conflicts.
    - The expert recommended renaming “advantages and challenges” to “advantages and trade-offs” to better reflect the nuanced role of AI in creative and deliberative contexts.

3. Feedback on the implementation strategy
    - The strategy was seen as highly practical and relevant for organisations but less academically grounded.
    - A suggestion was made to clearly differentiate between the framework (academic contribution) and the strategy (practical tool).
    - The strategy’s concentric layout and connection to Kotter’s model were seen as appropriate, especially for reflecting the iterative nature of change in real-world projects.

4. Theoretical reflections and broader implications

A reflective discussion followed based on a set of open-ended questions posed by the researcher:

- AI as agent, not tool: The expert emphasised that generative AI should not be viewed as a neutral support tool but as a powerful actor that changes how attention, autonomy, and understanding are shaped during deliberation.
- Deliberative logic and transformation: AI shifts the foundations of deliberation by affecting what people notice, how they interpret each other, and what information is prioritised. This challenges the assumption that deliberation is merely enhanced, it may also be fundamentally transformed.
- Intentions and unintended consequences: While AI has the potential to broaden perspectives and reduce echo chambers, it also risks excluding those underrepresented in data or without the capacity or motivation to deliberate effectively.
- Deliberation vs. decision-making: It was advised to revisit the conceptual distinction between deliberation and decision-making in the conceptual framework that is linked to the results. The five synthesis themes (facilitation, augmentation, inclusivity, efficiency, coordination) may overlap

more with decision-making literature. Anchoring them more explicitly to deliberative values such as reflection, mutual understanding, and learning would increase theoretical coherence.
- Individual vs. collective creativity: While the framework currently lists “loss of creativity” as a potential disadvantage of AI-supported deliberation, the expert recommended a more nuanced formulation. Referring to recent experimental findings (Doshi & Hauser, 2024), it was argued that generative AI may actually enhance individual creativity, especially among less inherently creative users, by helping them overcome blocks and generate novel content. However, this comes at the cost of reduced collective diversity, as AI-generated outputs tend to converge. The expert encouraged reframing this aspect as a trade-off, rather than a one-sided disadvantage.

Expert panel 2: Project manager at NEOO

Date: May 1, 2025
Time: 14.00 – 15.00
Location: NEOO Office
Participant: Project manager from NEOOF
Facilitator: Annefloor Pluut (researcher)

Purpose

The aim of this second expert session was to validate the two main research deliverables from a practical perspective. While the first expert panel focused on academic and conceptual clarity, this session explored the applicability and usability of the outcomes within the day-to-day context of real estate development projects.

Session structure and main topics

1. Presentation of deliverables

The session began with a walkthrough of the deliberation framework, structured around three deliberative modes (divergent, convergent, operational) and aligned with design stages. A set of general AI-supported functions was also discussed. The implementation strategy, based on Kotter’s 8-step change model, was then presented as a roadmap for integrating AI-supported deliberation in practice.

2. Feedback on the framework
    - The expert found the framework logically structured and relevant but noted the risk of it remaining too abstract for practice unless translated into concrete, accessible tools.
    - The current visual presentation was described as theoretical. The expert recommended clarifying the role of AI by using visual indicators (e.g. arrows or icons) to show where and how AI tools support deliberation.
    - The "general functions" layer was appreciated but required clearer explanation. It was suggested that these blocks explicitly show how AI supports activities like documentation, risk assessment, and coordination.
    - The concept of “reflective learning” was seen as important but ideally integrated throughout the process, rather than placed solely at the end. In practice, structured reflection is often omitted due to time pressure.
    - A major opportunity identified was the potential of AI to support integrality checks. For example, it could help align architectural drawings with consultancy reports and contracts. AI could flag discrepancies between documents and automate parts of this coordination.
    - The framework could also include tools for handling “change orders” and late-stage design updates, which often create inefficiencies during execution phases.
    - The use of scenario simulation and compliance checking tools in the convergent phase was confirmed as relevant. These tools help structure decision-making by comparing design options and aligning them with building regulations or stakeholder inputs.

3. Feedback on the implementation strategy
    - The eight-step implementation roadmap was seen as applicable, particularly in reflecting how change occurs in complex project organizations.

- The expert emphasized the importance of translating the strategy into clear and simple steps that are easy to communicate and apply across teams. Without this, there is a risk that the strategy remains too abstract.
- The strategy was considered especially useful when accompanied by practical next steps, such as tool selection, training, or standard prompts.

4. Reflections on AI in practice
    - AI is currently perceived as a supporting tool that improves structure, data access, and speed. It is not yet seen as an autonomous actor in deliberation.
    - The expert expressed concern about work acceleration and its impact on wellbeing. As AI tools increase productivity, expectations may rise, leading to more pressure rather than less.
    - Roles may remain largely the same, but professionals could become more self-reliant by verifying information themselves, without needing constant input from external advisors.
    - In project execution, AI could enhance efficiency by validating contract documents and automating change request workflows. These processes are currently time-consuming and prone to errors.
    - The expert suggested that AI could also support improved communication between disciplines by cross-checking conflicting or outdated documents, especially when combining narrative reports with technical drawings.

Revisions made based on the expert panel

- Relocated 'reflection': The concept of reflection was moved from the final design phase to the general functions layer, based on the consensus that reflection is a continuous, cross-phase activity.
- Reframed 'advantages and challenges' to 'advantages and trade-offs': This shift acknowledges that tensions in AI use are not merely obstacles to overcome but often involve structural dilemmas that require conscious balancing.
- Added ‘managing contract changes’ to operational deliberation: Based on practical feedback, AI-supported functions for identifying, verifying, and documenting contractual changes were added to address time-consuming execution issues.
- Merged ‘weighing trade-offs’ and ‘refining design direction’: These were combined into one deliberative characteristic and expanded with a new focus on ensuring cross-disciplinary alignment across consultant reports, design inputs, and documentation.
- Added AI-supported integrality checks to convergent deliberation: A major opportunity identified in practice was the ability of AI to verify consistency between architectural designs, consultancy documents, and contracts. This integrality function was explicitly added to the convergent deliberation phase.
- Reframed 'loss of creativity': Rather than presenting creativity as simply diminished, the framework now reflects the trade-off between increased individual creativity and reduced collective diversity (Doshi & Hauser, 2024).
- Revised visual layout of general functions layer: Icons and tool placements were updated to improve clarity and better show the link between AI tools and their corresponding deliberative support functions.
- Clarified AI roles in cross-disciplinary alignment: Specific reference was added to AI’s potential to assist with multi-stakeholder consistency checks, particularly where conflicting or outdated documents risk misalignment.
- Updated AI tool classifications: Tools were reclassified to clarify which ones qualify as generative AI, and the tool explanations were refined to align more clearly with the framework’s deliberative logic.