

Value creation in the building sector

Creating value for stakeholders and the environment

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Kurzzusammenfassung

Die Entwicklung im Bausektor hängt davon ab, worauf die verschiedenen aktiv und passiv beteiligten Akteure Wert legen. Aufgrund der bekannten negativen Auswirkungen des Sektors auf die Umwelt ist Nachhaltigkeit ein wichtiger Bestandteil des Sektors. Aufgrund der konkurrierenden Werte und Ziele der verschiedenen Interessengruppen ist es jedoch nicht immer möglich, nachhaltige Gebäude zu realisieren. Daher stellt sich die Frage, was diese Interessengruppen schätzen und was sie tun können, um einen besseren Nutzen für die Umwelt zu erzielen, der auch ihren Interessen entspricht.

Die durchgeführte Untersuchung analysierte die Interessengruppen, die in erster Linie an der Entwicklungs- und Planungsphase beteiligt sind, anhand einer Umfrage. Das Konzept des Wertes wurde auf der Grundlage einer Literaturrecherche bewertet, in der die Definition des nachhaltigen Wertes gegeben wurde: Werte sind die Bedürfnisse von Individuen oder Gruppen von Individuen, die sich aus den verschiedenen externen und internen Faktoren ergeben, die die spezifischen Individuen oder Gruppen von Individuen beeinflussen oder beeinflusst haben. Diese Bedürfnisse werden als Funktion von Zeit, wirtschaftlichen Kosten, Ressourceneinsatz und Qualität definiert. Auf der Grundlage der Ergebnisse der Umfrage wurden 7 Stakeholder identifiziert, von denen die Projektmanager, Investoren und Projektentwickler auf der Grundlage der Analyse ihrer Macht und ihres Einflusses als die wichtigsten Stakeholder angesehen wurden. Die Studie hat auch gezeigt, dass beim Nachdenken über Nachhaltigkeit Umweltthemen dominieren, jedoch überwiegen bei der Wichtigkeit wirtschaftliche Themen sowohl Umwelt- als auch soziale Aspekte.

Auf der Grundlage des Verständnisses des Wertes und der Wahrnehmung der Stakeholder in Bezug auf Nachhaltigkeit wurden Schlüsselaktionen als Ausgangspunkt empfohlen, wie die verschiedenen Projektphasen durch die Integration von Schlüsselaktionen auf der Grundlage der Macht und des Einflusses der Stakeholder verbessert werden könnten, um nachhaltige Gebäude besser zu realisieren.

Summary

The development in the building sector is dependent on what the various stakeholders actively and passively involved value. Sustainability is an important part of the sector due to the known negative impacts that the sector has on the environment. However, due to the competing values and objectives of various stakeholders, realising sustainable buildings is not always possible. This brings about the main question of what do these stakeholder value and what can they do to realise better value for the environment also within their best interests.

The research conducted analysed stakeholders involved primarily in the development and design stages by making use of a survey. The concept of value was evaluated based on literature research in which the definition of sustainable value was given *Values are the needs of individuals or groups of individuals which are a result of the various external and internal factors that influence of have influenced the specific individuals or groups of individuals. These needs are defined as a function of time, economical costs, resource input, and quality.* Based on the results of the survey seven stakeholder groups were identified of which the project managers, investors and project developers were observed to be the most relevant stakeholders based on the analysis of their power and influence. The study also showed that when thinking about sustainability, environmental topics are dominant however in terms of importance, economical topics outweigh both environmental and social aspects.

Based on the understanding of value and the perceptions of the stakeholders towards sustainability, key action points were recommended as a starting point of how the various project phases could be improved by integrating key actions based on the stakeholder power and influence to better realise sustainable buildings.

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1. Introduction

1.1. State of the Building sector

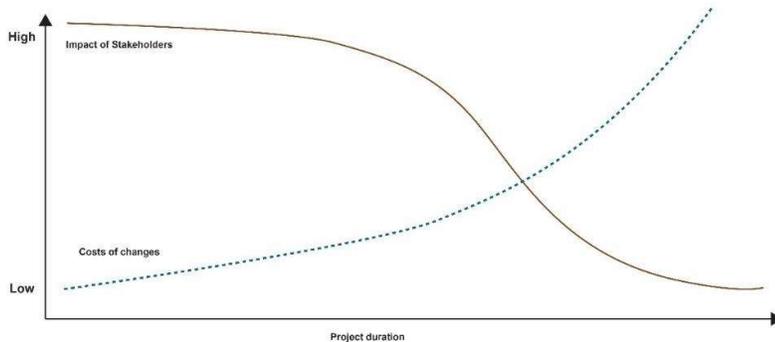


Figure 1: Influence of stakeholders during the project lifecycle in relation to cost impacts. Own illustration according to PMBoK(Olander, 2007).

The building sector today finds itself in a time when a lot of the processes that have existed for long periods of time need to be rethought and renewed due to the rising necessity of the topic of sustainability. With sustainability gaining more attention in the design and construction processes, the design process and subsequent construction processes have become even more complicated than before and so requires new innovative approaches in order to reach the desired goals (Kochendörfer et al., 2018). Several projects, public and private, have begun putting sustainability in the forefront of their work not only as a gimmick but rather as well-thought-out long-term solutions by implementing, as an example, concepts of the circular economy (Mrad & Frólén Ribeiro, 2022). There are challenges related in the implementation of such sustainable concepts in the building sector. Reasons for this are partially attributed to the complicated management of the design processes and construction from the initiation of the project to the completion of the project (Vegard, 2017). Projects consist of several experts on the team and there is a large information flow between them. In order to successfully complete the project with respects to all targets, in this case sustainability, the teams and information flow need to be managed as efficiently as possible to deliver a successful result (Knotten et al., 2015). For sustainability targets to be reached, they need to be integrated as early as possible in the project i.e., during the initiation of the project and the conceptualization of the project (Tian et al., 2015). The right partners with the required expertise need to be engaged early enough to be able to consult and

give the right input without instigating large negative consequences on the project which would impact the value delivered to the stakeholders (Krips, 2017; Vegard, 2017). Within the planning of the projects, it is also important to address how environmental value is perceived and integrated in all stages. The aim of sustainable building design is to conserve design values close to a maximum without letting the value drop whilst adding new values or services over the whole lifecycle of the building (Vakili-Ardebili, 2007). The current trend of the design value progression is shown in figure 2 and illustrates the focal point for sustainability to preserve and increase value throughout the whole lifecycle of buildings.

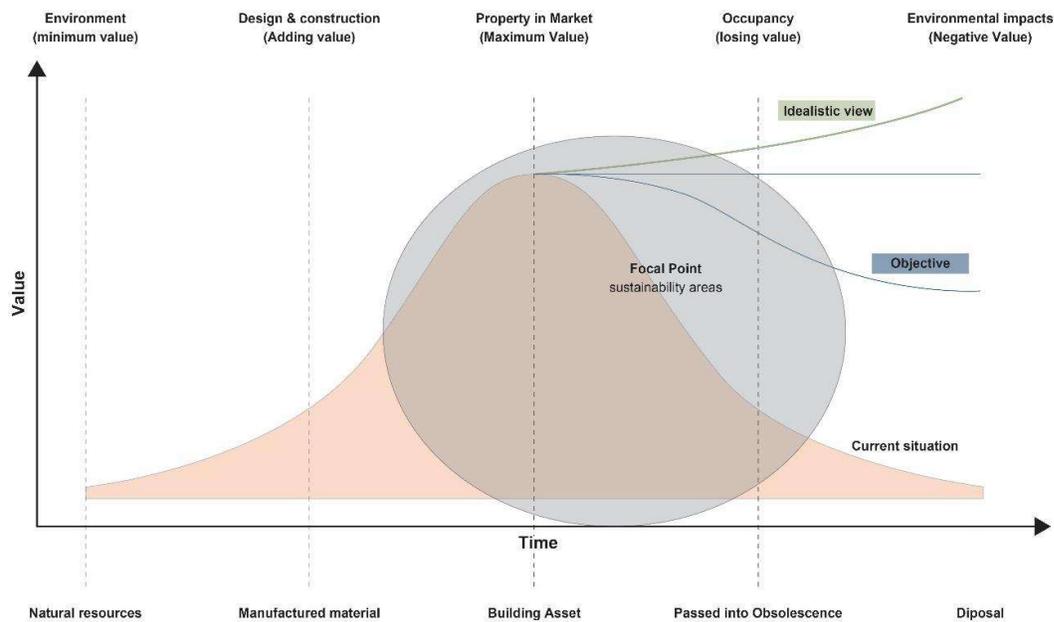


Figure 2: Flow of design value in the building process. Own illustration based on (Vakili-Ardebili, 2007)

1.2. Challenges in the building sector

There are various challenges that plague the design and development processes of the building sector. Among the long list of challenges faced there are problems with knowledge gaps (Vegard, 2017), collaboration (Knotten et al., 2015), early design planning (Knoth et al., 2022), decision making (Tian et al., 2015) and communication (Tirado et al., 2022). These challenges have to do with how stakeholders can relate to each other and work together within projects. Since projects are dynamic due to the various project phases and objectives, the way stakeholders need to collaborate and work together changes with the project (Krips, 2017; Lim & Yang, 2008). It is therefore

important to understand the project phases from development to realisation. In addition to understanding how the various project phases relate to each other, it is also necessary to understand who the stakeholders are and what their interests and perceptions are. In the context of this research, this would relate to their interests and perceptions towards sustainability.

Challenges in the building sector can be structured according to 3 main topics:

- Development and design process challenges
- Stakeholder related challenges
- Real estate market system challenges

1.3. Development and design process challenges

One of the big issues that plague the building sector today is the lack of sufficient information the early phases of development and the design phase to aid to strategy development of the project and the design concept respectively (Joana Bonifácio, 2017). When considering sustainability, this is quite problematic since certain aspects such as the financial impacts of integrating environmentally sustainable features might not be quantifiable or known early in the project which could potentially lead to the de-prioritisation of the environmental sustainability components and result in the disproportionate focus on economic aspects. Since there is no tangible knowledge on the building features early in the design phases, conclusions or decisions that take into consideration sustainability might be difficult to make since the impact might not be known or known with little uncertainty (Gervásio et al., 2014). These challenges could potentially lead to easily focusing on economic aspects since this is known ground for most key decision makers and easily quantifiable (Vimpari & Junnila, 2016). In addition to the availability of required information, the process of decision making is rather complex since the process involves evaluating benefits and losses for the stakeholders involved (Laurell-Stenlund, 2010). On one hand there is the issue of knowing how the processes can be better managed by involving the correct stakeholders and on the other hand, how to manage compromises made between the various stakeholders with their varying importance. This relates to the trade off in values between the various stakeholders such as the investment costs vs environmental output (Lam et al., 2009).

Important during these processes as discovered above, is also the availability of information to make well informed decisions.

From the beginning of the project, there are various processes that take place and produce outputs. Some processes are linear, iterative, synchronous with other processes, and asynchronous to other processes (Knotten et al., 2015). The manner in which these processes are managed including the outputs is important and quite challenging. The complex processes in addition to the high number of them creates a management problem. Management tools do exist in order to deal with the main coordination and management aspects:

- Agile management (Sprint, Scrum)
- Virtual design and construction (BIM)
- Integrated concurrent engineering
- Collaborative design management
- Lean management (Last planner system)

Below are brief descriptions of the identified tools with emphasis on the disadvantages and the existing gaps.

1.3.1. Management methodologies

Agile management

Agile management is a strategy that breaks down tasks into smaller work packages (Straçusser, 2015). The execution of these challenges is carried out in sprints. During these sprints, which are cycles of executions, there are scrums involved at which the teams come together and execute, monitor and adapt to the existing circumstances (Straçusser, 2015). It is important to plan for the sprints to ensure that they are well structured with respect to which how the tasks are to be completed and how the stakeholders are to be incorporated (Straçusser, 2015). Evaluating the lessons learnt is a key part in agile management (Straçusser, 2015). This way of working allows for a dynamic adaptation throughout the lifecycle of the project to any changes (expected and unexpected). A challenge often mentioned in relation to Agile

Management is the high demand on the clients and the executors due to the large number of meetings required, project complexity, and too many open issues that exist within the project among other parameters (Miller, 2007). In order for the strategy to work, all the stakeholders need to be on the same page and committed to the process (Miller, 2007).

The following values are important in agile management (*Manifesto for Agile Software Development*, n.d.):

- It is more important to focus on the needs of the people and on how the people cooperate
- Instead of comprehensive documentation, it is more important to have a good functional product
- Collaboration of the customer or client and the relationship with them is more important than contract negotiations
- How one reacts to change is more important than following a plan

Virtual design and construction

Virtual design and construction (VDC) is the management of the design teams i.e., Architecture and construction teams using multidisciplinary planning models or tools such as BIM to improve value of projects, productivity, and reducing costs (Lee et al., 2020). Similarly, VDC is also by the Stanford University Centre for Integrated Facility Engineering as “*The use of integrated multi-disciplinary performance model and design-construction projects to support explicit and public business objectives*” (Kunz & Fischer, 2009) Key components of VDC are the analysis methods in model based design (Savio et al., 2022), technical modelling and planning methods, visualisation methods, assessment of models such as performing lifecycle cost assessments (*Virtual Design and Construction - BIM Magazin - Building Information Modeling*, n.d.). By applying virtual design and construction, value can be created for the stakeholders through the generation of key data from the virtual models (qualitative and quantitative) that could be useful in decision making at the different stages. This also provides a source of valuable documentation (Sehrawy et al., 2021) for the management of the project during the operation phase or for the purposes of asset management and facility management. Similar to agile management, it is important to ensure that all the team members are on

board. In relation to Building information modelling (BIM) which is key in VDC, a challenge here is the knowledge gap and the challenge of interoperability of the different models that the various experts in the project produce (Lindström et al., 2019). Since each stakeholder needs to work in the same model, management of the model itself becomes complex as there is always a risk that some stakeholders are working on an outdated model. With respect the value creation, it important that beyond all this complexity in the panning with a lot of information, the values generated is clearly communicated to the key stakeholders and the project objectives are kept in perspective in during the execution and management of the processes.

Integrated concurrent engineering

The main purpose of integrated concurrent engineering (ICE) is to reduce the amount of time required to make decisions, improve the quality of the outputs from the various process and to improve collaboration within the team (Álvarez & Roibás-Millán, 2021). ICE is usually conducted in conjunction with VDC (Álvarez & Roibás-Millán, 2021). ICE is a methodology in which meeting structures or workshops that is focused on coordinating the various planning teams (*VDC and Integrated Concurrent Engineering - ICE Sessions in Practice - Part 1*, n.d.). It is important to plan well for such meetings to ensure that required objectives are met. Similarly, the European Cooperation for Space Standardisation (ECSS) defines integrated concurrent engineering as “*a collaborative and multidisciplinary approach that derives, develops and verifies a system solution that is balanced over its life cycle to meet stakeholder needs*” (ESA/ESTEC Requirements and Standards Division, 2017). Similarities between ICE and scrums can be drawn since this allows for the teams to come together and effectively coordinate and work together. The issue with stakeholder management can be better solved through these ICE sessions.

Collaborative design management

The main objective of design management is to enable the company or client to achieve their strategic goals efficiently and effectively. This involves organising, planning and managing the design process (Sinclair, 2011) Through the managing the design strategically and systematically, it can be expected that greater value can be created for the stakeholders. During the design development phases, stakeholders assert their own requirements based on their position/power in the system and exchange their expertise to achieve their goals.

Lean management

Lean management is a management approach focused on delivering value for the customer. The main principles of lean management are value identification, value stream identification, establishing a pull system and continuously improving the system. The main goal is to ensure that the needs of the customers are met, processes are optimised and waste in respect to outputs, is reduced (Kochendörfer et al., 2018). There are various techniques and principles of lean construction such as value stream mapping, the pull system, “just in time”, Kanban board and the Last planner system (Kochendörfer et al., 2018).

1.4. Stakeholder challenges

“Stakeholders are groups and individuals who can influence the achievement of an organization or project goals or who are influenced by the organization or the project” (Freeman, 1984). Stakeholder management is a key area within the development and construction sector due to the large number of groups involved in the numerous phases. The handbook of stakeholder management from the institute for project management in Germany (de: Deutsche verein für Projektmanagement (DVP)) identifies external and internal stakeholders (Krips, 2017).

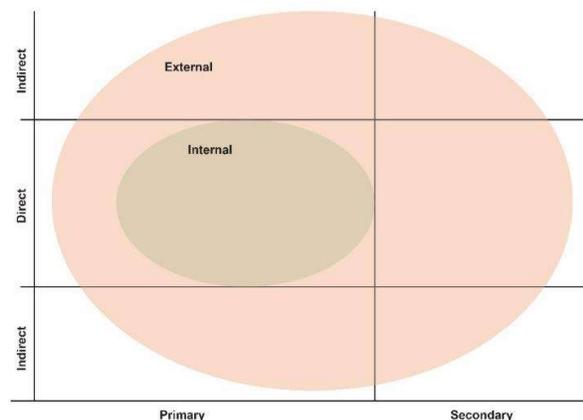


Figure 3: Stakeholder landscape. Own illustration according to Krips, 2017

The overview provided in this book shown how complex and large the stakeholder landscape is. Managing stakeholders relies in understanding what each stakeholder values, their goals, influence, power and many other criteria. In addition to the large stakeholder landscape, the complexity of stakeholder management increases since the

stakeholder positions change throughout the life cycle of the project depending on the requirements of that design phase.

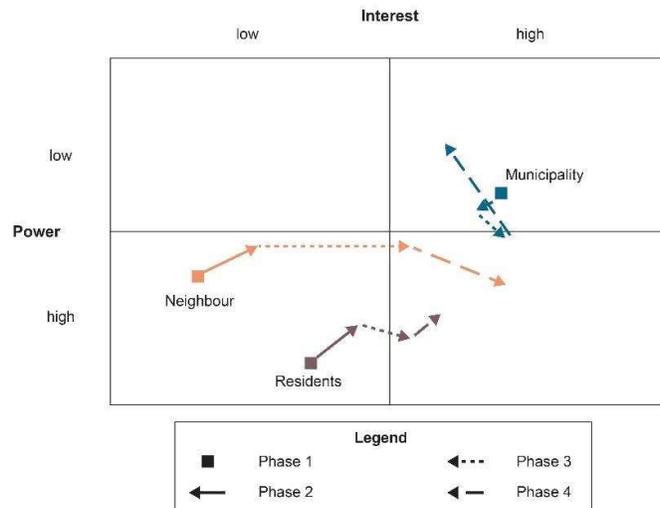


Figure 4: Stakeholder dynamics throughout the project lifecycle. Own illustration based on Krips, 2017

Since stakeholders are very central in the project lifecycle and beyond, the way stakeholders collaborate has a considerable influence on the ability of the project to be successfully meet its targets such as sustainability objectives, economic targets and social objectives (Krips, 2017). As mentioned above, there several methods on how processes can be managed which applies as well to stakeholder management. Since each project is unique, a general comprehensive solution cannot be provided that can answer the question of how stakeholders can be better managed during the lifecycle of a project. In light of this, (Krips, 2017) provides a framework on the possible strategies that can be applied to better manage stakeholders. The framework focuses on the main strategies of managing the stakeholders including communication strategies and tools that can be made use of (Krips, 2017). However, no clear action points are described most likely these could be derived from the stakeholder analysis in the project. In scope of strategic planning, this is expected as the action points can be generated through the application of the strategy however for a better implementation of sustainable principles in the development and design/management phases, detailed guidelines are required especially in relation to the stakeholders.

1.5. Development sector and Real estate system challenges

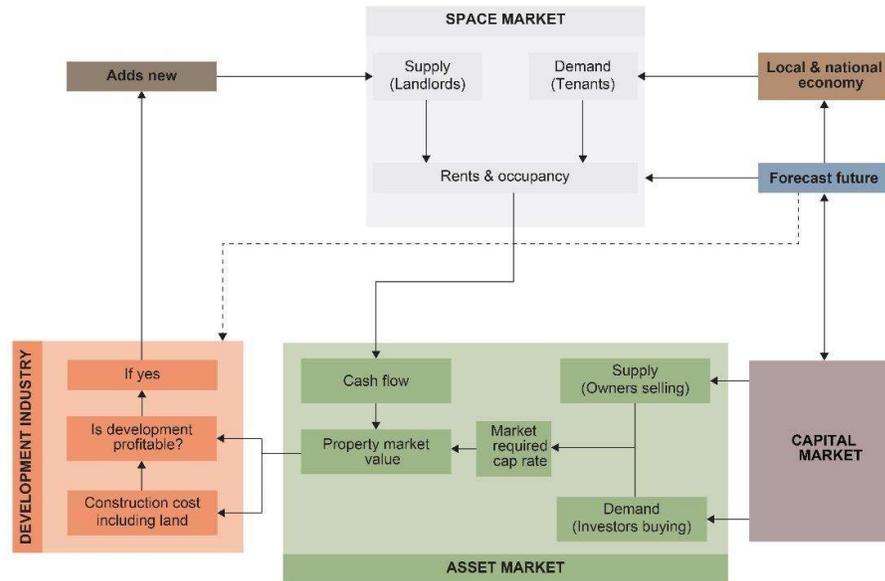


Figure 5: Interactions of the real estate spaces. Own illustration based on Zhu, B, 2021

The real estate market involves various mechanisms that allow for the exchange of real estate among owners and users (Keogh, 1994; Zhu, 2021). These exchanges are based on the owner and user needs which translates to their values which then influence the various decisions. This is important to understand since the result of the decisions made by the different parties have an influence on what is valued during the development and design phases of real estate. The choice to construct new buildings, renovate buildings is therefore a result of the decisions made in the market. The real estate market is comprised mainly of 2 markets namely the space market and the asset market. In addition to these markets there are related markets that not dealing with the exchange of real estate on the tangible level. One of the most significant markets with respect to this are the capital market and the financial market. The interactions in the real estate market are also explained in great detail using the 4-quadrant model to explain the real estate activities by Dipasquale and Wheaton (Lisi, 2015)

1.5.1. Space market

The space market describes the market in which the real estate is used (Zhu, 2021). The main activity is the exchange of rights to use land or a building between a tenant and a landlord. Within this space, there is a dynamic between supply and demand on

the rental side at play. It is important to note that there is no exchange of ownership in this market. The demands of the tenants will drive the need for more space from the landlords which have an influence on the rental prices, occupancy rates and cashflow which is an element of the asset market. The demands for space from the tenants drive the need to supply new buildings and more space. Taking that into account, the new construction or the new additions to the building stock will be aimed at fulfilling the needs of the users/tenants (market actors). When considering the entire real estate system shown in figure 5, the activity in the space market is influenced by the availability of property, the local and national economy, and future forecasts from experts (Zhu, 2021).

1.5.2. Asset market

Unlike the space market, the main activity is the exchange of ownership of real estate with respect to land and property between buyers and sellers. In addition to this, within the asset market, by exchanging rights of ownership of real estate products, rights to collect residual cashflows are inadvertently exchanged. The rights to cashflows could occur in various formats. An example could be the right to collect money from various loans pooled in a bond i.e., Mortgage-backed securities. These bonds (pools of loans) could be traded within the capital asset market in order to gain the right to the incoming cashflow from the bonds through loan repayments (Zhu, 2021). These various rights to cashflow exist within the scope of the capital asset market such as (Zhu, 2021):

- Real estate investment funds
- Real property
- Mortgage-backed securities
- Whole mortgages

The activity in this capital market will directly influence the buying and selling of real estate as can be seen in figure 5 or better said, the demand for buying real estate and the amount of supply from owners selling the properties. Depending on the pricing of the properties dependent on the demand and supply, a minimum market cap rate (explain what the cap rate is) is established which determines the value of the property. These relationships are also explained in the 4 quadrant model of Dipascale and Wheaton (figure 6). Property market value is not only determined by the market cap rate but also the cashflow emanating from the rental market among other aspects. Based on

this the extent of new construction and renovations in the development industry are carried out in alignment with the needs in the different markets.

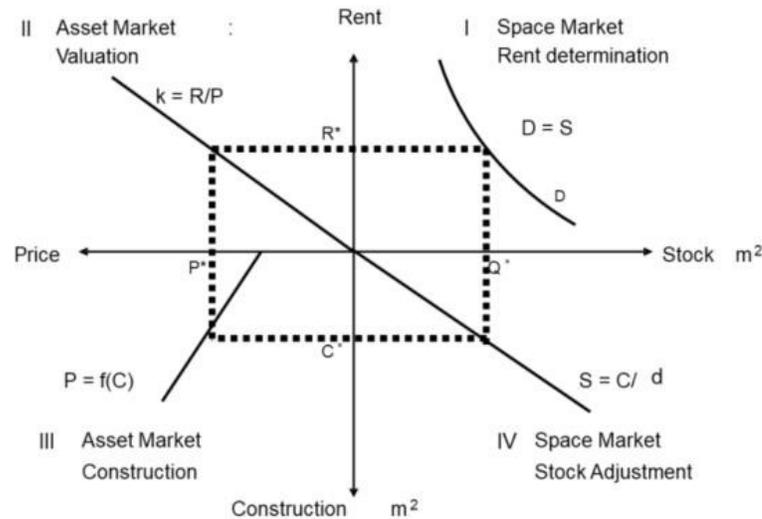


Figure 6: 4- quadrant model of real estate. Lisi, 2015

These interdependencies between the various markets makes it quite difficult to decide upon the strategic plans for the project. Due to the high complexity, various stakeholders rely on the quantification of the information which is most likely related to financial aspects as can be observed in various articles that deal with value creation in the construction sector (Boge & Temeljotov Salaj, 2017; Giménez et al., 2020; Haddadi et al., 2016). Sustainability could therefore be considered implicitly throughout the planning stages. In the development industry this non-direct approach could lead to sustainability not being well addressed in the processes. Implicit incorporation of sustainability could be in the form of regulation making certain concepts mandatory or certain sources of financing requiring a certain dedication to sustainability. In this case, sustainability could be incorporated as a form of risk management in order to ensure that either financing is secured or conformation to certain regulations is guaranteed. Though these are drivers to encourage more investments and a greater focus on environmental sustainability in development, they still leave sustainability in the background since sustainability could be simply seen as a means to an end. The future of development should be considering sustainability within development/real estate as the end. Financing for example needs to be perceived as a means to sustainable constructions. The existing challenge is therefore the manipulation of stakeholder values and system values to focus more on sustainability and put more importance to it.

2. Aim of the research and research question

Taking into account the aforementioned problems in the building sector, the main goal of the research is to develop an understanding on how stakeholder values can be maximised in the lifecycle of a building project up until early design phase by embedding sustainable principles in the core processes and decision making. There is a need to better understand how stakeholders understand value and how sustainability can be better implemented in the project process with a focus on maximising value not only for the stakeholders but also the environment. When considering the given definition by (Freeman, 1984) for stakeholders, the environment can be understood as a stakeholder with its own values that need to be maximised. The development industry is influenced by many other system components whereby there is a constant relation between owners and users exchanging real estate rights. These rights are aimed at fulfilling certain needs which in most areas could be attributed to economical aspect and other personal motivations. The people are central in the events. Within the context of this thesis, the following research questions will be addressed:

RQ1: *Who are the stakeholders in the development and design phases and what influence do they have on the realization of environmentally sustainable buildings?*

To understand how sustainable value can be created within building projects, there is a need to further understand on who the stakeholders are that are involved in the various phases of development and design phases. Knowledge of this can assist the stakeholders themselves and other relevant experts to act accordingly within the existing project management frameworks. Knowledge on the influence and the power that stakeholders have in the projects is also valuable as better strategies can be applied to deal with the existing stakeholder challenges such as collaboration and decision making. This means that key stakeholders can be strategically identified and targeted to drive sustainable value within the project. Understanding stakeholders is the first step in understanding how value can be better created for both the environment and the relevant stakeholders.

RQ2: *How can sustainable value for the environment and stakeholders be created in development and design?*

Value has many facets to it. To understand the basis of how value can be created, the definition of value is important with respect to the common understanding of it and as well as its meaning towards sustainability. This create basis on which the action points of stakeholders can be attributed to in order to realize this defined value. The process of value creation allows for the values that have been defined to be generated and realized through various processes. In the construction sector, the development and design phases could be seen as a value creation chain. Going beyond these set processes there is a need to understand the fundamental of the value creation chain such the phases involved and what is important in each phase to ensure that the value is maximized. This knowledge will serve as a framework in which the stakeholders can act in leading to the final research question.

RQ3: *What can stakeholders do to realize value for the environment and for them and other stakeholders?*

By combining the knowledge on what it means to create sustainable value and as well as the stakeholders involved in the various project phases, action points with respect to the relevant stakeholders can be proposed. This acts as a rule of thumb of actions in the project phases to ensure that value is maximized with focus on environmental factors. The realization of environmental benefits is necessary in the building sector to reduce the impact that it has with respect to greenhouse gas emissions, waste and the eco-system.

2.1. Limitations

This research is based primarily on theoretical knowledge and information obtained from various stakeholders that are active in the industry. The information represented in this thesis represents the perception of the stakeholders that responded. Due to the sample size, the generalisation of the results is not possible however gives a glimpse into what the potential orientation of the stakeholders. Results of this thesis could vary dependent on the project since it can be understood that by the uniqueness of the stakeholders and the type of project, the values are also unique and relate to that situation and context. It is important in each project a specific stakeholder analysis is carried out. The proposals offer a starting point in the phases were a lot of information is missing. In the research conducted, there are inherent limitations in the methodology which is primarily based on survey. Bias from the author is to be expected which will be dealt with accordingly as

expected in Chapter 6. In addition to this, some of the questions posed in the questionnaire were found to not be completely suitable for some of the stakeholders further distorting the results and perceptions of the assessed stakeholders. More information on this is provided in the relevant chapters.

3. Structure of the thesis

The following sections will first aim to address the aspect of sustainability i.e., what is sustainability? This will form a fundamental understanding also of what can be understood as sustainable value which will be addressed in chapter 7. However, the theory behind project development and design will first be discussed in chapter 5 to shed light on the different phases that exist. This information will primarily serve to understand the current value creation chain of the development and construction sector. The focus on the design stages will focus on the German system based on the Fees for architectural and engineering services structure (de: Honorare für Architekten- und Ingenieurleistungen, HOAI) for the design phases. The methodology will be described in chapter 6 whereby the various tools applied will be explained including relevant research that has contributed to the development of the methodology. Based on the methodology, the results of the research will be presented concluding the paper with a discussion on the future of value creation in the building sector including the relevant fields that influence construction. In chapter 7, the results will be presented in chapter 7, followed by the recommendations which address the final research question in chapter 8. Finally, chapter 9 will discuss the results obtained highlighting the key findings and limitations of the study with further actions for improvements proposed as a basis for further research.

The purpose of the paper is to highlight the importance of concurrent value creation for both the environment and the stakeholders. The ideology behind this is that true value considers the environment to ensure that in the future this created value still exists. Without the environment there cannot be true value. The action points and the framework proposed including the knowledge of the perceptions of stakeholder towards sustainability should assist the relevant stakeholders in how to either execute, plan and make decisions in the project. Furthermore, this work aims to generate a bigger discussion on how value is perceived not only in the development industry but as well as in the other relevant spaces as shown in figure 5. This should generate a large consideration of value within the larger system and enhance the way buildings are developed more sustainably.

4. Sustainability

Sustainability is defined as meeting our needs without compromising the possibility of the future generation to meet their own needs (World Commission on Environment and Development, 1987). This therefore implies that for the concept of sustainability to function it must refer to maintaining, renewing or restoration (Sutton, 1999) including the consideration of the ethical dimension of fairness of trade-off between the future needs of the environment and current economic pressures (Wilkinson, 2014). It is however important to assert that within this ethical trade-off, social considerations need to be considered (this could also be regarded as part of economic aspects however a distinction is important). In line with this line of thinking, there are different models of what sustainability is, especially the classification of sustainability into 3 distinct categories of environment, social and economy. The classification of the several topics into these 3 overarching aspects is also an area that is not easy to do since there are some topics that overlap into the other areas or potentially address all 3 aspects. In the image shown below, the landscape of sustainability is depicted with respect to the building sector based on the areas identified by (Gander, 2015) and certification standards. This provides the challenge on how to classify the various topics however provides a rounded understanding of the interactions that exist or could exist within the discussion of sustainability.



Figure 7: Sustainability variables(Lerner, 2022)

5. Theory: The design and development process

5.1. Project Processes/Project development

Project development can be described in two ways; Project development in the strict sense (de: Projektentwicklung im engeren Sinne), and Project development in a broader sense (de: Projektentwicklung im weiteren Sinne) as evaluated (Diederichs, 2006). Project development in the strict sense considers the phases from project initiation to the point of deciding whether the project should continue by awarding all the planning contracts.

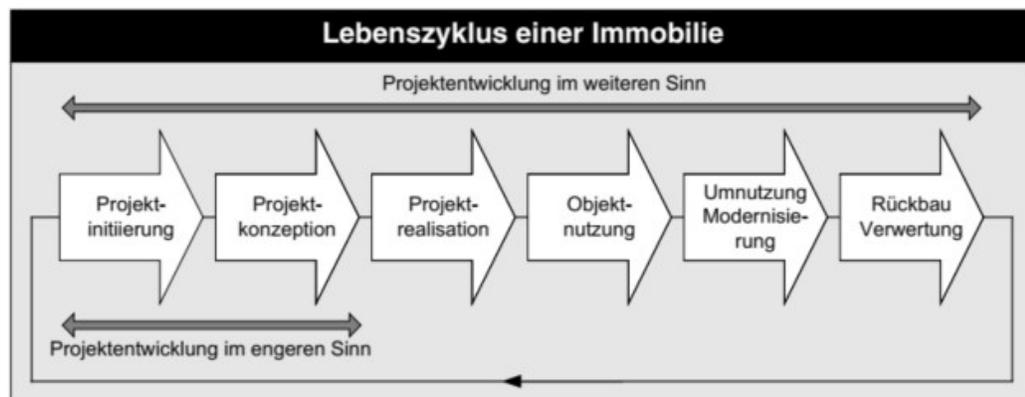


Figure 8: Project development in the lifecycle of real estate. Own illustration based on (Alda & Hirschner, 2016)

With the confirmation of the decision to continue (exit 1), project management begins (Diederichs, 2006). This phase considers the planning, execution, and delivery of the project. Project development in the broader sense covers the entire lifecycle of the property beyond design decision until demolition and renovation (Diederichs, 2006). In the scope of this thesis, project development is understood in the strict sense which is simply named Project development in the rest of the paper. The purpose of focusing on the strict sense aspect of project development is to better highlight and structure the various processes that take place during the lifecycle of the project. Additionally, stakeholders can be better identified and organised in the various design stages. During project development the following phases as shown in fig X exist, project initiation, and project conception.

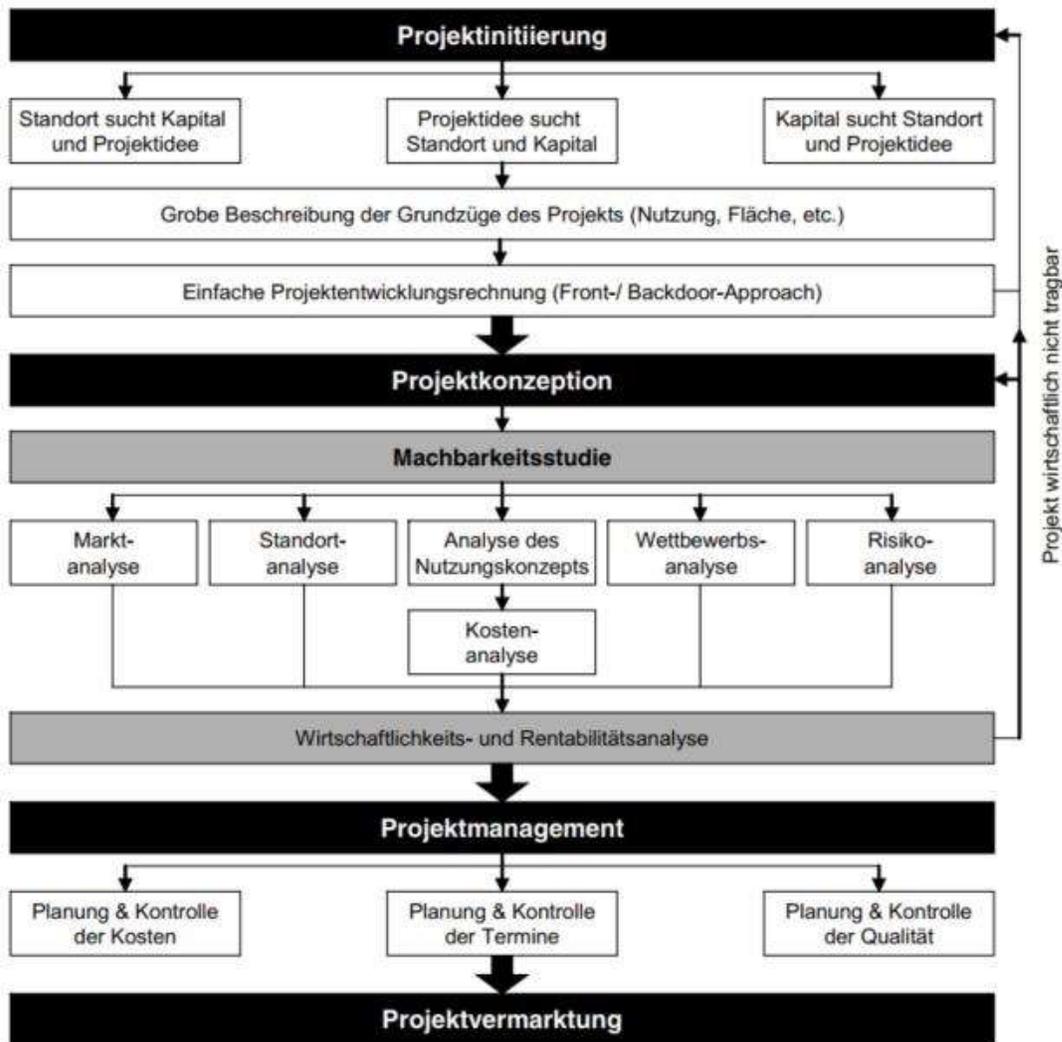


Figure 9: Phase - terminated view of tasks fields of project development. Own illustration based on (Alda & Hirschner, 2016)

5.1.1. Project Initiation

A project originates as a result of the unification of a project idea, a suitable location, and required financing (Diederichs, 2006). The process could have any of these three components as a starting point resulting in three key scenarios as shown in figure 9. During the project initiation phase, regardless of the scenarios, the required market needs and objectives need to be formulated in line with the existing financing opportunities and land availability. With knowledge of these boundary conditions, rough project development calculations can be carried out to assist the decisions that need to be made to continue the project as illustrated in figure 9. There are two main methodologies that exist namely the front door approach and the back door approach

(Alda & Hirschner, 2016). The front door approach utilising estimations of upcoming costs which can be used to calculate the minimum rent per square meter. Alternatively, the back door approach will first forecast the expected rental income and derive the investment costs and acquisitions (Isenhöfer, 1999).

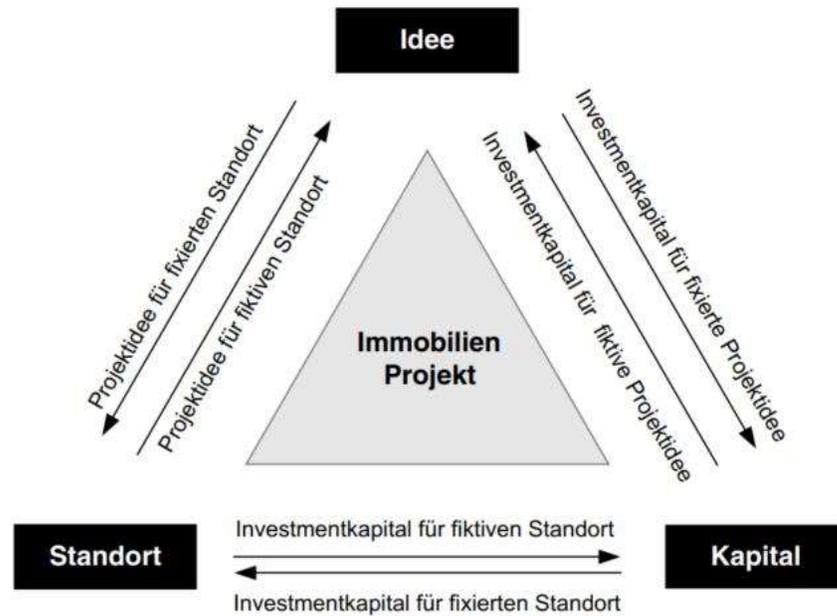


Figure 10: Building blocks of project developments. Own illustration based on(Alda & Hirschner, 2016)

5.1.2. Project conception

The goal of project conception is to set up the main project concept based on the various assessments such as the market analysis, location analysis and risk analysis (Alda & Hirschner, 2016). The various steps contribute, to varying degrees, to the final decision on how to proceed with the project. The most important result or rather question that needs to be answered at the end of this stage is:

“How economically successful can the project be?” (Hirschner, 2007)

To be able to accurately answer this question, a profitability with sensitivity analysis including forecasting is carried out (Alda & Hirschner, 2016). It is at this point that an exit from the project is possible based on the results of the stage (Diederichs, 2006). In the case that the results are not satisfactory, the project can be terminated, or an alternative could be provided regarding the use concept. This process is repeated if required by the stakeholders. An important part of this phase is the development of the use concept in which a design brief is constructed. The design brief is a vital document for the project

since this sets the targets across various parameters that need to be achieved. The project brief needs to be developed well and as complete as possible addressing the different operational and strategic goals since failure to do so can lead to an increase of the probability of achieving a sustainable building for instance (Chandramohan, A. Narayanan et al., 2012).

5.1.3. Project management: Design

Since project development is dealing with the initial phase of the design until the beginning of the design process, it is important to understand how development processes align and influence the design phases. In the German construction sector, there are nine phases described according to the HOAI (Bayerische Ingenieurekammer-Bau, 2021).

Table 1: HOAI project phases

Phase 1	Base analysis
Phase 2	Preliminary planning
Phase 3	Design planning
Phase 4	Approval planning
Phase 5	Construction drawings
Phase 6	Procurement preparation
Phase 7	Procurement
Phase 8	Object supervision – construction supervision and documentation
Phase 9	Object management

In each of the phases there are outputs required in various forms to make the decision to be able to progress from one stage to the other. The HOAI describes not only the design phases but also the construction phases which would begin at phase 5. The focus of this thesis will be on the design phases, i.e., phase 1 – phase 3. This is based on the notion that the most important decisions especially in relation to sustainability that could have a large impact on the progress of the project are made in the early design phase despite the lack of sufficient data available (Kohler & Moffatt, 2003; Son & Kim, 2015; Zeiler et al., 2010), which could increase the building values and lower costs

(Bogenstätter, 2000; Kovacic & Zoller, 2015; Nielsen et al., 2016). During the project lifecycle, the development phases and some of the design phases take place simultaneously and there needs to be a cooperation on both fronts to ensure that the project can successfully progress leading to a positive result. Appendix A provides an overview of the layered project phases

5.1.4. Project materialisation

In the case that the project progresses, the next phase focuses on ensuring that all the required permits and financing, are obtained. Parallel to this, based on the concept and goals of the project, a team is assembled of key stakeholders such as project managers or general planners. The choice of team structure is highly dependent on the project owners' profile and the goals of the project in relation to the uniqueness of the project including the required quality, the timeline and the budget. In the German context five, main contracting types exist, each with varying advantages and disadvantages. The contracting types available are (Diederichs, 2006):

- Total contractor (de. Totalplaner)
- Total overtaker (de. Totalübernehmer)
- General overtaker (de. Generalübernehmer)
- General contractor (de. Generalplaner)
- Individual contracting (de. Einzelvergabe)

Once the organizational form has been identified and selected, various stakeholders are onboarded onto the project depending on the criteria of the project owner. The procurement of team members can happen with the assistance of a project manager in the scope of the chosen contracting structure. In addition to team selection, a stakeholder analysis can be carried out to better understand how external stakeholders such as neighbourhood groups perceive the building and what risk they pose to the project. In the case that they are against the project this could be a barrier for the project which could initiate an exit process or a renewal or revision of the set concept (Diederichs, 2006). For this, stakeholder management is required, and it is in this stage that a strategy is developed.

6. Methodology

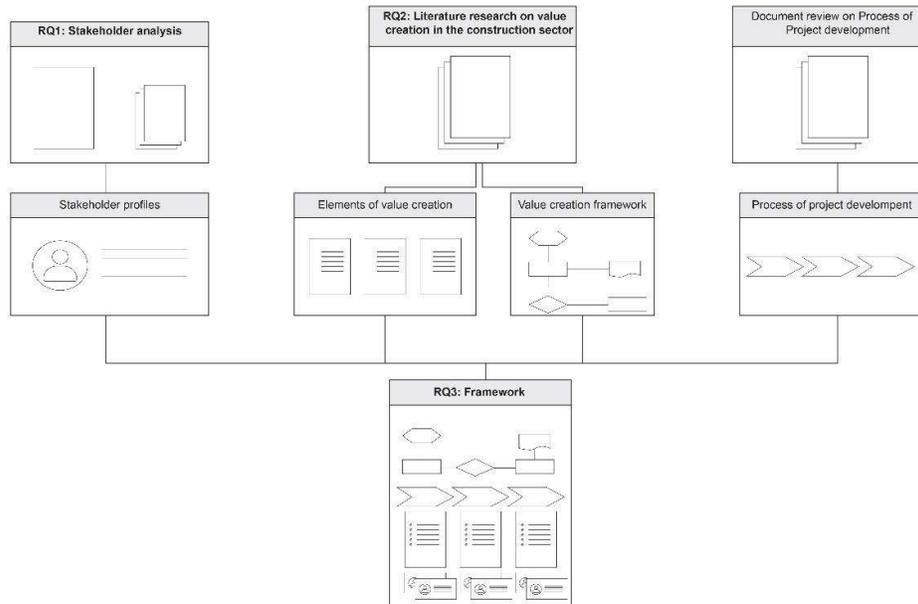


Figure 11: Methodology

The following methodology illustrated in figure 10 will be used to address the research questions.

6.1. RQ1: Stakeholder analysis

A stakeholder analysis is defined as a “*holistic approach or procedure for gaining an understanding of a system*” (Ludovico et al., 2020). The aim of it is to understand the stakeholders in order to determine their relevance to a system, in this case a project (Wu et al., 2020). The stakeholder analysis will be carried out in the following stages:

- Stakeholder identification
- Stakeholder categorisation
- Data extraction
- Analysis

	Stakeholder identification	Stakeholder Data extraction	Analysis
Goal	Develop a complete list of stakeholders	Gain information on the stakeholder's interests, perceptions	-Understand the power and influence the stakeholders have -Understand the alignment of stakeholders towards sustainable topics
Methods	-Literature/Document review/Selection by researcher (Ludovico et al., 2020; Ringel et al., 2021) -Snowball sampling from questionnaires (Garton et al., 2021; Ludovico et al., 2020; Voegeli & Finger, 2020)	Questionnaires (Ringel et al., 2021)	-Thematic content analysis (Garton et al., 2021) -Power/Interest matrix (Lou et al., 2022; Pelyukh & Paletto, 2020) -Descriptive statistics
Limitations	Bias from author	-Bias from responses -Bias from the author the structuring of the questions -Finding a sufficient sample of respondents for meaningful results	

Table 2: Stakeholder analysis methodology

6.1.1. Stakeholder identification

To understand who is involved in the design development phases and early design phases, a combination of a document review and a questionnaire was utilised to develop a comprehensive list of stakeholders involved in the development and early design phases. The use of a document review allows for an initial stakeholder group to be formed. Though projects are different, there are recurring key stakeholders which can be identified. Since there might be a limitation that the lists documented in literature

might not be complete, a questionnaire was made to get input from practice to better understand the stakeholders involved. Once the results of the stakeholders were collected, this was combined with the data extracted from the document review to complete the list. The questionnaire was dispersed online through social media and direct emails to companies. Chosen individuals and companies were from various professional fields such as project management, project development and architecture. By carrying out the stakeholder identification, a wide range of stakeholders could be identified as seen relevant by various stakeholders with different perspectives. The result of this was a complete list of relevant stakeholders in the development and design phases which could be evaluated in the later stages.

6.1.2. Data extraction

A questionnaire was used for gathering all the data required for the stakeholder analysis. The questionnaire was semi structured making use of open and closed questions which allowed for various types of information to be obtained from the stakeholders. In addition to this, information on the power and influence of the stakeholder on the integration of sustainability was also extracted from the questionnaire. Key principles for the questionnaire with respect to how certain questions were formulated in order to reduce bias were adopted from (Creswell, 2012; Krosnick & Presser, 2010). In developing the questionnaire, key aspects such as how do the stakeholders prioritize environmental sustainability in consideration of economic and social factors, how they perceive sustainability, which phases of the project they are involved in as well as decision making roles, were probed.

First of all, the sampling of the participants was random since the questionnaire was sent out to various participants in the form of a link directly. The link to the questionnaire was also be distributed via social media allowing anyone with access to the link to fill in the questionnaire. The benefit of this was the reduced bias due to the author selecting specific participants and allowed for a wide variety of answers to be collected from different experts in varying positions and with varying experience. Regarding quality control, the questionnaire was evaluated with a few stakeholders to make sure that the information that needs to be obtained was collected as desired and to also check the quality of the questions. A limitation to questionnaire as explained in table 2 is the varying understanding of certain questions by the participating stakeholders which leads to inconsistent answers. A quality check of the questionnaire assists in improving the way the questions are structured and worded. Due to the weak correlation between the

time required for a questionnaire to be completed and the number of expected responses, the focus of the questionnaire was mainly on the quality of the content (Rolstad et al., 2011). However, due to the target audience of experts in the construction industry it was still relevant to ensure that the time required for completion was kept within a good margin of 15-30 minutes based on discussions with known experts. By conducting the data extraction in this manner using primarily a questionnaire, there are some key limitations that need to be highlighted in addition to the aforementioned limitations. Bias will be prevalent in the results from the respondents and the author of the questionnaire. The respondents may understand the questions differently and therefore the answers will be biased towards their own personal understanding. Vagueness from the questions may also lead to distorted results. In addition to this the questions asked in the questionnaire may have a tendency to lead the respondents on through suggesting certain aspects and therefore reducing the authenticity of the responses given by the respondents (Creswell, 2012). In order to reduce these factors a quality assessment is important which is based on the test sheet to evaluate the differences in responses and extent of bias.

6.1.3. Analysis of results

The results were analysed with use of different methods. Open questions were analysed based on thematic content analysis to aggregate the data into core groups which was useful in interpreting the data. RStudio and excel were implemented to analyse this data due to the ease of use and flexibilities in how data is visualised. In addition to the thematic content analysis, quantitative data was grouped and analysed per stakeholder to better understand the general stakeholder group perceptions. It was expected that there would be intra group variances in the responses given since the topic of sustainability is a very personal topic however, the mean was used as a representative value for the group. A drawback to using this is the impact of outliers on the results. The choice of using the mean values was based on the number of responses received and the use of the basic scales for responding to the questions. Despite the large sample size, it was important to ensure that analysis would be possible for the subgroups comprised of the relevant stakeholders. According to (Robin, 1998), it is recommended to not conduct statistical analysis for a sample size of less than 10. In the scope of the thesis all data sets were accepted and assessed since the main idea was to show the general tendencies of the stakeholders though this could vary in specific projects.

6.1.4. Power influence matrix

By organising stakeholders in a power-influence matrix, can be categorized to create a basis on which their role within the project can be understood especially in comparison to other stakeholders (Krips, 2017). The various stakeholders can therefore be better prioritized and managed. Using this method of analysing the stakeholders assist in the identification of the stakeholders that have the greatest impact on realising value in projects and simultaneously identifying high priority stakeholders that require their own needs met in order to realise the value in question. Power is defined by (Krips, 2017; Wu et al., 2020) as the position that the stakeholder has in order to assert their interest, or the ability of a party to impose an outcome over another party (Killian & Pammer, 2003) The amount of influence that a stakeholder has is defined by their level of involvement in the various processes (Krips, 2017; Nye Jr, 2013). In order to assess the power and influence that each stakeholder has, an evaluation matrix was developed which takes into account the stakeholder involvement, position in project hierarchy and decision making power among other parameters as seen below. These parameters were developed based on the 14 sources of power by (Morgan, 2006). Since some parameters are more influential than others, weights of importance were applied. These weights were based on the rank sum method as a way to normalise the data (Roszkowska, 2013)

$$w_j(RS) = \frac{2(n + 1 - r_j)}{n(n + 1)}$$

Where:

r_j is the rank of the j -th criterion

n are the prioritized (ranked) criteria

The prioritization of the categories was done based on the knowledge of the author and the sources of power as described by (Morgan, 2006)

6.1.5. Stakeholder profiles

With the aid of a Strength, Weaknesses, Opportunities, and Threats (SWOT) analysis taking into consideration the results of the questionnaire, existing literature and knowledge of the building sector, stakeholder profiles were developed to summarise the key information discovered from the research. Such stakeholder profiles address the first research question:

RQ1: Who are the stakeholders in the development and design phases and what influence do they have on the realization of environmentally sustainable buildings?

In each stakeholder profile the following information will be presented:

- SWOT analysis results
- Prioritisation of sustainability topics (Environment, Social, Economy)
- Opportunities for action
- Value of selected environmental, social, and economical factors developed based on the classification in certification standards such as LEED and DGNB.

6.2. RQ2: Value creation literature research

The second part of the research addresses the aspect of value creation. A systematic literature research following the guidelines (Booth et al., 2016) will be carried out based on the following research question:

RQ2: How can sustainable value for the environment and stakeholders be created in development and design?

The literature research was be guided by the following sub-questions:

- What is value creation?
- What are the components of value creation in the construction sector?
- What are existing frameworks for value creation?

Due to the time limitation of this project, the literature review was not extensive and focused primarily on a maximum of 20 papers selected through a process to ensure high quality as will be later explained. The database of *Scopus* was used as it contains a wide array of relevant sources for the construction sector. Following the input rules of the database, the following research term was used.

("value creation" AND "(building design" OR "construction sector" OR "real estate"))

Papers were limited to those that were available for open access to ensure that all the papers taken into account in the research were available. The papers were also selected based on the title, key words, abstract and conclusion. This method of filtering ensured that all the papers were relevant and that all excluded papers had no relation to the question under study. This strategy of selecting papers was part of the quality management to ensure that the papers select were adequate. Further information on this can be found in the excel document attached. Information obtained was not only relevant to the German context due to the availability of information as realised during the scoping process. It was however assumed that the topic of value realisation and creation is a universal topic and has no boundaries with respect to the different national standards. With respect to the frameworks on value creation, the identified papers were used as the main source for this information. The frameworks were further evaluated based on their coverage of the development and design processes. Based on this, the most complete and applicable framework for the development and design was used for further studies in this research.

6.3. RQ3: Consolidated value creation framework

RQ3: What can stakeholders do to realize value for the environment and for them and other stakeholders?

Based on the results of the stakeholder analysis and the research on value creation, action points for stakeholders were proposed outlining what each stakeholder can do to create better value for the project (sustainable value as per the definition proposed in this document). These action points were proposed and structured according to the project phases. In this way it was also made clear which stakeholders who could do what and at what time during the project phases.

7. Results

7.1. RQ1: Stakeholder analysis

7.1.1. Stakeholder identification.

Various books and journals name different stakeholders. In the table below, various key literature sources in Germany are summarised with the different groups of stakeholders that exist. The document selection was based on known literature and as well as using the Scopus database. The identified stakeholders from the various stakeholders are relevant to the building sector as required. Since the focus of this thesis is the development and design stages as defined in chapter 5, only stakeholders relevant to these stages are considered for the study. Table 5 summarises identified stakeholders for the development stages

Authors	Stakeholders
(Kochendörfer et al., 2018)	Client/Investor/Owner; Project Developer; Planner; Consultant; User; Authorities
(Krips, 2017) (Stakeholders in the project phases)	Architects; Client; Project Developer; Building technician; Investor; Credit provider; Supplier companies; Consultant; Construction companies
(Köster, 2021)	Investors and equity partners; Political decision-makers, Property owners, Approval authorities and public bodies, Urban planners and Architects, Experts and Surveyors, Neighbours; General public.
(Alda & Hirschner, 2016)	Institutional investors; Construction companies; Banks; Architects/Engineers; Brokers/consultants; Municipalities

Table 3: List of stakeholders identified in literature

Consolidated list of identified stakeholders:

- Project developer
- Investor/Capital provider
- Public sector (including municipality)
- Project manager
- Planners
- Consultants
- Property owners
- Local residents
- Construction companies/Contractors

The above listed stakeholders were identified to be significant. The list consolidates the information from research based on the document review. In addition to the document review, a questionnaire was developed with the goal of capturing the stakeholders based on practical experience. The preliminary list of stakeholders identified for the document review was used as a reference in which the respondents had to select which of the identified stakeholders are relevant for the design and development phases.

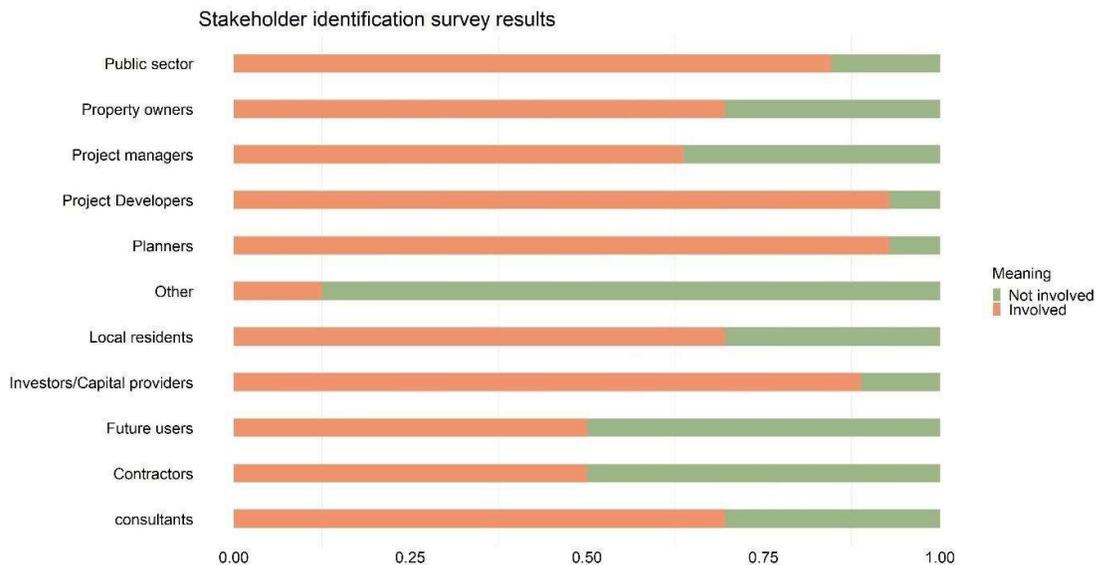


Figure 12: Stakeholder identification survey results

Based on a questionnaire sent out to some stakeholders identified, the results show that most of the stakeholders identified from literature are relevant for the development and design stages. The exceptions in this case were future users, and contractors whereby 50% of the stakeholders identified them as not being relevant to the project phases in

focus. In addition to this, an extra stakeholder namely the facility manager which was not previously part of the document review was stated as a relevant stakeholder by one of the respondents. The respondents varied in their professions ranging from project managers, research assistants and project developers. Due to the expected expertise of the respondents and the alignment of the results with document review, the results are observed as being accurate to a large extent. The detailed results of the questionnaire can be found in Appendix C Taking into consideration both the document review and the results of the questionnaire, the final list was generated which was used applied in the questionnaire.

	Stakeholders
1	Project developers
2	Investor/Capital providers
3	Public sector (including municipality and general public)
4	Project manager
5	Planners
6	Consultants
7	Property owners
8	Local residents
9	Construction companies/Contractors
10	Facility managers

Table 4: Stakeholders identified for the development and design phases

In contrast to the preliminary list generated, some of the stakeholders since their function was expected to be similar. This was the case for municipalities and the local residential groups which were categorized within the public sector group, The main reasoning behind this was to ensure a compact list to ease the data analysis. Additionally, this would also provide the respondents with clear options for their group in the later stages of the research.

7.1.2. Questionnaire

Based on the distribution of the questionnaire using social media platforms such as LinkedIn and sending out email to randomly sampled stakeholders, 67 responses were received. Due to the way of distribution was carried out, a response rate cannot be given.

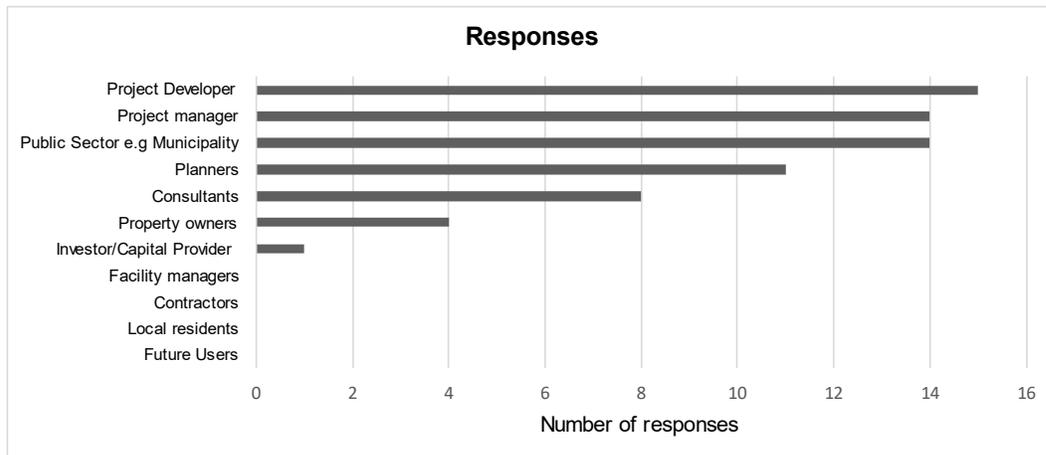


Figure 13: Number of responses received

As can be seen from the figure 12, most responses were received from planners and project developers. It is important to note that from the facility managers group, users group, contractors, and from future users, no responses were obtained. Due to limited time to further prolong the survey in order to include these groups, the research was conducted omitting the respective stakeholders. Following up to this work, it would be therefore interesting to analyse these groups in better detail to fully understand the stakeholder dynamics in the design and development stages. From investors, only 1 response was received. Though this information can be used, a lot of discretion was required especially with the end results since the response is not representative of the entire investor group as already mentioned earlier in this paper. In the following section, the results of each group will be shown including the swot analysis and the resulting stakeholder profiles. From a general point of view, the stakeholders were asked about their perspectives of sustainability. Topics related with energy were mentioned more frequently compared to environmental topics and social topics. Considering all the topics mentioned, the efficient use and application of materials and resources, and energy were highest mentioned topics amongst **all** the stakeholders. These results show that essentially when the topic of sustainability is brought up for discussion, the environment is most likely the topic in reference.

Investors

Based on the responses received, there is a clear polarity towards economical topics followed by the environmental topics and lastly, the social pillar of sustainability. This polarity was obtained by evaluating the average ratings for each of the subtopics within each sustainability pillar (economy, environment, and social. The respondent was also asked to rank the importance of the pillars of sustainability directly. Which was in line with the ratings of the subtopics.

When focusing on Economical topics, most of the subtopics were rated as being very important by receiving the highest score on the scale (1 – 5 with 1 being somewhat important and 5 being the extremely important). Based on the responses, investment costs, space efficiency building lifespan and building flexibility and adaptability received the highest scores. When considering the environmental topics, the average rating of all the topics was 4,2. Most important topics here were Greenhouse gas emissions, Land use, Green and Blue infrastructure and energy more specifically the efficient use of energy. Social topics on the other hand received the lowest average rating. Based on the results obtained, Accessibility, visual comfort and thermal comfort are the most important. It is interesting to observe how these social aspects also have a strong relation to some of the environmental aspects such as how decisions made regarding thermal comfort can influence the energy used by the building. Based on the information obtained, this gives a slight insight on the perception of sustainability topics from the perspective of the investors and what is prioritized. It can be assumed that investment topics will be prioritized first in consideration of topics such investment costs and building flexibility for example. The topics would need to be addressed and would most likely be prioritized before all the other sustainability areas.

When considering the involvement of the stakeholders, investors are only involved in the development phases. During these phases they have the role of a decision maker for the selection of team members and the project budget. This also aligns with their position in the project and prioritization of the sustainability topics. Based on this, it could be assumed that Investors have a lot of influence on the team structure and the way finances are management are planned. These could be seen as potential areas of intervention for the investors. Taking into consideration that perception of sustainability is understood in the scope of environmental aspects due to the understanding of sustainability provided by the investor, sustainability is actually not highly valued in the

key processes in which the investors are involved in namely, market analysis and location analysis. During land purchase, sustainability is valued which could mean that it is part of the decision-making process. Detailed information on the extent at which it is valued and how it is incorporated in the decision-making process is not clear. However, based on existing literature sustainability can be integrated in land acquisition and purchasing by considering the following factors (British land, 2022):

- Availability of green blue infrastructure
- Risk of environmental contaminants (water, gas, soil, etc...)
- Environmental protection regulations (e.g., for animal habitats or protection of tree species) (Biodiversity risk)
- Availability of sufficient daylighting
- Climate risks
- Opportunities for improving biodiversity on-site
- Existence of a biodiversity action plan

These topics are examples of what could be possibly considered in the selection and purchasing of land. Ultimately, they have a strong impact on the overall potential risk of the investment and the potential achieved value of the building property. As assumption that can be met here is that if sustainability is able to effectively reduce the investment risk, improve the building value, and contributes to the overall strategy and resilience of a portfolio for example, this would increase the willingness to decide for sustainability. In such a scenario sustainability is a means to fulfilling the core values of the investors. Since these results only represent the opinions of a single investor further analysis would be required to better understand these areas.

Project developers

Most of the data was collected from project developers as they made up 22% of the total sample. Firstly, by evaluating the information obtained regarding their perception of sustainability, a wide range of topics are mentioned taking mostly into account environmental topics such as efficient use of resources and materials, and energy. In addition to the environmental topics, social and economic topics were also mentioned

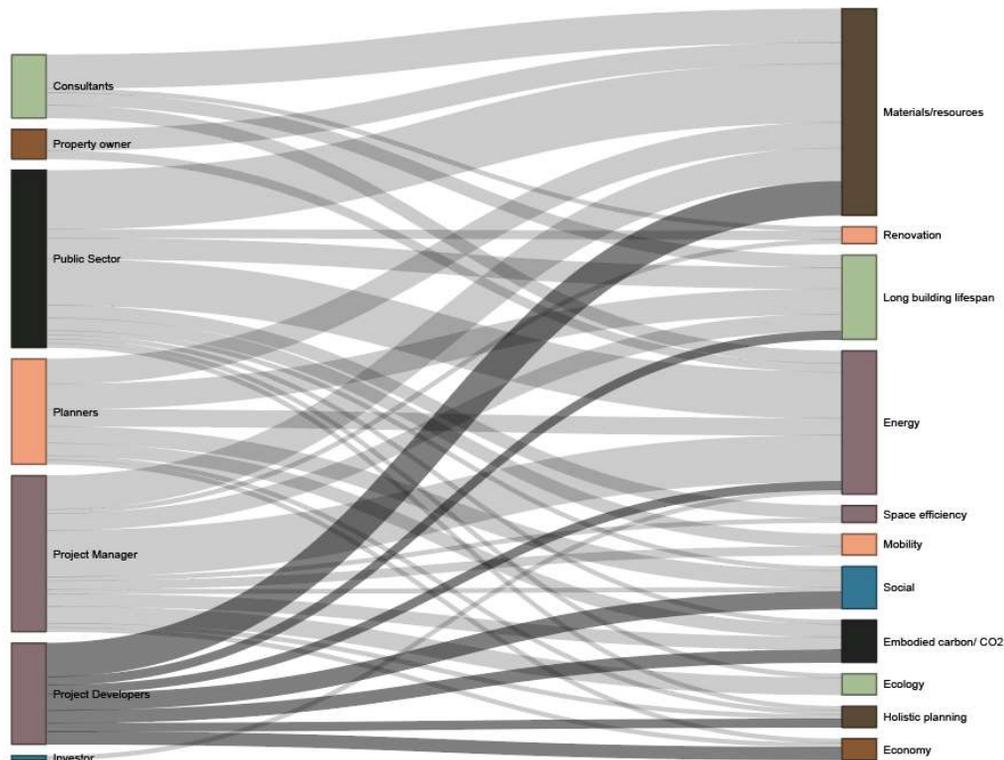
but not in very specific ways. Respondents gave detailed responses for environmental topics as seen below which was not the case for the economical topics.

Question: "What do you understand by sustainability in construction and planning?"

Respondent 1: „Schadstofffreie Materialien, Recoursenschonendes Bauen“

Respondent 2: „möglichst geringer Verbrauch von Energie während Herstellung und Betrieb“

Respondent 3: "Sustainability means considering the entire lifecycle of a building from the very start, from the embodied carbon in the materials, to the user comfort and energy consumption/emissions during the building use phase, to integrating circular economy principles that will help preserve materials at the end of life."



Compared to all the other stakeholders with the exception of project managers, project developers seem to have a more rounded understanding of sustainability, however due to the weight on environmental topics when referring to sustainability, environmental aspects will mostly come to mind. When assessing the prioritization of the sub-topics in each category with respect to the environment, it was evident that land use and energy

are most valued. Other topics generally receive a high rating of 4/5 however these two were most outstanding with the maximum rating. An explanation of this could be extrapolated from the phases at which the developers are involved is which are the design and development phases namely location analysis and the development of the concept. Similar to the investors, there are key environmental aspects to consider and have a large impact on the project which developers also find relevant. The high value of energy is to a certain extent expected since this is easily quantifiable and has a large impact on the operational costs of the building. Energy can also be used as a marketing tool such as the role it plays in some certifications and the general perception of energy efficient building being better performing in the real estate market.

With respect to the economic factors, investment costs and value stability were identified as the most important amongst the given economical topics by the stakeholders who participated in the survey. These two topics deal with the extreme ends of the lifecycle of the building. Investment costs have to do with the near future or the current state of the situation whereas value stability looks more into the future and how value of the real estate could be retained. In this context value is more to do with economic factors. Since the general polarity of the project developers is towards economic factors followed by environmental factors and lastly social factors, the decision made by the developers or solutions implemented need to ensure above all that investment cost are minimum or worth the high costs and also that they contribute to ensuring a high value of the real estate which could be considered as market resiliency. After assessing the results of the social topics, accessibility, visual comfort, and thermal comfort are the most important topics similarly to the perceptions of the investors.

During the development and design stages, the project developers found sustainability to be of value during the use concept stages, and the preliminary design conceptualization phase. When considering that project developers have the decision-making role during the selection of team members, scheduling, Project organization, and preliminary design development, their influence and power is expected to be very high in the project. In addition to this position and their involvement in the various phases including their prioritisations of sustainability topics, areas of opportunities can be identified in relation to the early stages on the development process and design processes. Their influence stretches from project initiation beyond project operation due their constant involvement in the various project phases and their decision-making

capabilities which increases their effectiveness as they are able to intervene as early as possible in the project.

Property owner

When looking at the results obtained for property owners, slight differences are noticeable compared to investors and developers. In total 4 responses were obtained from the property owners. When assessing the results of the ranking of economic, environmental, and social topics, on average, all topics had an equal rating. This however deviates from the calculated averages of the rating of the individual topics in each category. Although on average when ranking the sustainability categories equal scores are realized, the average of the importance of economical topics was 4, environment 3,9, and social 3,7. Though the differences are minor the results generally show the trends in the perception of the categories of sustainability. Environmental and economical topics have similar ratings with the exception of a single criterion each, which led to the minor variation observed. In the social category most topics are rated between 3 and 4 with respect to their importance. Although it might be difficult to clearly define the difference in importance between the economy and the environment, it is clear that social topics have the least importance. Since economic and social topics have very similar importance levels for the property manager, this signals possibly a willingness to make more compromises compared with the developer and investor. This could be impacted by the fact that there is a high possibility that the property owner is dealing with an existing building and in order to keep it competitive on the market it needs to keep up with the market standards and regulations especially in respect with sustainability as this could be demanded more in the future. This assumption aligns with the results of the property owners with respect to the value of sustainability in the various stages. For them, sustainability is of value in the market analysis stages and land purchase. Regarding the land purchase the same mindset can be observed similar to that of the project developers. Property owner's mindsets towards sustainability is also related to environmental topics. In response to this question, most of the property owners understand sustainability in terms of materials and resources, the energy. To quote one of the responses, a stakeholder mentioned the following:

Respondent 1: „Verwendung von recycelten Produkten; Anwendung von energiesparenden Maßnahmen; Effizienzhaus; nachhaltige Zertifizierungen (DGNB, BREEAM etc.), emissionsarme Ausführung“

Property owners tend to be involved in few project phases however play an essential role in the decision making of the key topics such as the project budget, and preliminary concept. In other phases such as the project schedule they tend to be in the role of a facilitator meaning that they influence the decision being made and play a role in the process structuring of the decision-making process. Some of these results are not expected due to the idea that property owners tend to be similar to investors however, the variations in the results could be explained by the lack of sufficient respondents and the fact that in the development industry, project developers also tend to also represent the values and power position of property owners due to their competence in the management of developments. This means that some property-owners handover their power to the project developers in which the project developer then is able to make decisions on behalf of them. This would as well explain their minimal involvement in the varying project phases as per the results obtained.

Public sector

The results of the public sector contain primarily the input of experts working for the municipality. Firstly, from the various participants that took part in the survey, Sustainability is perceived in a broad sense concerning the environment, the economy and social considerations. Despite this well-rounded perception, most of the responses collected mentioned materials and resources, and energy the most which depicts a large focus on these topics. Several of the respondents gave responses similar to this:

Respondent 1: "Flächensparend, Energieeffizient, Ressourcenschonend"

Although sustainability is perceived like this, the most important topics with respect to environmental topics are energy, land use green and blue infrastructure and mobility. Though these are the most significant topics for the municipality they did not receive the highest rating in comparison to the input from developers for instance whereby the most significant topics received the highest possible score in the applied matrix. Most of the social topics similarly to the economical topics received high rating of importance from the respondents. Some feedback was also received from some participants stating that some of the criteria did not fully apply to them ²

DE: „...allerdings beleuchtet die Studie scheinbar nicht primär die Relevanz der Genehmigungsbehörden für die endgültige Umsetzung von Bauprojekten. Natürlich sind diese nicht maßgeblich am kreativen Prozess und der Wahl der technischen

Möglichkeiten beteiligt, jedoch müssen in der Praxis Vorentwürfe und Projekte allzu oft aufgrund nicht ausreichender Beachtung von Rechtsgrundlagen, die von Gemeinden und Aufsichtsbehörden vollzogen werden, umgeplant oder verworfen werden, sobald Scopingtermine oder Antragsprüfungen stattgefunden haben (Stichwort Bauplanungs- und Bauordnungsrecht). Oft scheitern beispielsweise aus städtebaulich erstrebenswerten, sinnvollen oder zukunftsweisenden Umbauten im Bestand oder Nachverdichtungsplanungen an bauordnungsrechtlichen Mindeststandards wie Abstandsflächen oder Brandschutz”

ENG: *“...however, the study does not seem to shed primary light on the relevance of permitting authorities to the final implementation of construction projects. Of course, they are not significantly involved in the creative process and the choice of technical options, but in practice, preliminary designs and projects all too often have to be rescheduled or discarded due to insufficient attention to legal bases enforced by municipalities and regulatory authorities as soon as scoping meetings or application reviews have taken place (keyword building planning and building code law). Often, for example, conversions of existing buildings that are desirable, sensible or forward-looking from the point of view of urban development, or redensification plans, fail because of minimum standards under building regulations law, such as clearance areas or fire protection.”*

This could explain the lack of differentiation of importance in economy category since it is expected that the municipality is not directly influenced by this (negatively or positively) and therefore the criterion which were included has little effect on them. As expected, most important for the municipality is the fulfilment of the building requirements put in place and conformity with existing regulation related to the land use. This means that in relation to sustainability topics in all three categories, their importance is most likely determined by their incorporation in the various regulations that the municipality puts in place. As long as it is not part of the regulation, it can be assumed that this is not important for the municipality since the integration or lack thereof of the respective sustainability concepts have no impact on the day to day business or potentially the strategy that they have in place. Additionally, their involvement is very limited as they are integrated in the project processes at a distance. The main purpose of the municipality is to ensure that all regulations are respected without fail in the development. In the case that the developer manages to fulfil these requirements the respective body of the municipality can provide the building permits and other relevant

permits. That being said, sustainability concepts outside the regulatory framework have a minimal impact to the municipality

Consultants

Consultants in the project were classified as the individuals that consult on the project and provide guidelines on how the project should be executed. The difference between them and the planners is that the planners then actively execute the work based on the given guidelines. Consultants can essentially assist the clients on the best way to execute the project. It is however possible that the planners can also fulfil the role of a consultant in the project depending on the various factors such as the expectations of the client, the project size and the scope of the project. From the responses received from the various consultants, sustainability is understood primarily from the perspectives of the environment mainly the use of materials and resources, energy, building resiliency and the reuse of buildings through renovations. When comparing the three main categories of sustainability, economy takes precedence over environmental and social aspects. Environmental and social topics had similar average ratings and thus importance. This difference could be attributed by the fact that most consultants consult on the side of the developer and the investor, hence the solutions that are provided need to meet the budget expectations of the clients. If there are any deviations reasons need to be given. With respect to economical topics, investment costs were rated to be the most important with all the other topics receiving a rating of 4/5. When considering the results of the environmental topics, energy was seen to be the most important with a maximum average rating while other topics received scores of 3 or 4. In general for social topics, there was a general perception of all the topics being of equal importance such as accessibility, indoor and recreational quality, safety, and thermal comfort just to name a few. Based on this it can be assumed that in most cases, the manner in which the consultants provide solutions and make certain decisions will be highly driven by the cost factors in order to create better value for their clients. Environmental and social factors can be debated on depending on the current needs and expertise. During the lifecycle of the project, consultants do not have any decision-making power. In all the phases they are involved in they are responsible to provide or highlight the possible solutions. This means that the possibility to influence the project is merely based on the quality of solutions that they provide. It is then up to the project developers, investors and project managers to decide on the best solution to move forward with. At this point

the consultant's power and influence are low though they have a possibility to persuade the client due to their expertise and in depth knowledge of the respective topic at hand.

Planners

Planners constitutes several experts that are responsible for execution the recommendations from the consultants in the form of solutions. This involves architects, landscape planers and MEP planners for instance. Based on the results obtained, planners tend to be involved mostly in the design phases, namely the preliminary design conceptualization phase and preliminary design phase. With regards to these phases, the stakeholders tend to prioritize the social topics. When assessing the responses received with respect to the sub-topics in each of the sustainability categories, economical topics received higher rating followed by social aspects and lastly, the environment. Within the category of economy, investment costs and space efficiency were observed as being the most important topics. In the environmental section, energy was the most important and lastly, when looking at the social topics, no social topics received the highest rating on average. Since the planners are mostly in the 'position of developing solutions based on the guidance of the consultants, they mostly do not have any decision-making power as seen in the results. This is the case for all of the phases they are involved in. In general it can be observed that planners put a lot of importance on mainly the economy taking into account the social aspects. Their influence is limited compared to other stakeholders.

Project Manager

The role of project managers is to coordinate and manage the project with the focus on minimizing costs, ensuring a high quality throughout the project, and ensuring that the project is delivered on time. Based on this, their influence is widespread during the lifecycle of the project. This can be seen by the responses received for the project phases in which they are involved in namely the design phases and development of the design brief. During the use concept phase and the preliminary design conceptualization, social aspects are of importance however, during the preliminary design, economical aspects become more important since the solutions become more concrete and the costs need to be better managed. This can also be observed in the average high ranking of investment costs within the economy category. In general, social topics are perceived with the same importance as most of the scores achieve high scores, however, more variations are present in the environmental topic. Low

importance scores up to 2 were attributed to Biodiversity for example which topics such as energy and resources and material receiving the highest score of 4. Based on their profile, it was expected that their perception of sustainability dealt more with the economical topics however most responses mentioned the environmental topics. Most mentioned topics by the stakeholders were materials and renovation and energy. Little mention of economical topics and social topics were mentioned. This highlights once again similar to other stakeholders that when discussing sustainability, it is mostly about environmental topics.

7.1.3. Power interest matrix: Development

To better understand the stakeholders, a power influence matrix was used according to (Turner, 2009). Developing the power – interest matrix allows the stakeholders to be better compared and categorized which allows for strategies to be adopted (Krips, 2017). By carrying out a power influence matrix, key stakeholder can be identified as well as stakeholders that do not require intensive management among other groups (Turner, 2009). Through the process, potential stakeholders that might be a threat to the success of the stakeholders can also be identified. Several other matrices exist such as the power interest matrix (Johnson et al., 1999), however, for the purposes of the study, a power influence matrix assist in better answering the research question since the influence that the stakeholders have on the project can be better evaluated. Based on the results obtained the following matrices were developed.



Figure 15: Power influence matrix for the development phases

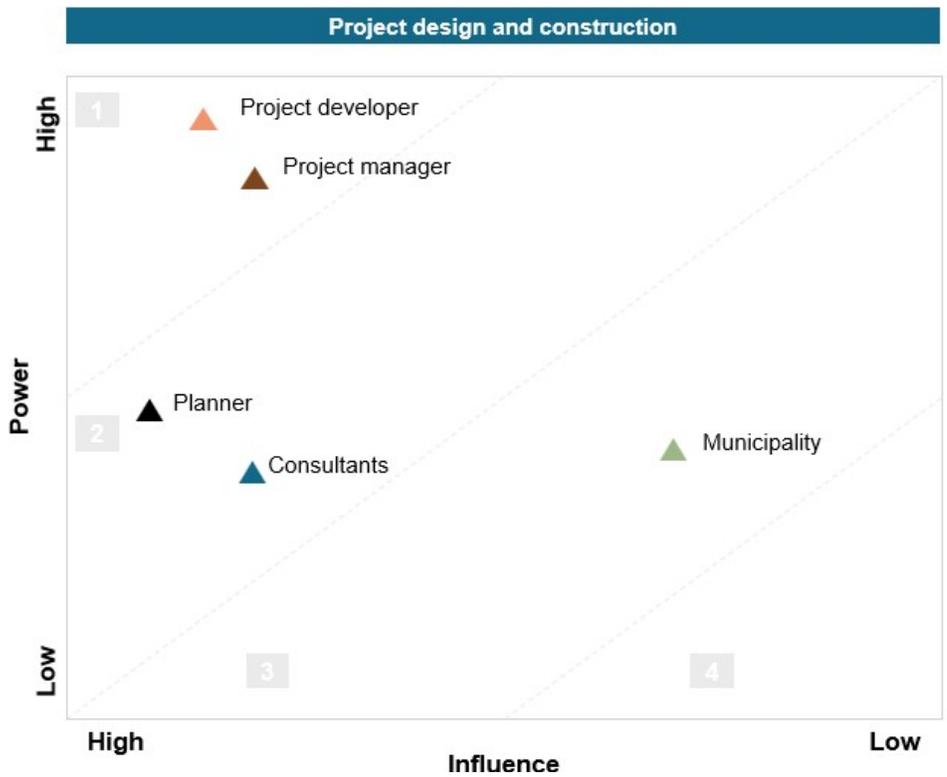


Figure 14: Power influence matrix for design phases

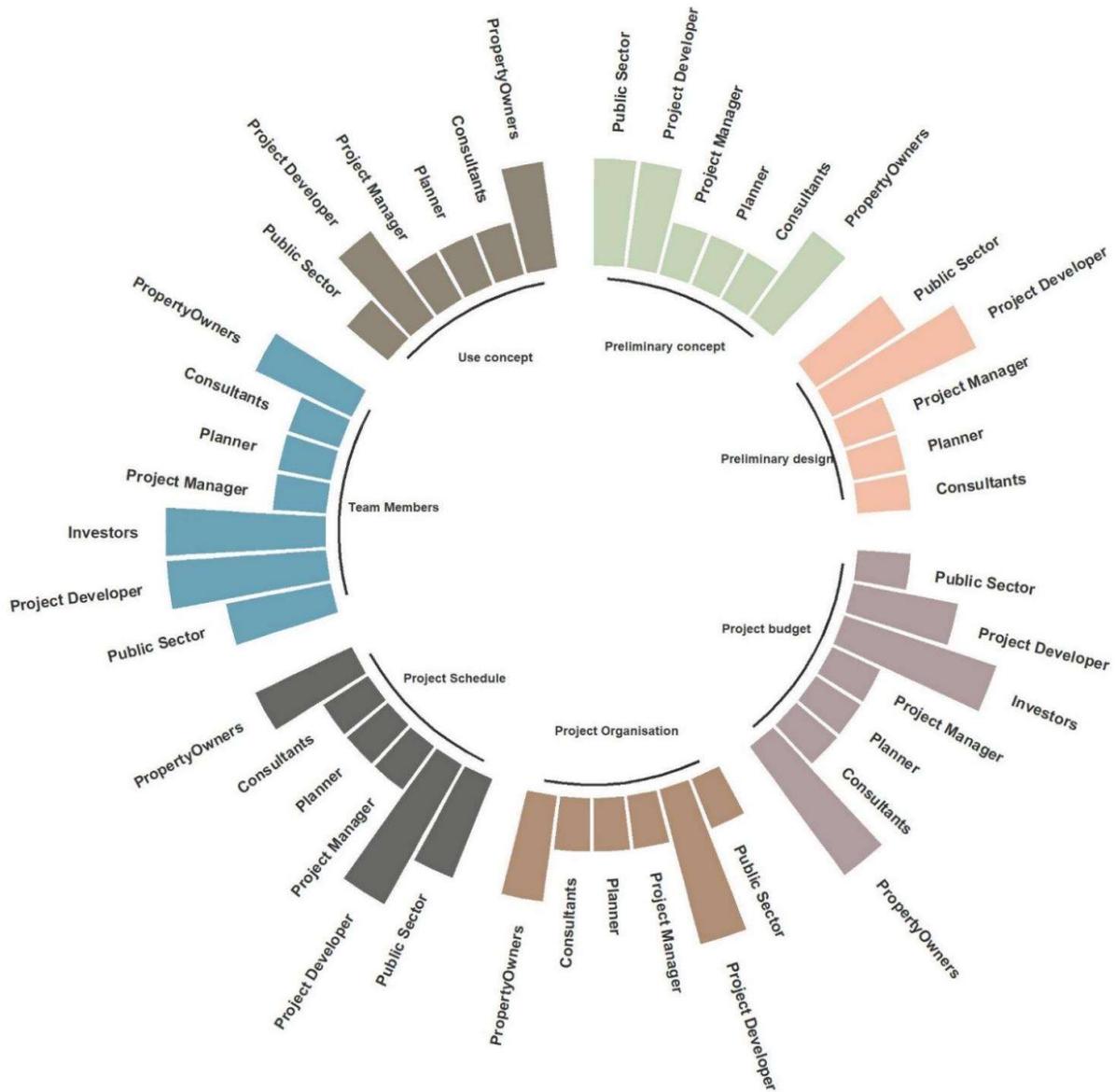


Figure 16: Decision making power sun burst chart

In both the development and early design stages, the dynamics of the stakeholders is different. This is due to both their involvement in the project phases and what role they have in the decision-making processes. During the development phases the main key stakeholder identified were the project developers and the investors. Together, these stakeholders are responsible for making the most important decisions regarding the control of resources, their formal authority in the project due to their hierarchical position in the project, and their control of the decision processes which define power among other categories (Morgan, 2006). Property owners and the municipality are also involved in the development stage. These two stakeholders are classified as those that require

active consultation. This implies that in the stakeholder management strategy and within the project processes, these two groups are not making any critical decisions however they need to be attended to ensure that the decisions are indeed the correct ones and



Figure 17: Amount influence each stakeholder has based on responses from the stakeholders

therefore have some influence in the progression of the project. This aligns as well with the perception of the municipality for example that is more interested in ensuring the new development aligns to their regulation and if not, a compromise needs to be made which they are satisfied with. For property owners, the dynamic shown could be influence once again by the fact that they would possibly have the project developer representing them. In the case they are the direct client, their position would be different. The development stage is very important since the decisions which are mainly strategic with respect to the project marketability for example in a few years or the target groups

are met here. It can be hypothesized that if sustainability is not of importance at this stage and is not well integrated, in the preceding stages it will not be considered or valued or it will be integrated to a minimal standard. There are possibilities for a bottom-up approach whereby the planners would need to propose solutions that implement sustainable features. Since the final decision still remains with the developers and investors a hurdle exists, and this hurdle needs to be identified as early as possible in the development stages.

During the early design phases more stakeholders join the team and there are changes in the varying powers and influences that some of the stakeholders have. The key stakeholders identified from the power influence matrix were the project developers and the project managers and consultants need to be actively addressed for consultation as they provide the various solutions as a basis for the decisions to be made. This also applies for the municipality since the solutions are more detailed and therefore due to the interest of the municipality, their input is relevant though they have no direct influence on the decisions made. They do have the power to assert their requirements due to their positions as a regulating body and therefore holds high power.

7.2. Literature review: Value creation

The main goal of the literature review was to be able to answer the main question:

RQ2: *How can sustainable value for the environment and stakeholders be created in development and design?*

As a sub question the following question was of interest to better understand value:

“How is value created in the building sector?”

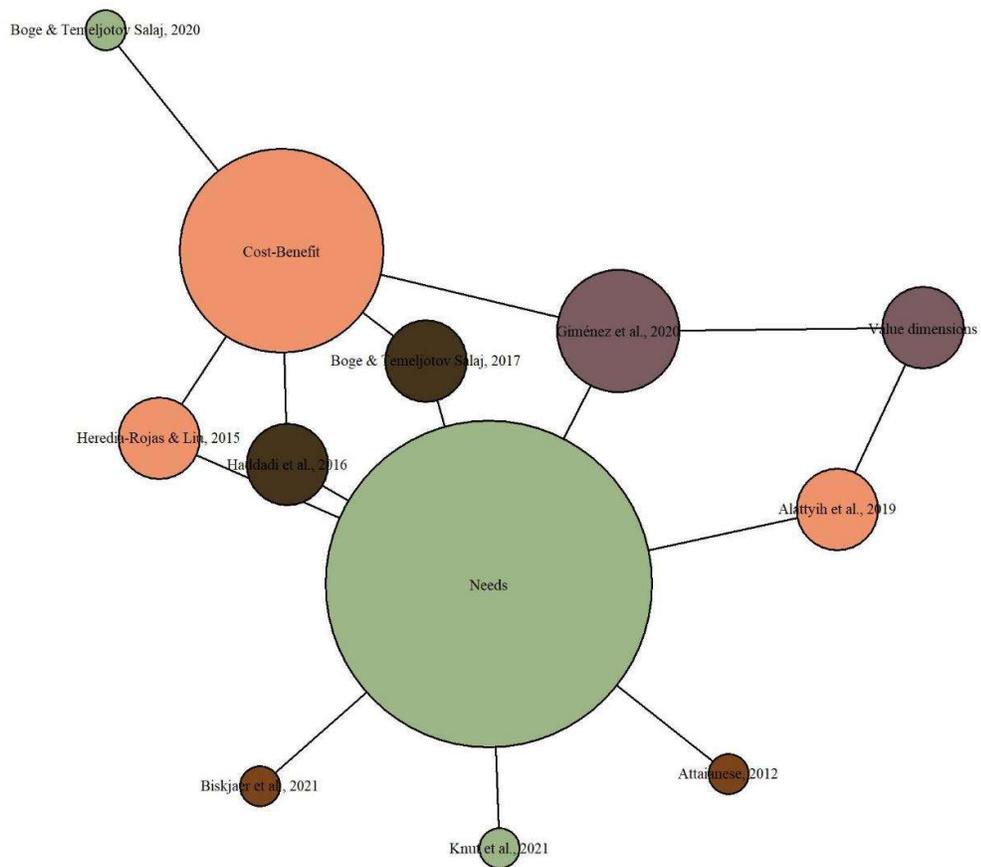


Figure 18: Literature review papers that mention themes of value

The results of the literature research aim to shed some light on how value is created and how the stakeholders that are involved can contribute to the better creation of value by taking into consideration their own needs and those of the environment which could also be referred to environmental value. Due to time constraints, the literature review

deals with a rough assessment of the varying definitions and frameworks on the creation of value to give a general overview on the discussions of value. Based on the results obtained a definition of value was developed and applied in the context of this thesis: When performing the review, a total of 15 papers were selected based on the title, key words, abstract and the conclusion. The main themes identified in the analysis of the research where the concept of value being related to:

- Needs
- Cost optimization (cost- benefit ratio)
- Value dimensions

From the sample of 15 papers, 10 were identified to define value in great detail. In the following section, each topic is addressed in better detail to give a better understanding of what value is which will aid in the definition of value in the context of the thesis.

7.2.1. Needs

In total the idea of value in relation to the client or user needs is addressed (Biskjaer et al., 2021; Giménez et al., 2020). In various cases value is defined as the fulfilment of the customer needs (Alattiyh et al., 2020; Attaianesse, 2012; Biskjaer et al., 2021; Boge & Temeljotov Salaj, 2017; Giménez et al., 2020; Haddadi et al., 2016; Heredia-Rojas & Liu, 2015; Knut et al., 2021). In the context of the building sector the clients could be the developer, the investor or the hypothetical user or buyer of the building either at the end of the construction phase or after the holding period of the property. In addition to fulfilment of needs (Haddadi et al., 2016) goes a step further to relate values with costs and time. First of when looking at costs, this goes a bit into the direction of cost and benefit. It can also be understood that for value to really be appreciated by the client, their needs need to be fulfilled at a maximum specific price to which they relate their needs to. An example of this could be a case that solar panels need to be installed on the roof of the building as part of the energy concept. This can be a need for the client however, if this comes at a cost that is above their maximum specific price which they attach to the benefit of installing the solar panels, then there is the potential that no value is generated for them in the strict sense. The costs need to equal the desired need also economically valued at a certain price. To quote, “*Value is only meaningful when it is expressed in terms of a specific product e.g., a building, at a specific price at a specific time*” (Haddadi et al., 2016). This means that values have a time component. In order to

realise value, the needs should be fulfilled at the required point in time. Another way of looking at needs and understanding them better is, the fact that these needs could be implicitly incorporated in the decision making as (Biskjaer et al., 2021) alludes to by that values are what the needs and aspects that matter when making decisions.

7.2.2. Value dimensions

An interesting component of value is the way that it is formulated. As understood in the previous section, value is about fulfilling the needs at a certain price and time (Haddadi et al., 2016). Though not mentioned in literature this draws similarities to the focus on project management which is cost time and quality. It could be possible that quality is also an element of value since this could also be part of what could matter in the decision-making process. In order to better understand the topics, needs will be used to refer to values. Needs exist in various forms/dimensions such as economic, cultural and social (Alattiyih et al., 2019). Economical needs could be understood to mean the economic objectives of the project with respect to the investment costs and the building value at the end of the construction (Haddadi et al., 2016). Social needs could be understood in terms of the need to socialize or the need to privacy which are influenced by cultural norms (Laurell-Stenlund, 2010). The same could be understood for cultural needs. Since from (Haddadi et al., 2016) it is understood that value/needs should be put in perspective with respect to price and time and potentially quality of fulfilment, needs are dynamic mainly due to the time component. Additionally, since the economy is constantly changing and the expected quality from other stakeholder changes with time, the needs themselves are also dynamic and change depending on the context. Based on this it is almost impossible to have general needs since these should be considered within the existing context at a particular time. The needs today may not be the same need tomorrow due to cultural and economic changes.

Economic, social and cultural dimensions can also vary per individual or cooperation in particular the social and cultural needs (Attaianese, 2012). (Laurell-Stenlund, 2010) states that “*Values are grounded in personal beliefs, social norms, and rules developed in society or related to specific groups i.e., they are culturally conditioned*”. This same notion of individualism in relation to value is also addressed by (Heredia-Rojas & Liu, 2015) whereby it is further reiterated that needs are developed for the respective perspective of the individual.

In summary, there are several dimensions in which needs (values) can be categorized such as economic, social and cultural whereby the formulation of these needs is highly dependent on the individual or the cooperation. This depends on the intrinsic personal beliefs, social norms and rules and regulation developed by society.

7.2.3. Cost benefit

Based on the sample assessed, value is also understood in terms of costs and benefits. Various authors address this in different whereby (Jensen et al., 2005) relates value to the processes and inputs that create stakeholder wealth. The idea of optimizing costs and benefits, is addressed in the scope of realizing the best value. This is also presented in a different form whereby value is seen as a function (Boge & Temeljotov Salaj, 2017; Giménez et al., 2020; Haddadi et al., 2016; Heredia-Rojas & Liu, 2015) of costs and benefits. In the field of construction and development there are different expertise and various requirements which need to be taken into account during the decision-making processes. In order to better understand the priorities, it could be theorized that the values need to be measured coherently (Alattiyih et al., 2019) either based on the capital expenditures (CAPEX) or any other common rating. Since this can be understood by all stakeholders in the project this would be logical to relate all the values/needs based on required costs and expected benefits. By measuring the values/needs, they can be weighed against each other and used a basis for decision making which would be useful during the project lifecycle. Challenges that may arise is that, since values/needs can be categorised differently such as economic, cultural and social, it might not be possible to adequately quantify the benefits against the costs for certain topics (Biskjaer et al., 2021) which could negatively impact them such as social and cultural topics which tend to be abstract. Based on the available data from the research papers value can be defined as following:

Values are the needs of individuals or groups of individuals which are a result of the various external and internal factors that influence of have influenced the specific individuals or groups of individuals. These needs are defined as a function of time, economical costs, resource input, and quality.

7.2.4. Value management

Value management is the overarching concept of in which value creation exists. According to (Alattyih et al., 2019), the main purpose of value management is to achieve the desired value with lower prices without negatively impacting the function and quality of the building. (Janani et al., 2008) defines value management as the process of delivering value throughout the project lifecycle. Essentially it could be said that value management is the overall strategy for maximizing value for the client. Value management is also known as value analysis, value methodology, or value engineering (National Audit Office, 2004). This varies with the concept of value management by in which a distinction between value management, value engineering and value analysis is made, since this disparity could potentially create a conflict in the understanding the understanding of value. The important aspect in this discussion is the knowledge that there is a strong relation between value management, value engineering and value analysis which are components of the overall value creation system (National Audit Office, 2004). The value management structure is value engineering, which also considered as management tools to deliver maximum value for the client such as the tools such as lean management, agile management, virtual design and construction (Vegard, 2017), and target value construction among others.

A value management strategy is structured around the client's value system as pointed out by (Alattyih et al., 2019) the value system or value creation system of a client is comprised of several elements in which the specific values can be structured and categorised. The value creation system or value system is therefore the combination of the various values that the clients have, structured in the relevant categories. (Kelly & Duerk, 2002) propose 7 elements of the value system: time, CAPEX, environment, exchange, esteem, and fitness for purpose. These elements of the value system, similarly to value are unique to the client as can be observed by a different varying list of performance variables by (Kelly, 2007), whereby 9 performance variables are identified. The process of identifying the value (value system) of the clients is also important in the value management strategy. (Giménez et al., 2020) identified 4 main methods based on a literature review, on capturing the value of stakeholders: Kano model, Quality function deployment, owner value interest, and stated references. There is also an importance within value management to assess the creation of value by implementing performance variables such as economic performance, functional performance, physical performance, and service performance. Other non-performance indicators also exist such as time, quality, flexibility, productivity, environment and

sustainability, and social responsibility (Arena, 2014) This concept of measuring value is also addressed by (Giménez et al., 2020) in which there is importance stressed on the need to measure value through various metrics or performance variables as stated by (Alattiyh et al., 2020) to ensure that value is generated for the customer. Various methods for measuring value creation throughout the project lifecycle as well as understanding the value system of clients exist such as the Kano model or the cost benefit analysis. Value assessment methodologies are also a branch of value management which are also referred to as value analysis models which assist in measuring value throughout the project lifecycle (Alattiyh et al., 2020).

<p>Value management (Abuzeinab et al., 2016; Giménez et al., 2020; Haddadi et al., 2016; Heredia-Rojas & Liu, 2015; Knut et al., 2021)</p>	<ul style="list-style-type: none"> • Measure and report on the progress of fulfilling the objectives and realizing value • Set up project evaluation strategies and methodologies • Set up project procurement strategies and delivery models that align with the chosen objectives • Focus on the management for stakeholders • Ensure holistic management focusing on project governance and policies, and stakeholder functions and roles • Ensure optimized communication in the team
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Table 5: Key elements of value management

7.2.5. Value creation

As can be understood above the concept of value and value creation is rather complex due to the various elements attached to it. As stated above, value management is the overarching system in which value is captured and delivered. Based on the knowledge that value management involves structuring and organizing the various processes that can maximise the value for the client, an overall value creation process/framework can be developed. The phases can be structured as seen in the table below:

Value exploration	(Biskjaer et al., 2021; Giménez et al., 2020)
Value negotiation and formulation	(Giménez et al., 2020)
Value design/flowdown	(Giménez et al., 2020)

Value generation	(Alattiyh et al., 2019; Biskjaer et al., 2021; Giménez et al., 2020; Heredia-Rojas & Liu, 2015; Laurell-Stenlund, 2010)
Value delivery	(Laurell-Stenlund, 2010)
Value delivery	(Laurell-Stenlund, 2010)

Table 6: Elements of value creation based on literature studies

Vital throughout the process is the continuous assessment and evaluation of the value integration to ensure that the values are comprehensively incorporated into the design and end result with the use of various methodologies applicable to the process. Focus should not only be on economic factors, but also other non-tangible factors as illustrated by (Chan et al., 2002). (Haddadi et al., 2016) propose a conceptual framework for value creation. There is a strong relation with the identified elements of value creation discussed earlier. In the first phase of project start-up/project initiation the values of the clients are captured. The clients in this case could be the owners and/or the users. By capturing their values and understanding their value system, the values could be negotiated either through prioritizing the values for purposes of decision making or in the case of various stakeholders, compromising between the values. Once the value system for the project has been finalized, these values need to be clearly formulated in a design brief for example to ensure clarity amongst all the relevant parties. Moving on to the next phase, which is the design stage, value needs to be designed whereby the requirements stated in the first stage need to be incorporated into the design. This is an iterative process which includes evaluation of the design based on the performance variables in which the relevant value analysis methods are applied. These performance variables could be environmental, social, economic or physical. Following this phase, during construction, value is then delivered and lastly realized during the use phase. The results need to be measured to ensure that the value has been well captured. Taking into account the results from the literature review concerning value management, the value creation framework of (Haddadi et al., 2016) can be adopted resulting in the framework shown in Appendix F.

<p>Value exploration (Sources refer to table 6)</p>	<ul style="list-style-type: none"> • Align and prioritize financial and environmental objectives • Consider the whole lifecycle of the building in setting objectives considering the long term and short-term impacts • Identify threats to value creation • Align objectives with physical asset characteristics (impact on value of characteristics such as structural plan and floor plan) • Identify threats to value creation
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Table 7: Elements of value exploration

<p>Value negotiation and formulation (Sources refer to table 6)</p>	<ul style="list-style-type: none"> • Consider the financial and environmental impacts to the building's whole life cycle • Proactively propose green values/strategies • Develop objectives and targets in collaboration with relevant stakeholders • Outline required key resources • Formulate objectives as clear as possible (provide quantitative information where possible) • Set up anchor targets in the early design stages • Formulate targets in collaboration with relevant stakeholders • Set value and objectives based on the lifecycle stages of the building
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Table 8: Elements of value negotiation and formulation

<p>Value design/flowdown (Sources refer to table 6)</p>	<ul style="list-style-type: none"> • Address knowledge gaps within the organization • Consider the whole lifecycle of the building • Involve the relevant stakeholders in the process
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Table 9: Elements of value design/flowdown

8. Stakeholder action points

According to the results of the stakeholder analysis, economical topics are the most important amongst economic and social issues. This corresponds with most research concerning value whereby a lot of focus is attributed to economical topics. This polarity towards economy does not however mean that the environmental and social topics are not of value. In the context of sustainable buildings with focus on environment aspects, it is therefore important to ensure that environmental value for the stakeholders is adequately captured as early as possible in the project i.e., Project initiation phase. The evaluation of these values in the different project phases according to the value creation framework is important as this allows for a more directed decision-making processes and enhances the value management. By understanding the various environmental values of the stakeholders and their roles and influence in the design project, taking into account the value creation framework, the following action points for each stakeholder can be recommended. These recommendations aim to ensure that the value management process is optimised, and shifts focus more on environmental parameters to enable their capture, assessment, including their implementation in the design and their realisation at the end of the project lifecycle and beyond.

8.1.1. Project developers

<u>Action point</u>	<u>Value creation phase</u>
Set environmental sustainability targets during the project initiation phases	Value exploration/value capture
Evaluate impact of environmental solutions to economical parameters	Value exploration/value capture
Incorporate environmental aspects in risk and competitor analysis	Value exploration/value capture, value negotiation & formulation
Assess “quick wins” early in the project (elements that provide a large output based on performance variables with minimal resources required)	Value negotiation & formulation
Integrate climate risk assessments in the project	Value negotiation & formulation
Decide on certification standards as a drive of value	Value negotiation & formulation

Carry out stakeholder analysis	Value design/flow down
Integrate sustainability within procurement processes	Value design/flow down
Establish incentives for the design teams for maximising environmental value	Value design/flow down
Make use of acknowledged decision-making tools in the project	Value design/flow down

Table 10: Project developer action points

8.1.2. Investors

<u>Action point</u>	<u>Value creation phase</u>
Set environmental sustainability targets during the project initiation phases	Value exploration/value capture
Evaluate impact of environmental solutions to economical parameters	Value exploration/value capture
Assess “quick wins” early in the project (elements that provide a large output based on performance variables with minimal resources required)	Value negotiation & formulation
Incorporate environmental aspects in risk and competitor analysis	Value exploration/value capture, value negotiation & formulation
Incorporate environmental aspects as part of economical valuation of the building	Value negotiation & formulation
Decide on certification standards as a drive of value	Value negotiation & formulation

Table 11: Investor action points

8.1.3. Project managers

<u>Action point</u>	<u>Value creation phase</u>
Carry out stakeholder analysis (external and internal) on the selected team.	Value design/flow down
Integrate sustainability in procurement	Value design/flow down

Sensitise team members on the environmental sustainability targets and prioritisation	Value design/flow down
Select fitting management strategy based on the stakeholders	Value design/flow down
Measure and management the fulfilment of sustainable objectives in the process against costs	Value design/flow down

Table 12: Project managers action points

8.1.4. Planners

<u>Action point</u>	<u>Value creation phase</u>
Assess the ambition levels of the stakeholders with respect to sustainability	Value design/flow down
Use and apply guidelines on sustainable construction	Value design/flow down
Utilise decision making tools in design with the assistance of BIM, Parametric design, LCA, and LCC	Value design/flow down

Table 13: Planners action points

8.1.5. Consultants

<u>Action point</u>	<u>Value creation phase</u>
Set environmental sustainability targets during the project initiation phases	Value exploration/value capture
Assess “quick wins” early in the project (elements that provide a large output based on performance variables with minimal resources required)	Value negotiation & formulation
Assess climate risks on the potential building project	Value negotiation & formulation
Assess the ambition levels of the stakeholders with respect to sustainability	Value design/flow down
Utilise decision making tools in design with the assistance of BIM, Parametric design, LCA, and LCC	Value design/flow down

Table 14: Consultants action points

9. Discussion

9.1.1. Stakeholders

The results of the stakeholder analysis provided an overview on the key actors in the construction sector. The perceptions toward sustainability were more oriented toward economic factors in comparison to the environmental and social aspects. Some variation upon further analysis was observed across many stakeholders in how they ranked or prioritised three branches of sustainability. This was due to the way the questions were structured. In one section they were asked to rank the environment, economy, and social sustainability. Later on in the questionnaire they were also asked to rate the importance of the sustainability topics for each element (environment, economy, social). The average values in each element showed a variance in their general importance. The main variances were observed between the environment and social, since these topics are also much related to personal motivations. On the other hand, in both sections of the questionnaire, the economy was always taking precedence over the environment and social aspects. The prepared lists of these factors were generated based on various sources especially the criteria outlined in the DGNB. Though this provided detailed information on what to consider with respect to sustainable features for the building there was a limitation identified regarding the comprehensiveness of the lists. Though the results provide a good insight on what is seen as more important than others, an in-depth understanding of the value drivers is required to which this thesis does not fully address.

The main value of the results is obtained from understanding who the relevant stakeholders are and which areas can be looked at to make an impact. The main challenges identified in the analysis of the stakeholders were the lack of sufficient participants in the study as well as a comprehensive understanding of their motivations. Though the questionnaire tried to deepen the understanding on how stakeholders perceive sustainability and value it, the reasons behind these perceptions were not clear. This was attributed by the fact that the questionnaire had been restricted in its boundaries. A step further would be to hold workshops on the basis of the identified information to identify any possible variances with a different group of stakeholders and assess the main drivers. Emphasis should be placed on the Project manager, Project developers and Investors due to the power they have. Moreover, the interaction between

economic factors (Investment costs) and environmental factors (Energy, and Resources and materials) identified in this paper.

9.1.2. Value creation

The study showed that values is about the needs of the individual. Each value system that an individual has is based on the context, social, economic, politics and more. This implies as well that values are dynamic and change with time. Additionally, it was also introduced that true value needs to take into account the environment. This notion also goes hand in hand with the results obtained from the stakeholders whereby there is a high importance placed on both environmental and economical topics. It is however also relevant to understand from the stakeholders themselves what they understand as value. This would highlight similarities or differences between industry and research on the definition of value and provide input on the further discussion of it in the development industry especially in conjunction with environmental sustainability

The research focused on a limited sample of literature due to the extent of the research and limited time and therefore, a possibility does exist whereby some relevant papers were excluded which could offer more insight into the topic. The study also highlighted the main components of the value creation system namely value exploration, value negotiation, value formulation, value negotiation and formulation, value delivery, value realisation. This is important to realise since within the process of development and construction it is possible that core values are neglected and not properly managed though this needs to be researched further. A brief analysis of how the value creation framework was carried out, though not exhaustive. In principle it is important to understand how each of the processes in the development and design phases contribute to creating value for the stakeholders and the environment. This points in the direction of scrutinizing the current status quo and rethink how projects could be structured with focus on value.

9.1.3. Stakeholder action points

In answering the final research question of what the stakeholders can do to create value, a set of recommendations were proposed for the relevant stakeholders according to the project phases. The actions are a synergy of the key stakeholder's power and influence in the project, and perceptions of sustainability. This knowledge is focused on assisting the key stakeholders to create better value in the project since their position allows them to have a much greater influence. The results are based strictly on the findings from the

literature review and the questionnaire. It can therefore be stated that the recommendations given may not be exhaustive due firstly to the multidimensionality of values and as well as the individualism and uniqueness of values and projects. The list does however allow for the creation of an open platform of thought to inspire the stakeholders on what is possible and to also create a starting point on the strategic planning of the project processes to create value. To further building onto these recommendations for action for the stakeholders it is necessary to engage with stakeholders 1 on 1 from different backgrounds and also assess various projects with focus on value creation for the stakeholders and the environment to better understand the system in which the stakeholder can act.

In summary the paper provides the starting points in the thinking of value creation in the development industry with focus on value creation for stakeholders and value creation of the environment. The results serve to initiate a discussion on how the real estate sector should be organised and structured deviating possibly from the status quo to realise more environmentally sustainable buildings. Social topics were not discussed in great detail in the paper. It is an important issue to tackle since it is part of the building sector. Despite most stakeholders prioritize the economy and environment, it is important to research of how social value can be created and understand the relationship between them with environmental and economical values. This would also lead to a more holistic perception of development and how policies, decision making processes and design processes could be improved.

10. Conclusion

The topic of value creation in the building sector is quite complex due to the many facets it has as discovered in the existing literature. Value is a topic that is not easily definable since it is highly specific however, this thesis highlights the possibility of understanding value in the strict sense in relation to the needs of the stakeholders. In the research presented, the main take out is that value is unique and needs to be defined by each stakeholder individually. Since construction projects are collaborative there is a challenge how these values can be reconciled. Questions exist with respect to how the overall value system for the project is developed. Based on the stakeholder analysis, the creation of this value system within the development industry is mainly influenced by the key stakeholders based on the power that they have within the project. There is potential to further this work by understanding in good detail the value system of each stakeholder with respect to what drives them beyond the focus of sustainability as carried out in this thesis. Knowledge of the value system of the stakeholder in its entirety will assist in the improved management of the stakeholders and help understand how sustainable values could even be better structured and prioritised within the projects. As understood from the literature review, there is an importance in assessing and measuring value throughout the project. This could be quantitative and or qualitative since such information is relevant for the stakeholder to make the required decisions. Further questions that arise here are:

- What does value mean for the stakeholders?
- What values do they have when involved in construction projects i.e., what are their needs?
- What is their value system?
- How much are they willing to compromise with other stakeholders?
- What makes other values more important than the others

Such questions were not able to be assessed in the context of this research but creates a basis especially in the context of sustainable building, how the stakeholders perceive value. It is not relevant to discuss value without relating it to the stakeholders since value is highly unique and specific to each stakeholder's needs. Value management is a key

topic which also needs to address in greater detail with respect to how values are measures and weighed against each other. This is relevant not only for the stakeholders that make key decisions, but also for the project manager whose main role is to ensure that maximum value is achieved in the lifecycle of the project. Value is a function of time and therefore there is a need to develop value systems in relation to time. This is vital since in the context of construction, the stakeholder who will realise the value in the future will change depending on the strategy. An example of this could be how the client will develop a building with focus on future investors who will acquire the building as soon as the project is completed whereby the investors that acquire would like to rent out the property. This means that the target customer is potentially both the investor and the future tenants. By considering the future, the current value could be determined. How this can be done clearly is a matter of developing the correct methodologies to capture time related value.

Based on the results presented in this thesis, the stakeholder can better understand how to create sustainable value that not only considers their own needs but also those of the environment. The solutions proposed are theoretical despite some being already applied in practice. Within the development industry, further work needs to be carried out to understand the interactions between the various markets. This is necessary since the values of the various sectors flow and intertwine with each other. This would allow for a more comprehensive integration of sustainability in the key process and alter the way the real estate sector is perceived. A system understanding is required since for example with project developers and investors, the question of how real estate valuation is carried out possess a potential challenge with respect to including sustainable aspect especially regarding environmental components. This implies that there is need to further develop or adapt valuation processes to unite both economic and environmental aspects together.

11. Bibliography

- Abuzeinab, A., Arif, M., Kulonda, D. J., & Awuzie, B. O. (2016). Green business models transformation: evidence from the UK construction sector. *Built Environment Project and Asset Management*, 6(5), 478–490. <https://doi.org/10.1108/BEPAM-10-2015-0060>
- Alattiyh, W., Haider, H., & Boussabaine, H. (2019). Development of value creation drivers for sustainable design of green buildings in Saudi Arabia. *Sustainability (Switzerland)*, 11(20). <https://doi.org/10.3390/su11205867>
- Alattiyh, W., Haider, H., & Boussabaine, H. (2020). Risk factors impacting the project value created by green buildings in Saudi Arabia. *Applied Sciences (Switzerland)*, 10(21), 1–32. <https://doi.org/10.3390/app10217388>
- Alda, W., & Hirschner, J. (2016). *Projektentwicklung in der Immobilienwirtschaft - Grundlagen für die Praxis*. Springer Berlin Heidelberg.
- Álvarez, J. M., & Roibás-Millán, E. (2021). Agile methodologies applied to Integrated Concurrent Engineering for spacecraft design. *Research in Engineering Design*, 32(4), 431–450. <https://doi.org/10.1007/s00163-021-00371-y>
- Arena, M. (2014). Value Drivers. In M. Arnaboldi, G. Azzone, & E. Giorgino, M. (Eds.), *Performance Measurement and Management for Engineers* (pp. 51–68). Academic Press.
- Attaianese, E. (2012). A broader consideration of human factor to enhance sustainable building design. *Work*, 41(SUPPL.1), 2155–2159. <https://doi.org/10.3233/WOR-2012-1020-2155>
- Bayerische Ingenieurekammer-Bau. (2021). *Honorarordnung für Architekten und Ingenieure novelliert*. <https://doi.org/10.51202/0042-1758-2020-48-29>
- Biskjaer, M. M., Kamari, A., Jensen, S. R., & Kirkegaard, P. H. (2021). Exploring blind spots in collaborative value creation in building design: a creativity perspective. *CoDesign*, 17(4), 374–391. <https://doi.org/10.1080/15710882.2019.1654521>
- Boge, K., & Temeljotov Salaj, A. (2017). Practice vs theory: short-term financials trumps long-term value creation. *Journal of Corporate Real Estate*, 19(3), 186–204. <https://doi.org/10.1108/JCRE-06-2016-0022>
- Bogenstätter, U. (2000). Prediction and optimization of life-cycle costs in early design. *Building Research & Information*, 28(5–6), 376–386. <https://doi.org/http://dx.doi.org/10.1016/j.autcon.2012.02.008>

- Booth, A., Sutton, A., & Papaioannou, D. (2016). *Systematic approaches to a successful literature review* (2nd ed.). Sage.
- British land. (2022). *Sustainability brief for acquisitions*.
<https://doi.org/10.36548/jaicn.2022.2>
- Chan, A. P. C., Scott, D., & Lam, E. W. M. (2002). Framework of Success Criteria for Design/Build Projects. *Journal of Management in Engineering*, 5, 437–448.
- Chandramohan, A. Narayanan, S. L., Gaurav, A., & Krishna, N. (2012). Cost and time overrun analysis for green construction projects. *International Journal of Green Economics*, 6(2), 167–177. <https://doi.org/doi:10.1504/IJGE.2012.050340>
- Creswell, J. W. (2012). Planning, conducting, and evaluating quantitative and qualitative research. In *Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research*. University of Nebraska Lincoln.
- Diederichs, C. J. (2006). *Immobilienmanagement im Lebenszyklus* (2nd ed.). Springer Berlin Heidelberg.
- ESA/ESTEC Requirements and Standards Division. (2017). ECSS-M-ST-10C Space project management. In *Project planning and implementation*.
- Freeman, Edward. R. (1984). *Strategic management*. Pitman.
- Gander, M. (2015). *AussenraumQualitäten - AussenraumRealitäten: Gestaltungsprinzipien für Planung und Architektur*.
- Garton, K., Swinburn, B., & Thow, A. M. (2021). Who influences nutrition policy space using international trade and investment agreements? A global stakeholder analysis. *Globalization and Health*, 17(1), 1–16. <https://doi.org/10.1186/s12992-021-00764-7>
- Gervásio, H., Santos, P., Martins, R., & Simões da Silva, L. (2014). A macro-component approach for the assessment of building sustainability in early stages of design. *Building and Environment*, 73, 256–270. <https://doi.org/10.1016/j.buildenv.2013.12.015>
- Giménez, Z., Mourgues, C., Alarcón, L. F., Mesa, H., & Pellicer, E. (2020). Value analysis model to support the building design process. *Sustainability (Switzerland)*, 12(10). <https://doi.org/10.3390/su12104224>
- Haddadi, A., Johansen, A., & Andersen, B. (2016). A Conceptual Framework to Enhance Value Creation in Construction Projects. *Procedia Computer Science*, 100(1877), 565–573. <https://doi.org/10.1016/j.procs.2016.09.196>

- Heredia-Rojas, B., & Liu, L. (2015). *Value creation in construction projects: current approaches and insight from stakeholder theory for future directions* (Issue July). <https://doi.org/10.13140/RG.2.1.2111.3441>
- Hirschner, J. (2007). Technisches Controlling bei der Projektentwicklung. In *Schriftenreihe des Instituts für Baubetriebslehre der Universität Stuttgart* (Vol. 47). Bauwerk Verlag GmbH.
- Isenhöfer, B. (1999). Strategisches Management von Projektentwicklungsunternehmen. In *Immobilienökonomie* (8th ed.). Rudolf Müller Verlag.
- Janani, R., Chakravarthy, P. K., & Raj, D. R. R. (2008). A Study on Value Engineering & Green Building in Residential Construction. *Int. J. Civ. Eng. Technol*, 9, 900–907.
- Jensen, P. A., van der Voordt, T Coenen, C., Felten, D., Lindholm, A.LBalslev Nielsen, S., & Riratanaphong, C Pfenninger, M. (2005). In search for the added value of FM: what we know and what we need to learn. *Facilities*, 30(5), 199–217.
- Joana Bonifácio, A. (2017). *Early stage design methodology to ensure life cycle sustainability of residential buildings*. August, 282. <http://hdl.handle.net/1822/48590>
- Johnson, Scholes, G., & Kevan. (1999). *Exploring Corporate Strategy*.
- Kelly, J. (2007). Making client values explicit in value management workshops. *Construction Management and Economics*, 25, 435–442.
- Kelly, J., & Duerk, D. (2002). Construction Project Briefing/Architectural Programming. In *Best Value in Construction*.
- Keogh, G. (1994). Use and Investment Markets in British Real Estate. *Property Valuation and Investment*, 12.
- Killian, J., & Pammer, W. J. (2003). *Handbook of conflict management*. Marcel Dekker.
- Knoth, K., Fufa, S. M., & Seilskjær, E. (2022). Barriers, success factors, and perspectives for the reuse of construction products in Norway. *Journal of Cleaner Production*, 337(July 2021), 130494. <https://doi.org/10.1016/j.jclepro.2022.130494>
- Knotten, V., Svalestuen, F., Hansen, G. K., & Lædre, O. (2015). Design Management in the Building Process - A Review of Current Literature. *Procedia Economics and Finance*, 21(2212), 120–127. [https://doi.org/10.1016/s2212-5671\(15\)00158-6](https://doi.org/10.1016/s2212-5671(15)00158-6)
- Knut, B., Amin, H., Ole, J. K., & Alenka, T. S. (2021). Facilitating Building Projects' Short-Term and Long-Term Value Creation. *Buildings*, 11(8), 1–26. <https://doi.org/10.3390>

- Kochendörfer, B., Liebchen, J., & Viering, M. (2018). Projekt-Management. In *Bau-Projektmanagement* (5th ed.). Springer Vieweg. https://doi.org/10.1007/978-3-663-13018-5_3
- Kohler, N., & Moffatt, S. (2003). Life-cycle analysis of the built environment. *UNEP Industry and Environment*, 26, 17–21.
- Köster, G. N. (2021). Grundlagen der Projektentwicklung. In *Projectentwicklung von Immobilien* (pp. 11–20). Springer. <https://doi.org/10.1007/978-3-658-35876-1>
- Kovacic, I., & Zoller, V. (2015). Building life cycle optimization tools for early design phases. *Energy*, 92(3), 409–419. <https://doi.org/http://dx.doi.org/10.1016/j.energy.2015.03.027>
- Krips, D. (2017). *Stakeholdermanagement* (2nd ed.). Springer Berlin Heidelberg. <https://doi.org/https://doi.org/10.1007/978-3-662-55634-4>
- Krosnick, J. a., & Presser, S. (2010). Question and Questionnaire Design. In *Handbook of Survey Research*. <http://books.google.com/books?id=mMPDPXpTP-0C&pgis=1>
- Kunz, J., & Fischer, M. (2009). Virtual Design and Construction: Themes, Case Studies and Implementation Suggestions. In *CIFE Working Paper 97*. Stanford, CA.
- Lam, P. T. I., Chan, E. H. W., Chau, C. K., Poon, C. S., & Chun, K. P. (2009). Integrating green specifications in construction and overcoming barriers in their use. *Professional Issues in Engineering Education and Practice*, 135(4), 142–152.
- Laurell-Stenlund, Kristina. (2010). *Value creation in development and construction of public buildings the case of houses of culture*. Luleå University of Technology.
- Lee, M., Cheah, W., Lau, S., Lee, X., Abdullahi, A., & Wong, S. (2020). "Evaluation of practicality of virtual design and construction (VDC) with 5D building information modelling (BIM) through a case study. *Materials Science and Engineering*.
- Lerner, L. (2022). *Bauliche Nachverdichtung und Außenraum: Systemische Untersuchung der relevanten Einflussparameter und ihrer Wechselwirkungen nach dem Sensitivitätsmodell nach Prof. Vester*. Technical University of Munich.
- Lim, S. K., & Yang, J. (2008). Understanding the need of project stakeholders for improving sustainability outcomes in infrastructure projects. *Queensland University of Technology*, 332–343.
- Lindström, J., Eliasson, J., Kyösti, P., & Andersson, U. (2019). Toward predictive maintenance of walls in hard rock underground facilities: IoT-enabled rock bolts. In *Proceedings of the I-ESA Conferences* (Vol. 9). https://doi.org/10.1007/978-3-030-13693-2_27

- Lisi, G. (2015). Real estate macroeconomics and the four-quadrant model. *Real Estate Practice and Education*, 18(1), 87–106. <https://www.jstor.org/stable/24863167>
- Lou, E. C. W., Lee, A., & Lim, Y. M. (2022). Stakeholder preference mapping: the case for built heritage of Georgetown, Malaysia. *Journal of Cultural Heritage Management and Sustainable Development*, 12(3), 291–308. <https://doi.org/10.1108/JCHMSD-08-2020-0114>
- Ludovico, N., Dessi, F., & Bonaiuto, M. (2020). Stakeholders Mapping for Sustainable Biofuels: An Innovative Procedure based on computational text analysis and social network analysis. *Sustainability*, 12(10317). <https://doi.org/10.3390>
- Manifesto for Agile Software Development*. (n.d.). Retrieved December 25, 2022, from <https://agilemanifesto.org/iso/en/manifesto.html>
- Miller, G. J. (2007). Agile problems, challenges, & failures. *PMI® Global Congress 2013*, 0–0. <https://doi.org/10.1109/AGILE.2007.38>
- Morgan, G. (2006). *No Images of organisation*. Sage.
- Mrad, C., & Frólén Ribeiro, L. (2022). A Review of Europe’s Circular Economy in the Building Sector. *Sustainability*, 14(21), 14211. <https://doi.org/10.3390/su142114211>
- National Audit Office. (2004). *Getting Value for Money from Construction Projects through Design: How Auditors Can Help*. Stairway Communications Ltd.
- Nielsen, A. N., Jensen, R. L., Larsen, T. S., & Nissen, S. B. (2016). Early stage decision support for sustainable building renovation – A review. *Building and Environment*. <https://doi.org/http://dx.doi.org/10.1016/j.buildenv.2016.04.009>
- Nye Jr, J. S. (2013). Hard, soft, and smart power. In *The Oxford handbook of modern diplomacy* (pp. 559–576). Oxford university press.
- Pelyukh, O., & Paletto, A. (2020). Stakeholder Analysis to Support Secondary Norway Spruce (*Picea abies* (L.) Karst.) Forest Conversion in the Ukrainian Carpathians. *Acta Silvatica et Lignaria Hungarica*, 15(2), 69–84. <https://doi.org/10.2478/aslh-2019-0006>
- Ringel, M., Bruch, N., & Knodt, M. (2021). Is clean energy contested? Exploring which issues matter to stakeholders in the European Green Deal. *Energy Research and Social Science*, 77(May). <https://doi.org/10.1016/j.erss.2021.102083>
- Robin, H. (1998). What sample size is “enough” in internet survey research. *Interpersonal Computing and Technology: An Electronic Journal for the 21st Century*, 6(3–4), 1–12.

- Rolstad, S., Adler, J., & Rydén, A. (2011). Response burden and questionnaire length: Is shorter better? A review and meta-analysis. *Value in Health*, 14(8), 1101–1108. <https://doi.org/10.1016/j.jval.2011.06.003>
- Roszkowska, E. (2013). Rank Ordering Criteria Weighting Methods – a Comparative Overview. *Optimum. Studia Ekonomiczne*, 5(5(65)), 14–33. <https://doi.org/10.15290/ose.2013.05.65.02>
- Savio, A. A. del, Quincot, J. F. V., Montalto, A. D. B., Delgado, L. A. R., & Fischer, M. (2022). Virtual Design and Construction (VDC) Framework: A Current Review, Update and Discussion. *Applied Sciences (Switzerland)*, 12(12178). <https://doi.org/https://doi.org/10.3390/app122312178>
- Sehrawy, A. al, Amoudi, O., Tong, M., & Callaghan, N. (2021). A review of the challenges to integrating BIM and building sustainability assessment. *AIP Conference Proceedings*, 2428(November). <https://doi.org/10.1063/5.0071055>
- Sinclair, D. (2011). *Leading the Team An Architect's guide to design management*. RIBA Publishing.
- Son, H., & Kim, C. (2015). Early prediction of the performance of green building projects using pre-project planning variables: data mining approaches. *Journal of Cleaner Production*, 109, 144–151. <https://doi.org/doi:http://dx.doi.org/10.1016/j.jclepro.2014.08.071>
- Straçusser, G. (2015). Agile project management concepts applied to construction and other non-IT fields. *PMI® Global Congress 2015*. <https://www.pmi.org/learning/library/agile-software-applied-to-construction-9931>
- Sutton, P. (1999). Sustainability. *Greener Management International Journal*, 23.
- Tian, Z. C., Chen, W. Q., Tang, P., Wang, J. G., & Shi, X. (2015). Building energy optimization tools and their applicability in architectural conceptual design stage. *Energy Procedia*, 78, 2572–2577. <https://doi.org/10.1016/j.egypro.2015.11.288>
- Tirado, R., Aublet, A., Laurenceau, S., & Habert, G. (2022). Challenges and Opportunities for Circular Economy Promotion in the Building Sector. *Sustainability*, 14(1546). <https://doi.org/10.3390>
- Turner, J. (2009). *The Handbook of Project-Based Management*. McGraw-Hill.
- Vakili-Ardebili, A. (2007). Complexity of value creation in sustainable building design (SBD). *Journal of Green Building*, 2(4), 171–181. <https://doi.org/10.3992/jgb.2.4.171>

- VDC and Integrated Concurrent Engineering - ICE sessions in practice - part 1.* (n.d.). Retrieved December 26, 2022, from <https://bimcorner.com/vdc-ice-sessions-in-practice-part-1/>
- Vegard, K. (2017). *Building Design Management in the early stages* (Issue November). Norwegian University of Science and Technology.
- Vimpari, J., & Junnila, S. (2016). Theory of valuing building life-cycle investments. *Building Research and Information*, 44(4), 345–357. <https://doi.org/10.1080/09613218.2016.1098055>
- Virtual Design and Construction - BIM Magazin - Building Information Modeling.* (n.d.). Retrieved December 25, 2022, from <https://www.planungsmethode-bim.com/virtual-design-and-construction-vdc/>
- Voegeli, G., & Finger, D. C. (2020). Disputed dams: Mapping the divergent stakeholder perspectives, expectations and concerns over hydropower development in Iceland and Switzerland. *Energy Research and Social Science*, 72.
- Wilkinson, A. (2014). The sustainability debate. *Environmental Science for Environmental Management*, April, 29–62. <https://doi.org/10.4324/9780429493744-21>
- World Commission on Environment and Development. (1987). *Our Common Future*. Oxford university press.
- Wu, W., He, F., Zhuang, T., & Yi, Y. (2020). Stakeholder analysis and social network analysis in the decision making of industrial land redevelopment in China: The case of Shanghai. *Environmental Research and Public Health*, 17(9206). <https://doi.org/10.3390>
- Zeiler, W., Quanjel, E., Velden, J., & Wortel, W. (2010). Flexible design proces innovation: Integral building design method. *TG62 - Special Track 18th CIB World Building Congress*.
- Zhu, B. (2021). *Seminar: Real Estate Development and Investment [PowerPoint slides]*. Technical University of Munich.

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Appendix A: Stakeholder identification questionnaire

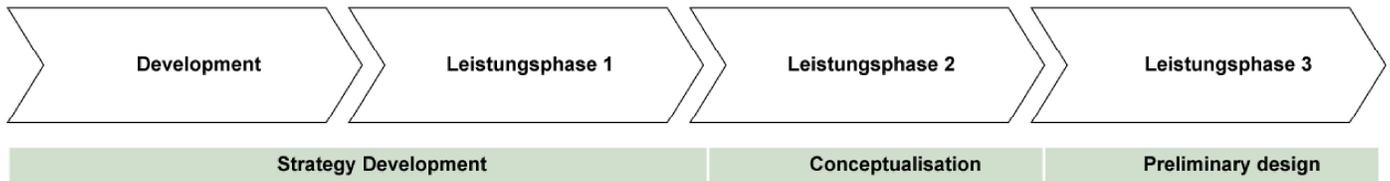
Estimated survey time: 1 minute

In the context of my Master thesis at the Technical University of Munich, I am carrying out a stakeholder analysis for the early stages in the design phase to better understand how sustainability can be better integrated as early as possible. This questionnaire deals with identifying the stakeholders involved. Through your input to the list of stakeholders, a thorough list of all stakeholders will be developed which will aid in a comprehensive stakeholder analysis. The duration of filling in the list should take maximum of 2 minutes of your time. Thank you for your collaboration. Your input is highly appreciated.

This survey is anonymous, and no personal identifying data will be stored.

1. What is your current job title?

Early Development and Design stage

**2. Which Stakeholders do you think are involved in the early design phases shown in the image above?**

Please select the stakeholders that you find relevant

- Project Developer
- Investor/Capital Provider
- Public Sector e.g Municipality
- Project manager
- Future Users
- Local residents
- Planners
- Consultants
- Property owners
- Contractors
- Other

3. If you selected other, please specify the missing stakeholders.

Thank you for taking time to complete the questionnaire!

Appendix B: Stakeholder analysis questionnaire

In the context of my Master thesis at the Technical of Munich with the chair of Energy efficient and sustainable planning and building, I am carrying out a stakeholder analysis for the early stages in the design phase to better understand how sustainability can be better integrated as early as possible. This questionnaire deals with understanding the interests and influence of each stakeholder in the decision-making processes in the early phases of a project.

Central in this analysis is sustainability and the information obtained from this questionnaire will help better build the knowledge on the individual perception on sustainability and how it can be better integrated in the processes and in the end product.

The questionnaire will require a maximum of 10 minutes of your time. Thank you for your contribution to this thesis.

1. Which stakeholder group do you belong to?

- Project developer
- Investor/Capital provider
- Public sector (e.g Municipality)
- Project manager
- Planners (e.g. Architect planners, Engineer planners)
- Consultants (e.g. Sustainability consultants, Fire safety consultants (Engineering consultation))
- Property owners
- Facility managers
- Local residents (e.g neighbourhood organisations)
- Other

2. If other please add which stakeholder you are

3. What do you understand by sustainability in construction and planning?

Make use of sentences or key words

4. In which project processes are you involved in?

Please select the project phases that apply to you from the available cards.

Market analysis

Land purchase

Preliminary design

Location analysis

Use concept

None

Land aquisition

Preliminary design
conceptualization

5. What do you value the most in each of the following design project phases?

	Economical	Social	Environmental
Use concept development	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preliminary design conceptualization	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Preliminary design	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Market analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Location analysis	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land acquisition	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land purchase	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. To what extent do you collaborate with the following stakeholders in the development stage in most cases?

The development stage includes the Market analysis, Location analysis, Land acquisition, Land purchase and use concept.

	no extent	very small extent	small extent	moderate extent	large extent
Project developer	<input type="radio"/>				
Investor/Capital provider	<input type="radio"/>				
Public sector	<input type="radio"/>				
Project manager	<input type="radio"/>				
Future users	<input type="radio"/>				
Local residents	<input type="radio"/>				
Planners (e.g. Architect planners, Engineer planners)	<input type="radio"/>				
Consultants (e.g. Sustainability consultants, Fire safety consultants (Engineering consultation))	<input type="radio"/>				
Property owners	<input type="radio"/>				
Facility managers	<input type="radio"/>				

7. To what extent do you collaborate with the following stakeholders in the design stage in most cases?

The design stage in this case comprises of the use concept development, preliminary design concept and design concept.

	very small		moderate		
	no extent	extent	small extent	extent	large extent
Project developer	<input type="radio"/>				
Investor/Capital provider	<input type="radio"/>				
Public sector	<input type="radio"/>				
Project manager	<input type="radio"/>				
Future users	<input type="radio"/>				
Local residents	<input type="radio"/>				
Planners (e.g. Architect planners, Engineer planners)	<input type="radio"/>				
Consultants (e.g. Sustainability consultants, Fire safety consultants (Engineering consultation))	<input type="radio"/>				
Property owners	<input type="radio"/>				
Facility managers	<input type="radio"/>				

8. Rank the following topics of sustainability from the highest priority to the lowest priority based on your professional experience and practice.

The ranking should follow the logic of which topic takes precedence in the execution of tasks and decision making.

Environmental	Economy	1
		2
Society		3

9. Rate the following environmental topics with respect to their importance based on your professional experience and practice (status quo)

	Not very important	Somewhat important	Moderately important	Extremely important
Energy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mobility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Biodiversity	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green and Blue infrastructure	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Construction and demolition waste	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Resources/Materials	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Land use	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Green house gas emissions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

10. Rate the following social topics with respect to their importance to you based on your professional experience and practice. (status quo)

	Not very important	Somewhat important	Moderately important	Important	Extremely important
Thermal comfort	<input type="radio"/>				
Safety	<input type="radio"/>				
Visual comfort	<input type="radio"/>				
User influence	<input type="radio"/>				
Accessibility	<input type="radio"/>				
Indoor and outdoor recreational quality	<input type="radio"/>				
Inclusive design	<input type="radio"/>				

11. Rate the following economical topics with respect to their importance based on your professional experience and practice (Status quo)

	Not very important	Somewhat important	Moderately important	Important	Extremely important
Building flexibility and adaptability	<input type="radio"/>				
Building lifecycle costs	<input type="radio"/>				
Space efficiency	<input type="radio"/>				
Value stability	<input type="radio"/>				
Investment costs	<input type="radio"/>				

12. What role do you play in the agreement of the project budget?

Decision maker
 Facilitator
 Consultant
 |
 I play no role

13. What role do you play in the agreement of the project schedule?

Decision maker
 Facilitator
 Consultant
 |
 I play no role

14. What role do you play in deciding who will be part of the project?

Decision maker
 Facilitator
 Consultant
 |
 I play no role

15. In the procurement of team members, how important is sustainability (economical, social, environmental) ?

Not important Somewhat important Moderately important Important Extremely important

Environmental	<input type="radio"/>				
Social	<input type="radio"/>				
Economical	<input type="radio"/>				

16. What role do you play in the decision of how the project will be organised?

Project organisation here entails the project delivery method either with a general contractor, general overtaker, total contractor, or total overtaker.



Decision maker



Facilitator



Consultant



I play no role

17. How much influence do you have on information flows?

This pertains to who receives what information when



No influence



Very little influence



Some influence



A lot of influence

18. How much influence do you have in the development of the use concept?

No influence



Little Influence



Some influence



A lot of influence

19. What role do you play in the decision of the use concept?

Decision maker



Facilitator



Consultant



I play no role

20. How important is it that sustainability topics are integrated in the development of the use concept?

not important somewhat important moderately important Important very important

21. How much influence do you have in the design process?

Design processes include the design decisions, iterations, brainstorming, design team and design tools used.

No influence Little influence Some influence A lot of influence

22. What role do you play in the decision and approval of the preliminary concept?

Decision maker Facilitator Consultant | I play no role

23. What role do you play in the decision and approval of the preliminary design?

Decision maker Facilitator Consultant | I play no role

Last Page

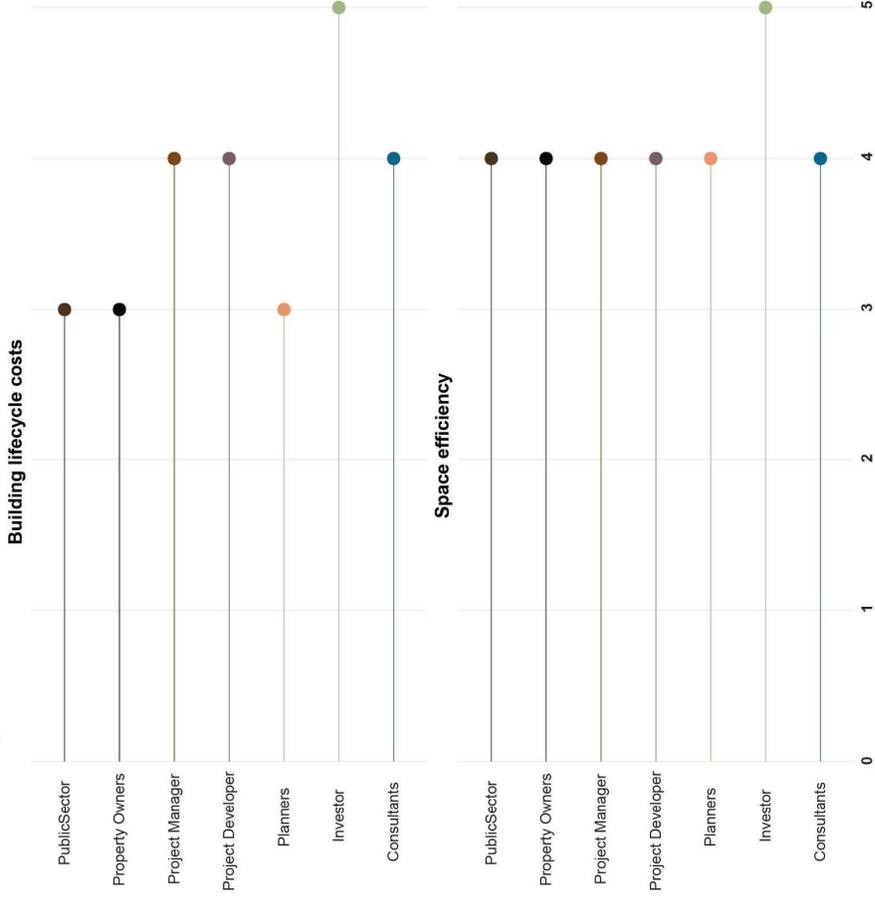
Thank you for completing this questionnaire! I would like to thank you for your assistance. Your answers were transmitted, you may close the browser window or tab now.

Appendix C: Importance rating of sustainability topics by stakeholders

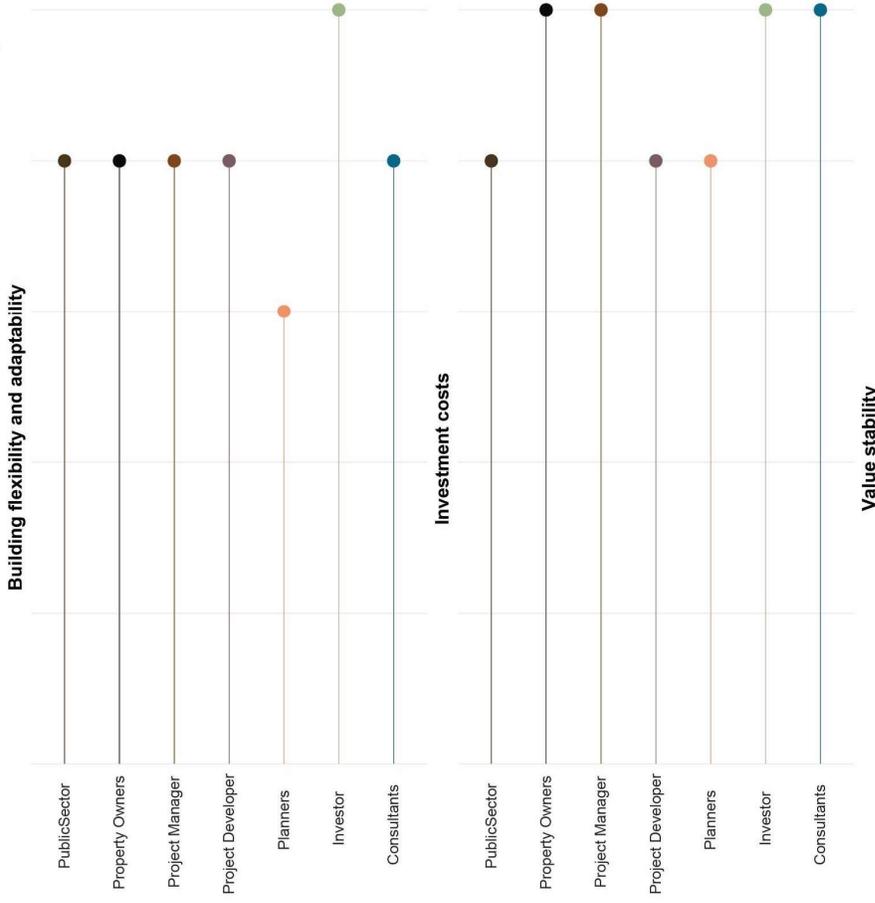
Importance of environmental topics



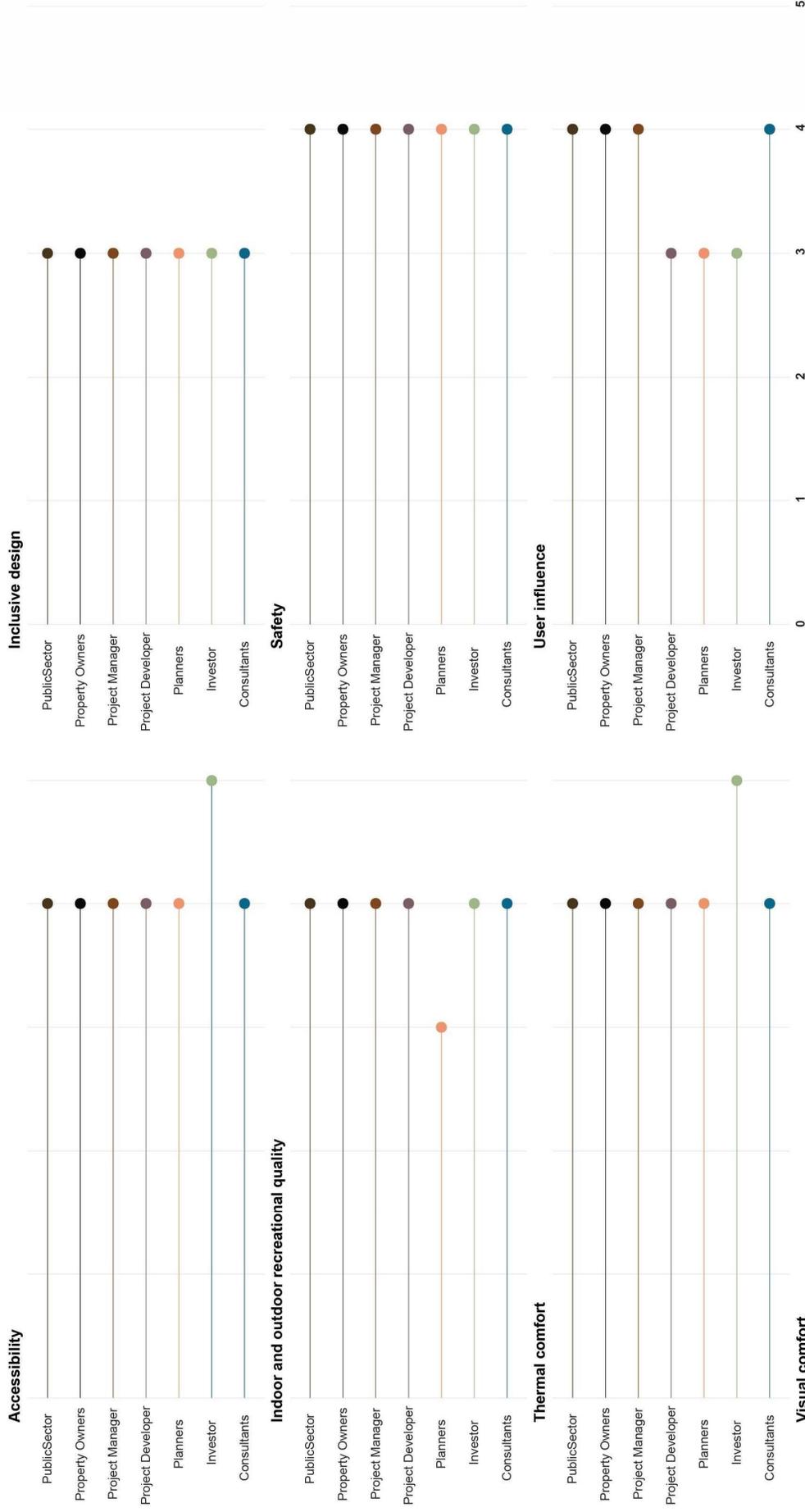
Importance of economical topics

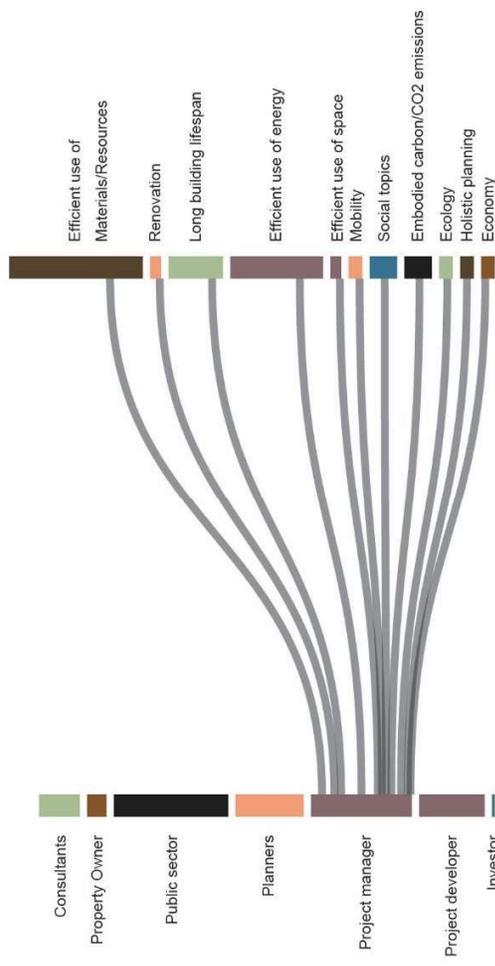
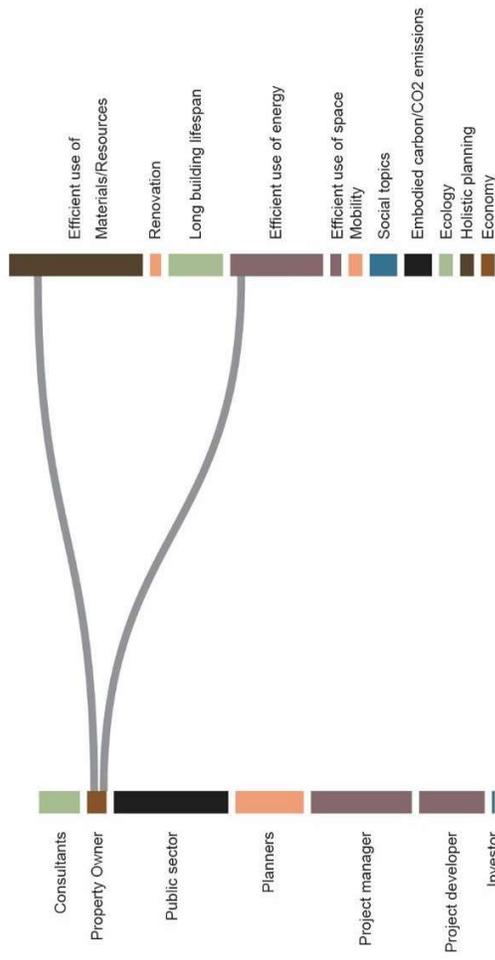
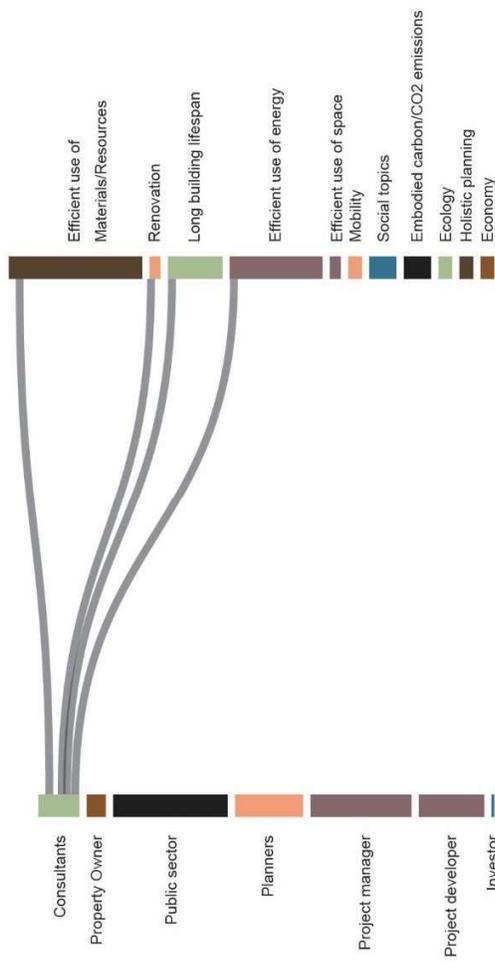
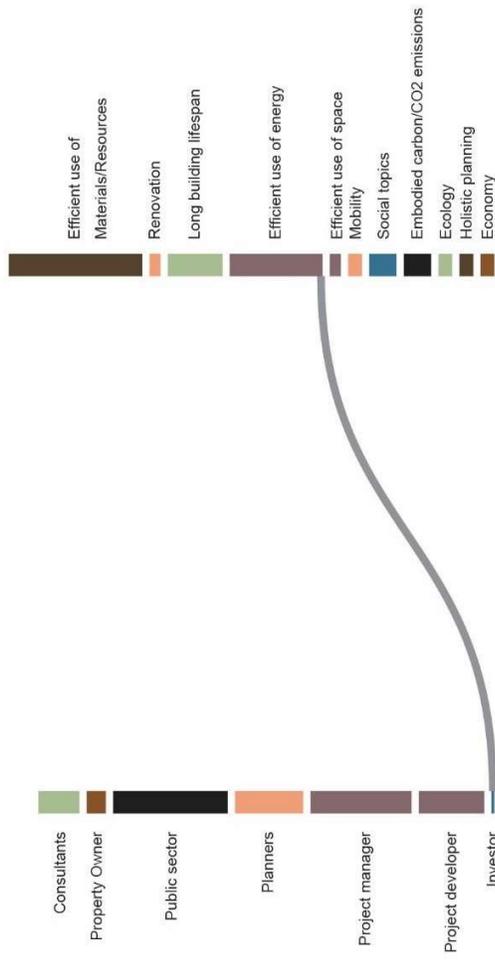


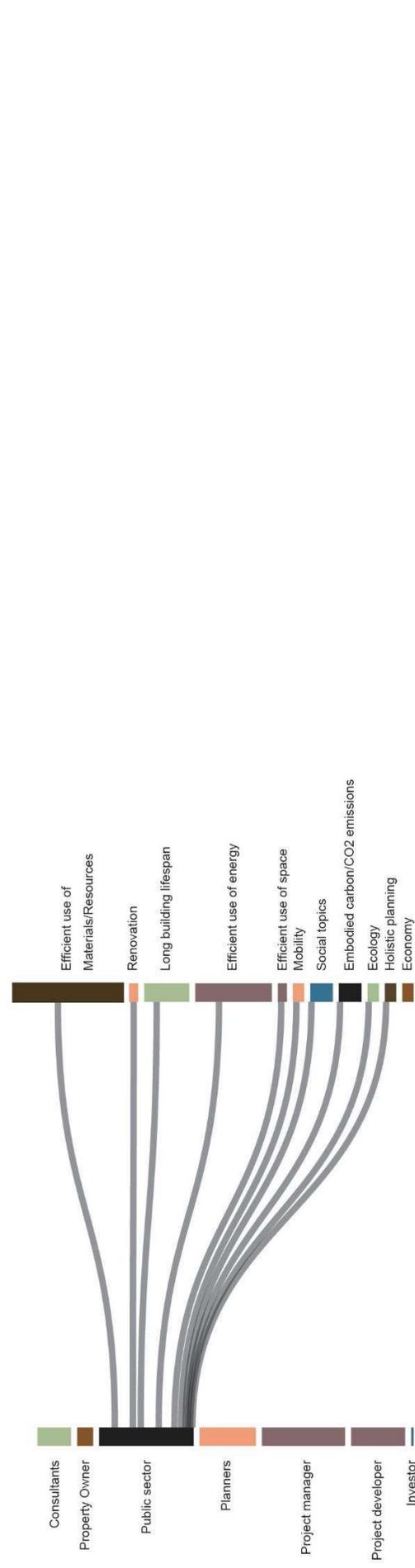
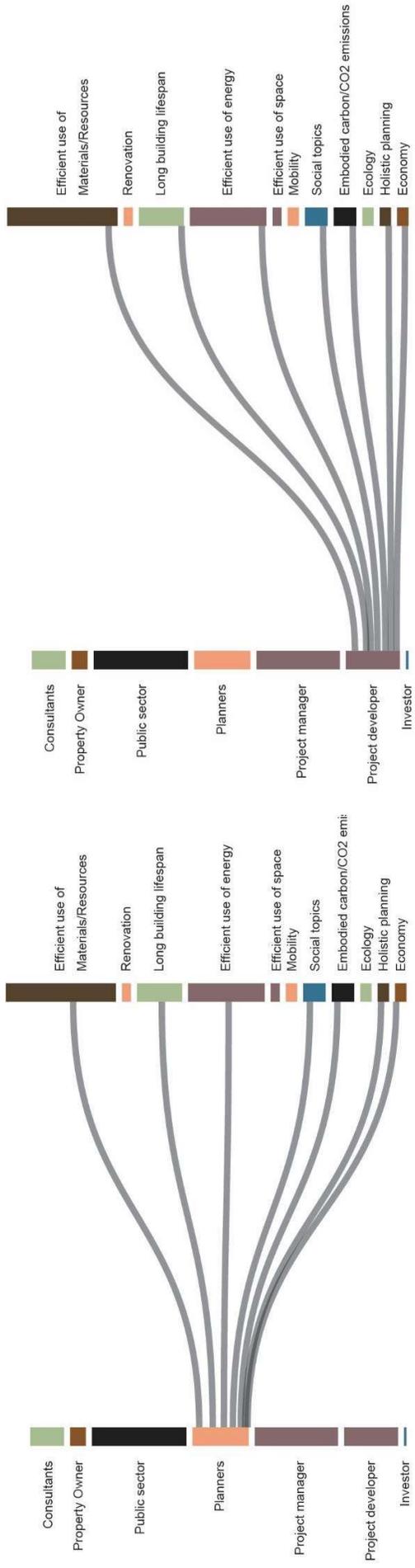
Building flexibility and adaptability



Importance of social topics

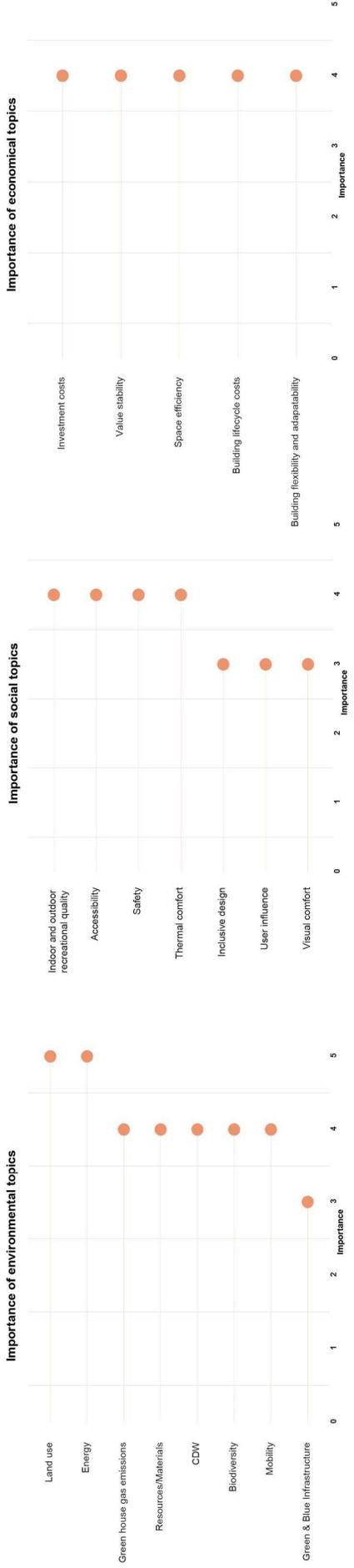






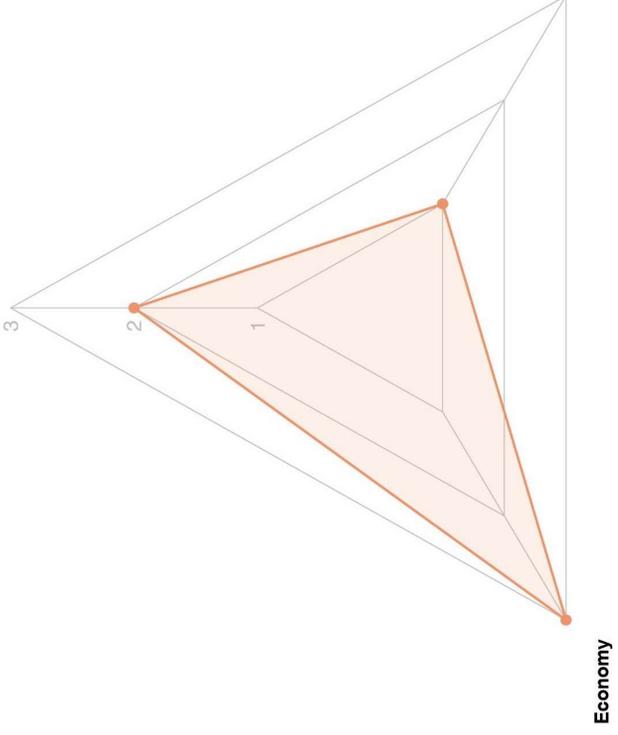
Appendix D: Stakeholder profiles

Project Developers

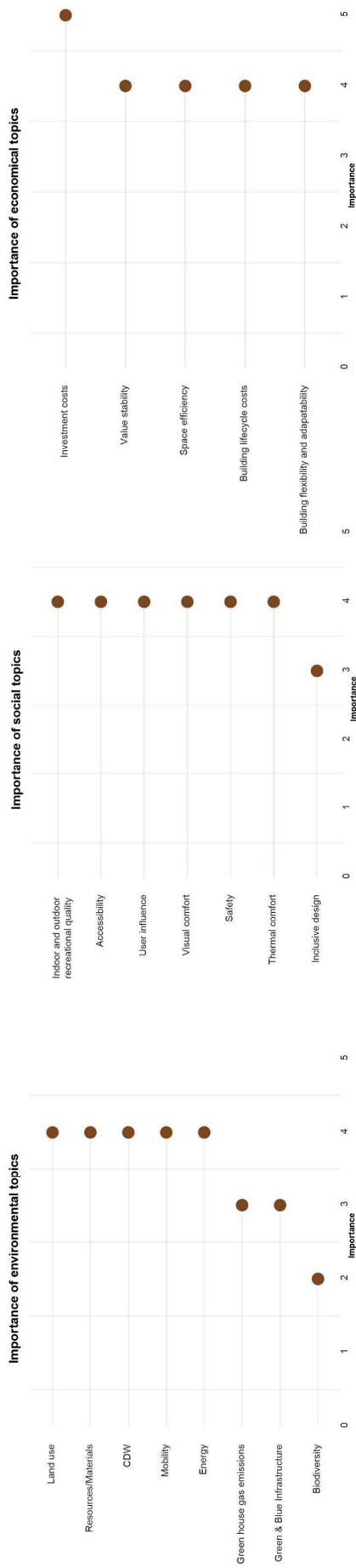


Environment

Strength	Weakness
<ul style="list-style-type: none"> A lot of inhouse expertise (Depending on the size of the developer) Ability to make the final decision in all stages of development and design Involved in the entire value chain of the project from project initiation to realisation Large interaction with the team throughout the phases though limited in the design stages Value sustainability in the design stages and the development stage (esp. Design brief and preliminary design concept) Good understanding of sustainability based on the knowledge of the wide range of topics relevant to the building sector 	<ul style="list-style-type: none"> Environmental and social sustainability is not highly valued in the development stages
Threats	Opportunities
<ul style="list-style-type: none"> Large potentially disproportionate focus on economical topics Strong dependency on the investor (money partner) Sudden change of mind during the project progress in terms of design goals due to changing external factors 	<ul style="list-style-type: none"> Engaging the Project developer more actively in the development phases with focus on sustainability More indepth analysis of environmental (market) and social (Location) sustainability in the development stages as much as relevant in relation to the economical topics. Performing sustainability focused risk analysis to avoid changes Strengthening the bond between developer and investor in terms of the understanding of sustainability and the targets. Possibility to influence the ambition level of the project through the participation in all project phases.

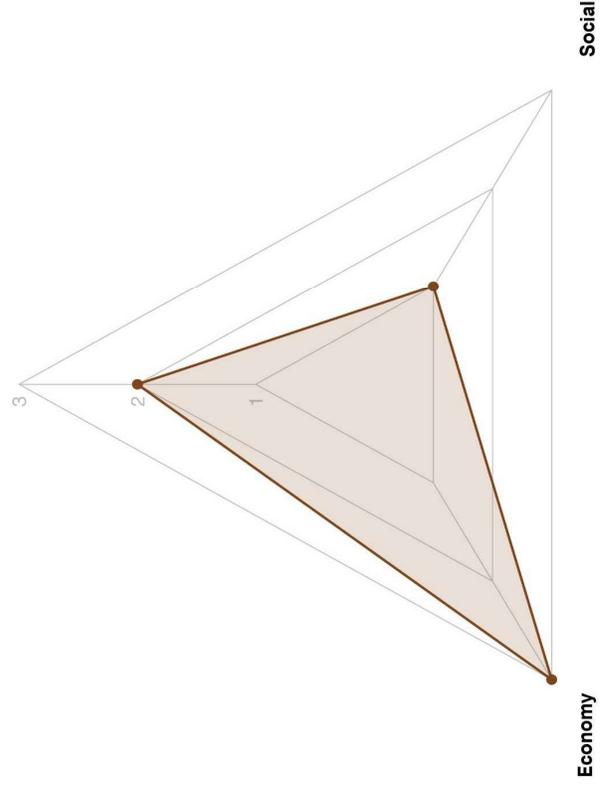


Project Managers

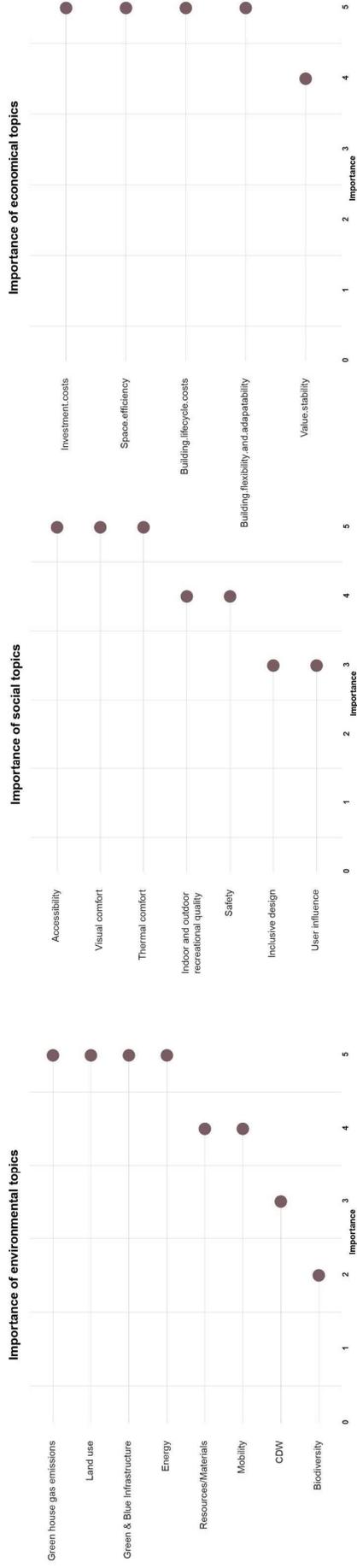


Strength	Weakness
<ul style="list-style-type: none"> Best overview on all the processes and all stakeholders They have strong communication ties with all team members Expertise in managing a large complex team Have the ability to control the pace, budget, and quality of the project 	<ul style="list-style-type: none"> No control of the details in the project Are easily swayed to be against or for sustainability due to their main goals of cost, quality and time, and their stronger alliance to the client i.e project developer.
Threats	Opportunities
<ul style="list-style-type: none"> Could hinder the ambition levels of the project through insisting on their three main targets. Failure of adequate project management has dire consequences for the entire project due to their key central role within the project. 	<ul style="list-style-type: none"> Can use their position to guide the team towards sustainable targets through the use of ideal management tools on a strategic level Persuading both the project developer and the design team towards sustainability goals through the formulation of supportive coalitions with the project developer and the investor.

Environment



Investors



Strength

- Involved from the beginning of the project
- Control the most important resources (money, time)
- Have an important role in the decision making process early on in the project
- Have the ability to stop or continue the project
- Have a good understanding of the real estate market in order to generate profits from a project

Weakness

- Limited function during the design stages
- Main focus on economy
- Limited understanding of sustainability

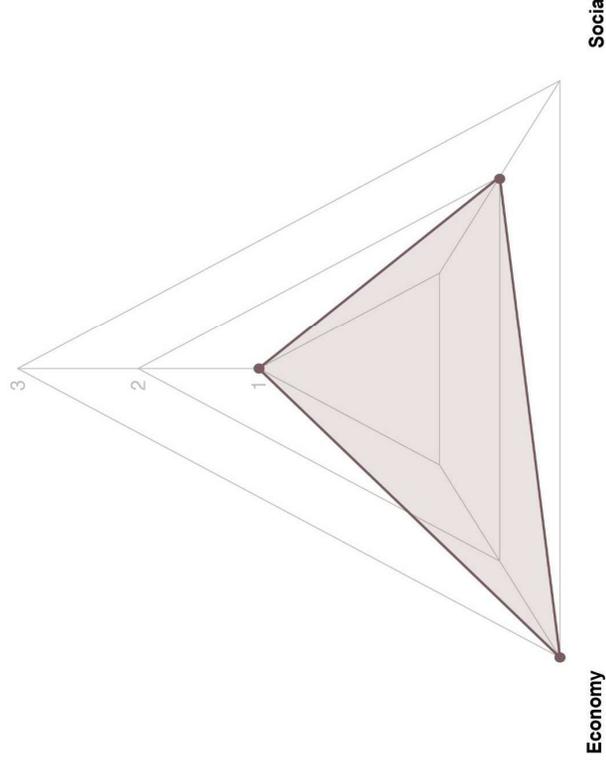
Threats

- Limited to no integration of sustainability in the design brief during the development stages
- Late focus on sustainability in the development stages limiting the extent to which it can be fully integrated
- Inability to quantify sustainability which may lead to neglecting various important topics

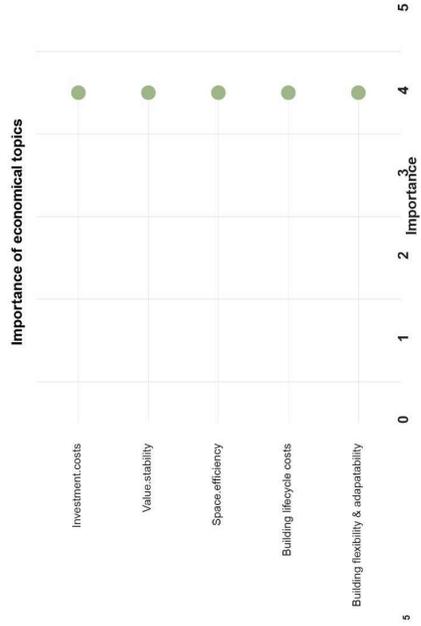
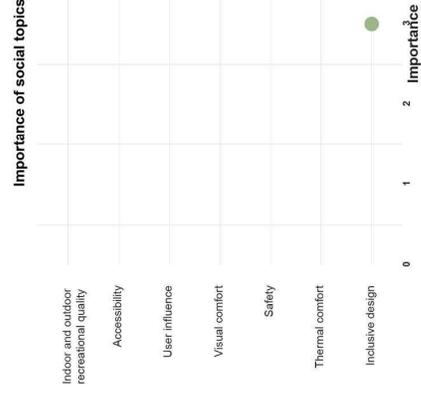
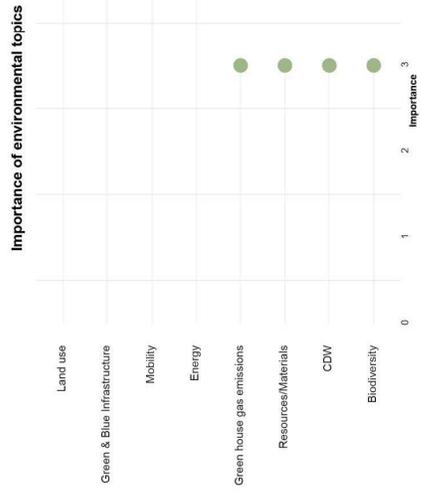
Opportunities

- Introduce consultants to bridge the knowledge gap, regarding sustainability early on in development
- Close collaboration between the investor and project developer since the developer is more involved in the design phases
- Relate sustainability to key economical criteria where possible for inclusion in decision making

Environment

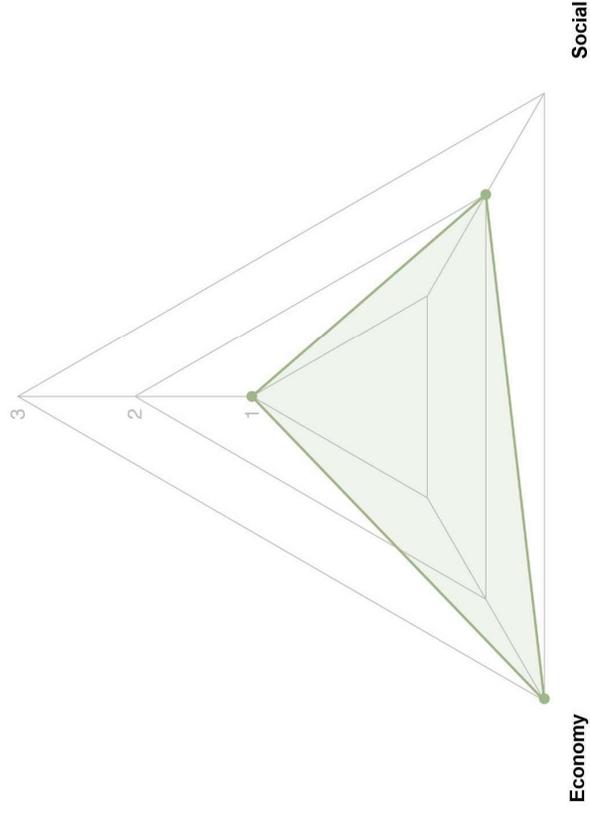


Municipality

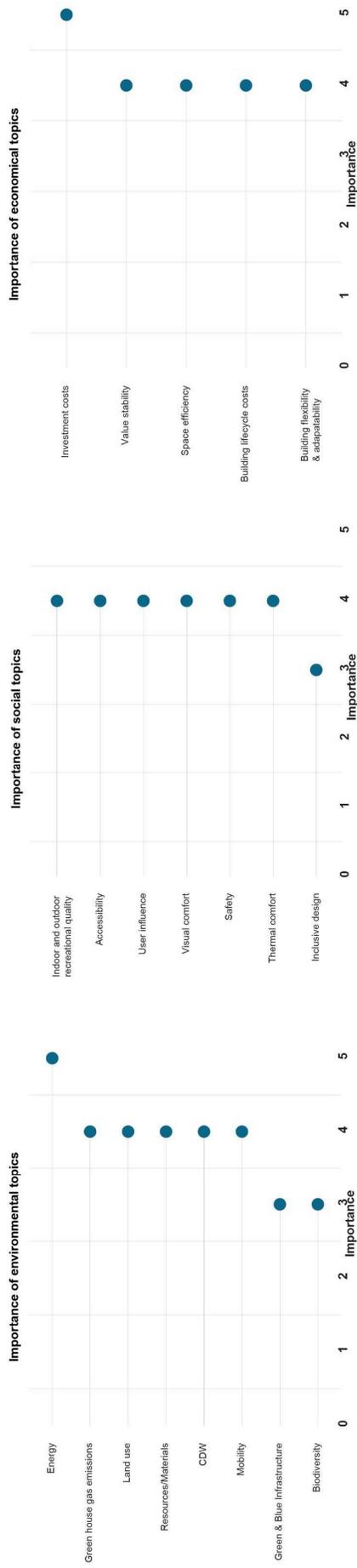


Strength	Weakness
<ul style="list-style-type: none"> Set the legal requirement that need to be followed without fail 	<ul style="list-style-type: none"> Environmental and social sustainability is not highly valued in the development stages
Threats	Opportunities
<ul style="list-style-type: none"> Potential loopholes in regulations that might be exploited by the developers for their own purposes Lack of clarity in some regulations 	<ul style="list-style-type: none"> Stronger engagement between municipalities and project developers. Possibility to better promote sustainability within and beyond the regulatory scope (Offering incentives to developers) [See Brochure 1 of Gruner Stadt der Zukunft]

Environment

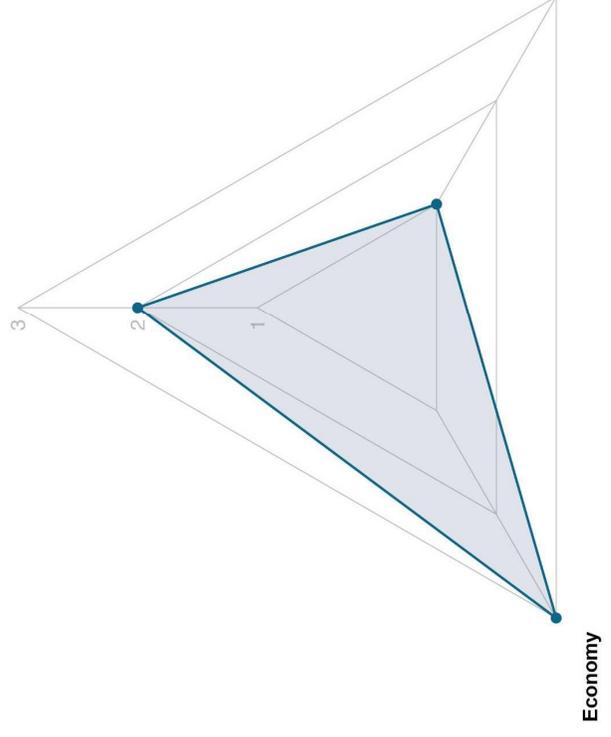


Consultants

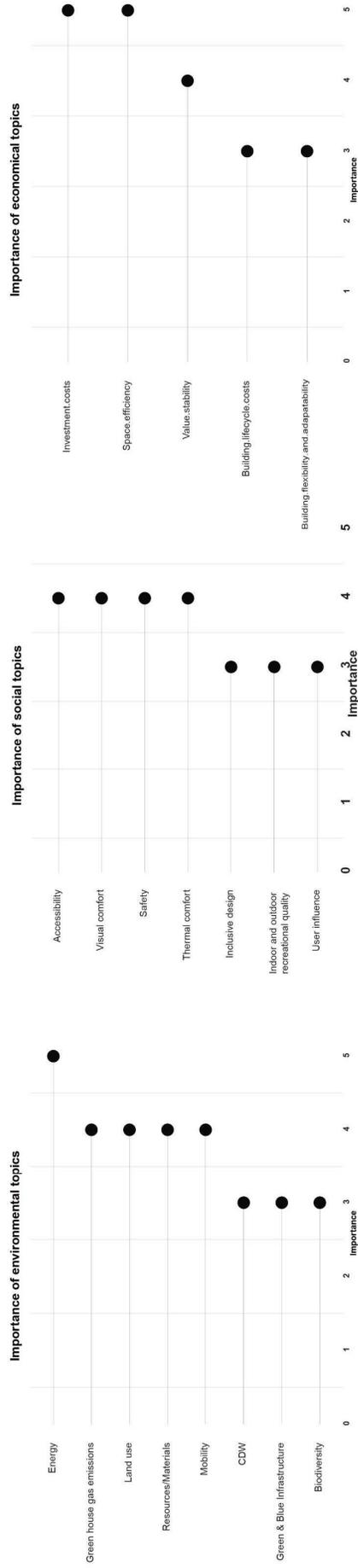


Strength	Weakness
<ul style="list-style-type: none"> Have ability to persuade the main client i.e The project developer Consultants have in-depth knowledge of their respective fields and are thus knowledgeable about sustainable solutions for reaching the project goal 	<ul style="list-style-type: none"> The implementation of the solutions does not impact them much.
Threats	Opportunities
<ul style="list-style-type: none"> Losing overview on the progression of the project due to the high specialisation. If stakeholder is not aligned with the client or project goals, they may possibly persuade them in the wrong direction depending on their personal perception on sustainability Insufficient collaboration with other team members Due to high specialisation, there might be a potential need to push their own opinions as the expert and might act as an opposer to any other alternatives 	<ul style="list-style-type: none"> Introduce consultants which are experts in sustainability. With this as a core focus, they might be able to push the direction more in that direction as it might possibly lie with their own personal goals. Their expertise of the topic and potentially the industry could be used in the selection of the team members i.e planners

Environment



Planners



Strength

- Play an active role in proposing and developing the designs
- Expertise in the various aspects of buildings
- Knowledgeable about sustainable building and construction
- Ability to communicate the design proposals to the team clearly
- Experts in planning and design
- Have persuasive power towards the client and project manager (Project developer/Investor) for how the needs could be met (Sustainability or not)
- Have a limited by relevant persuasive power for the selection of team members, Project budget, Organisation, design brief
- Value sustainability for the project phases they are involved in. (Use concept, design brief)

Weakness

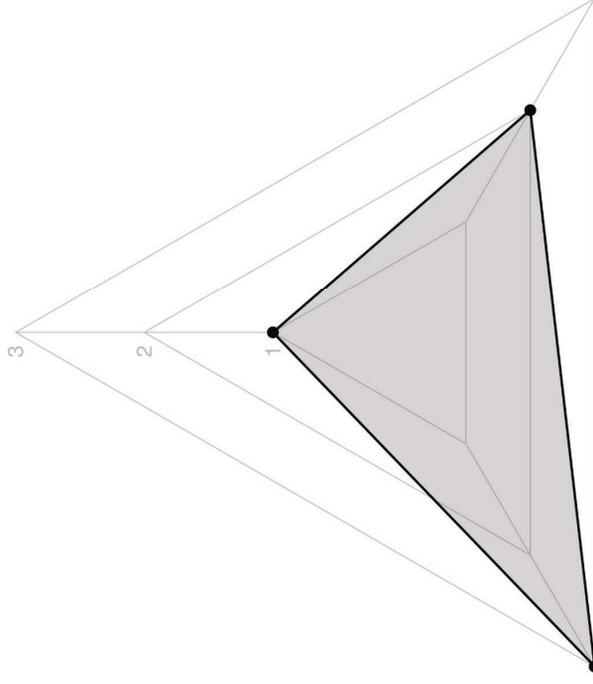
Threats

- Potential to get preoccupied with the details which could have a negative effect on the bigger picture
- Efficiency in communicating design changes or updates with large complex teams
- Delayed project deliverables which can negatively influence the project schedule
- Potential to 'leave out' some parts of the design brief due to overlooks or design complexity and project size.
- Abrupt changes in design decisions (derailing project schedule and causing communication and alignment issues within the design)

Opportunities

- Effective project management within the internal design team
- Use of architects as the key communicator in the design process since they have an overview on everything pertaining to the design in collaboration with the project manager
- Use of digital tools/methods for better communication, procurement, quality control, on time delivery of documentation, and design changes.
- Possibility to change the direction the project takes due to the power position the planners have.

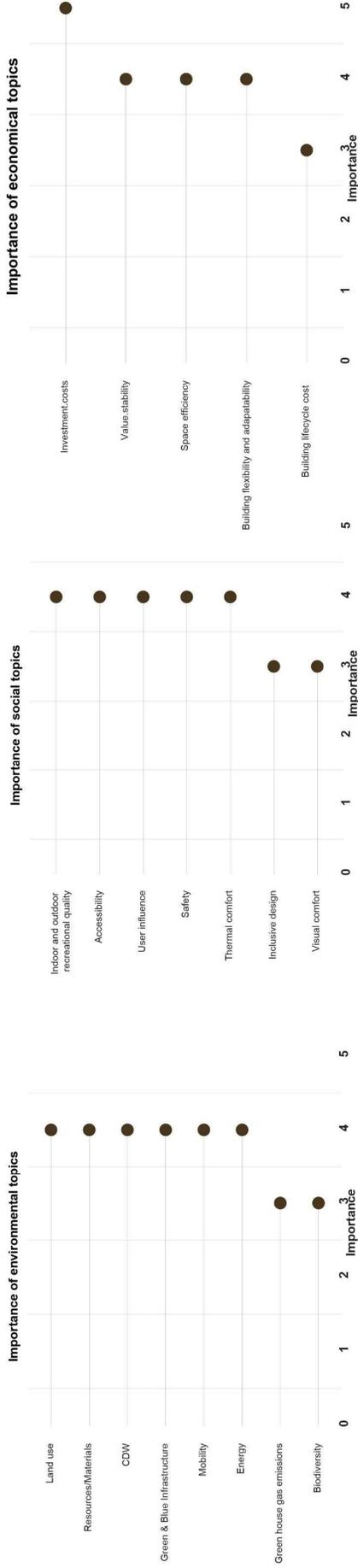
Environment



Economy

Social

Property Owners



Strength

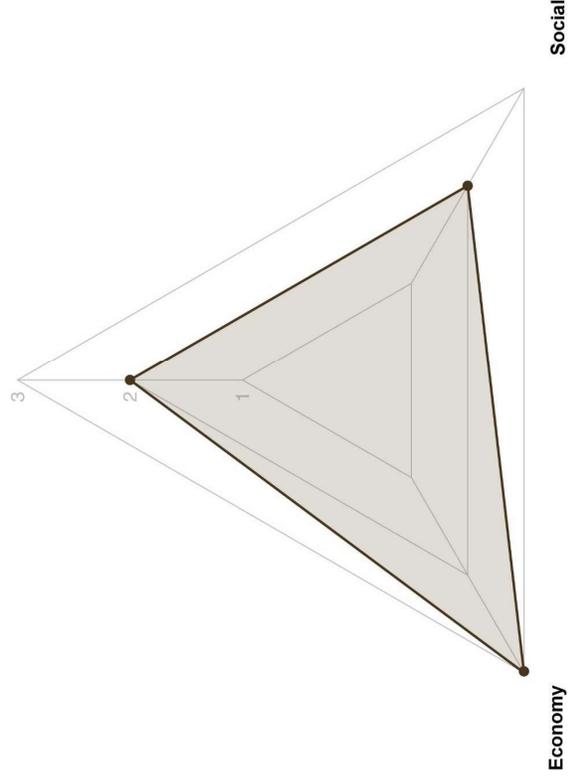
- Involved from the beginning of the project
- Control the most important resources (money, time)
- Have an important role in the decision making process early on in the project
- Have the ability to stop or continue the project
- Have a good understanding of the real estate market in order to generate profits from a project

Weakness

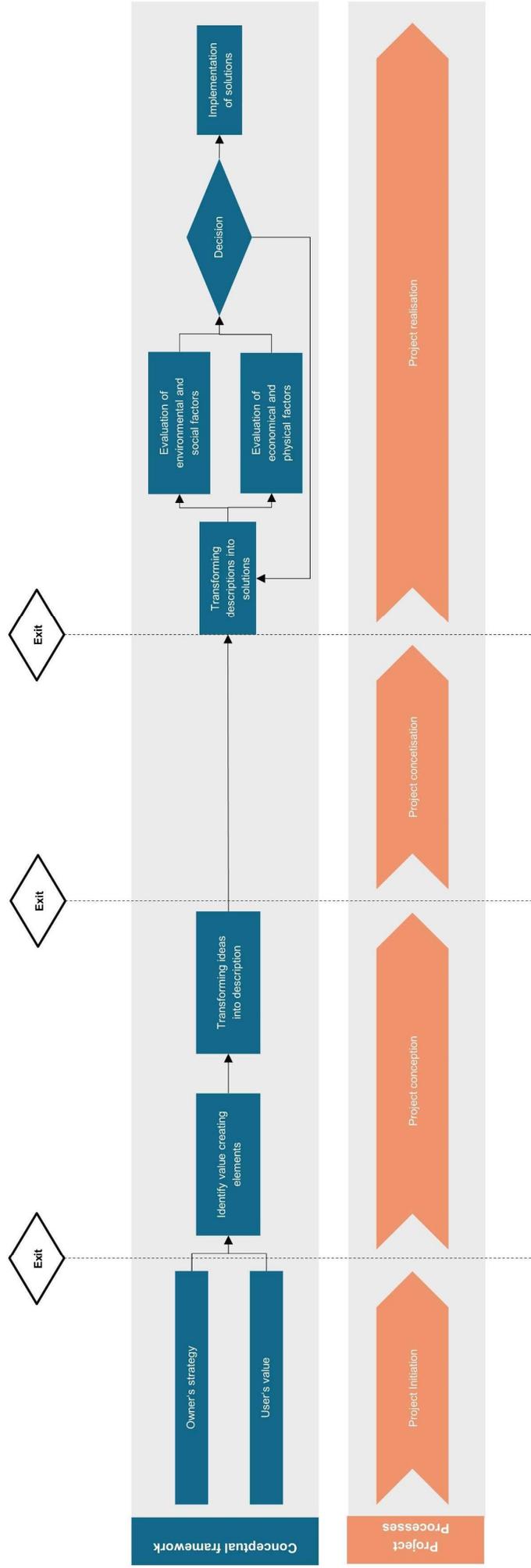
Opportunities

Threats

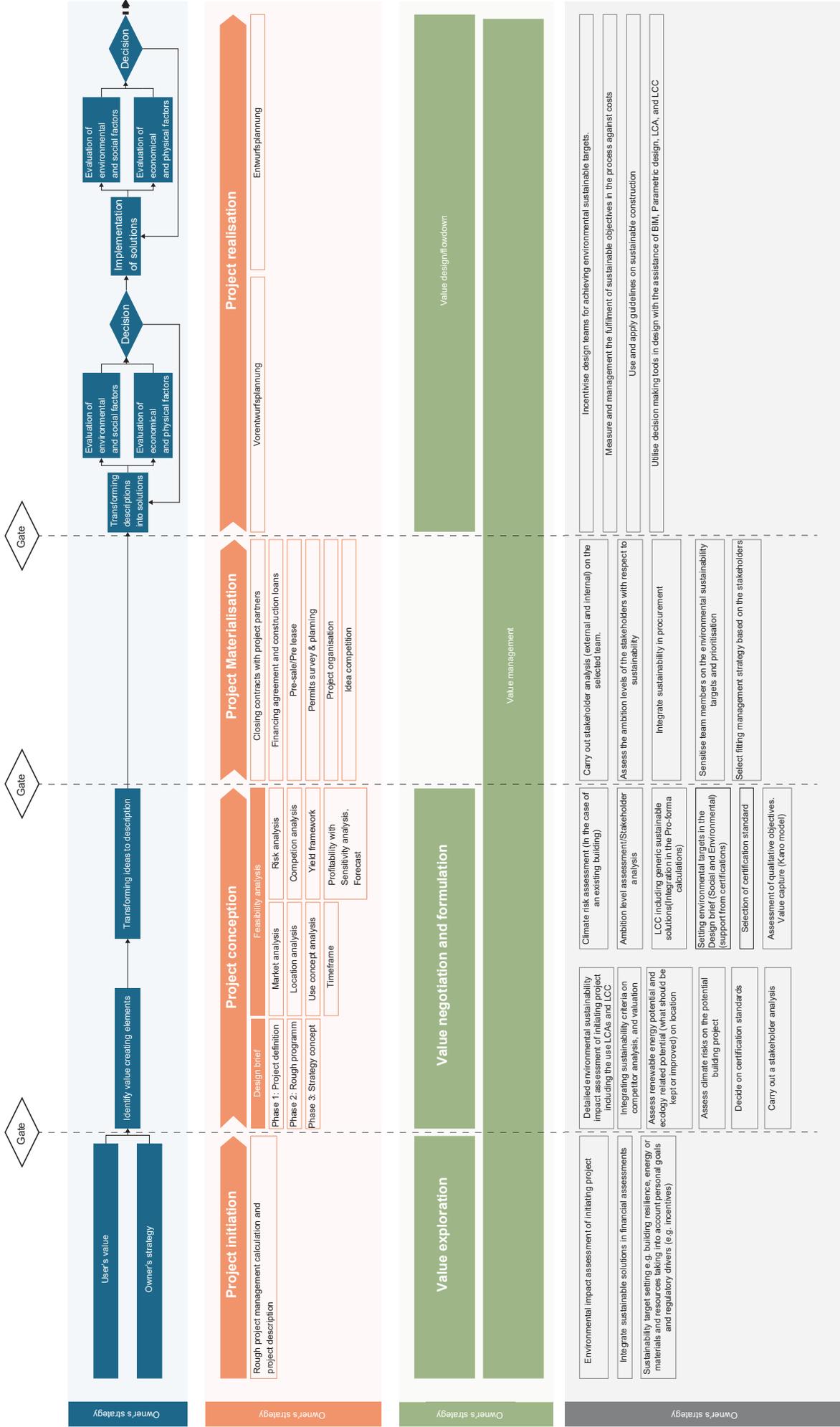
Environment



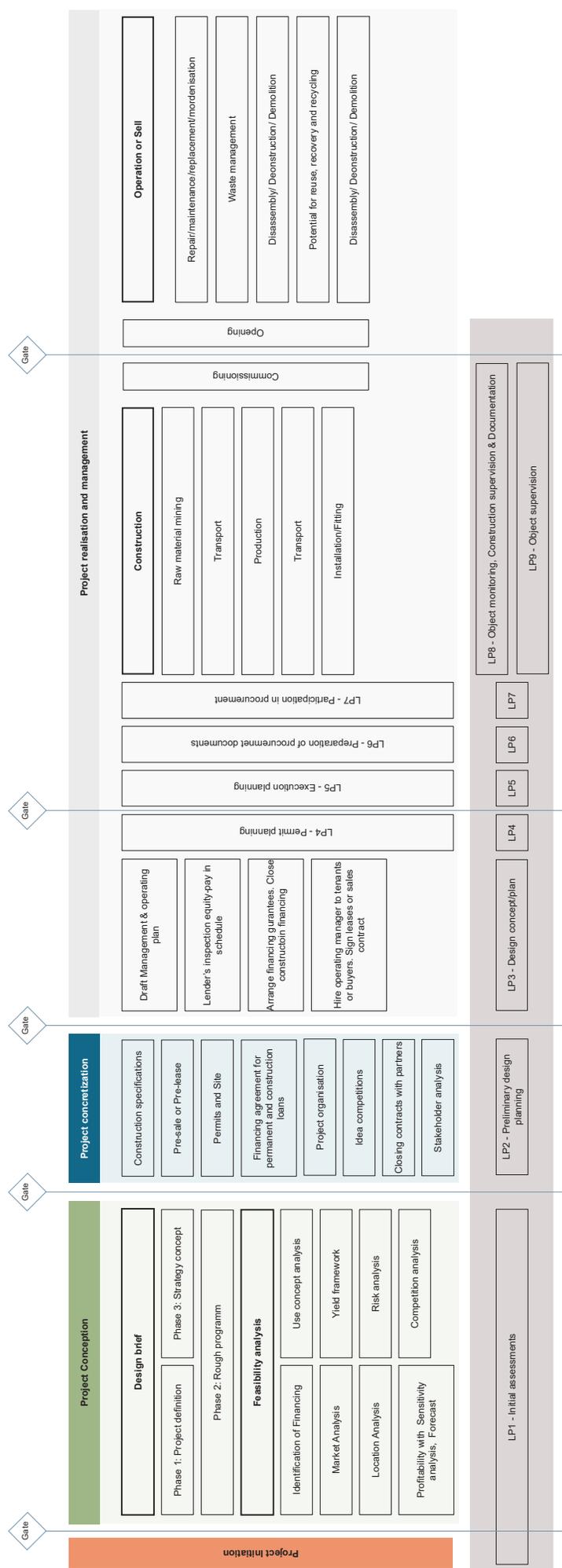
Appendix E: Value creation



Appendix F: Value creation Framework



Appendix G: Project processes



Gate

Gate

Gate

Gate

Project realization and management

Project conception

Design brief

Operation or Sell

Phase 1: Project definition

Phase 2: Rough programm

Phase 3: Strategy concept

Feasibility analysis

Use concept analysis

Yield framework

Risk analysis

Competition analysis

Identification of Financing

Market Analysis

Location Analysis

Profitability with Sensitivity analysis, Forecast

Construction specifications

Pre-sale or Pre-lease

Permits and Site

Financing agreement for permanent and construction loans

Project organisation

Idea competitions

Closing contracts with partners

Stakeholder analysis

Draft Management & operating plan

Lender's inspection equity-pay in schedule

Arrange financing guarantees. Close construction financing

Hire operating manager to tenants or buyers. Sign leases or sales contract

LP4 - Permit planning

LP5 - Execution planning

LP6 - Preparation of procurement documents

LP7 - Participation in procurement

Construction

Raw material mining

Transport

Production

Transport

Installation/Fitting

Commissioning

Opening

Repair/maintenance/replacement/modernisation

Waste management

Disassembly/ Deconstruction/ Demolition

Potential for reuse, recovery and recycling

Disassembly/ Deconstruction/ Demolition

LP1 - Initial assessments

LP2 - Preliminary design planning

LP3 - Design concept/plan

LP4

LP5

LP6

LP7

LP8 - Object monitoring, Construction supervision & Documentation

LP9 - Object supervision

Appendix H: Power evaluation

Categories	Rank	Weighting	Normalised
3 Position within the hierarchy	1		0.222
1 Number of ties to key stakeholders	2		0.194
7 Ability to persuade key stakeholders	3		0.167
4 Control of the design process	4		0.139
5 Role in team member selection	5		0.111
6 Ability to influence budget (control)	6		0.083
8 Control and coordination of design team	7		0.056
2 Centrality within the organisation	8		0.028
Sum			36

	Project developer		Project manager		Planner		Consultant		Municipality	
3 Position within the hierarchy	5	1.111	3	0.667	2	0.44	1	0.22	3	0.67
1 Number of ties to key stakeholders	5	0.972	5	0.972	4	0.78	5	0.97	5	0.97
7 Ability to persuade key stakeholders	5	0.833	4	0.667	5	0.83	4	0.67	4	0.67
4 Control of the design process	1	0.139	3	0.417	5	0.69	1	0.14	1	0.14
5 Role in team member selection	5	0.556	5	0.556	3	0.33	2	0.22	1	0.11
6 Ability to influence budget (control)	5	0.417	5	0.417	2	0.17	1	0.08	1	0.08
8 Control and coordination of design team	3	0.167	5	0.278	4	0.22	1	0.06	1	0.06
2 Centrality within the organisation	5	0.139	4	0.111	4	0.11	4	0.11	2	0.06
Total score		4.333		4.083		3.58		2.47		2.75

	Project developer		Investor		Property Owner		Municipality	
3 Position within the hierarchy	5	20.000	5	20.000	2	8.00	5	20.00
1 Number of ties to key stakeholders	5	15.000	5	15.000	4	12.00	5	15.00
7 Ability to persuade key stakeholders	5	25.000	5	25.000	5	25.00	5	25.00
4 Control of the design process	0	0.000	0	0.000	5	25.00	1	5.00
5 Role in team member selection	5	25.000	5	25.000	3	15.00	1	5.00
6 Ability to influence budget (control)	5	20.000	5	20.000	2	8.00	1	4.00
8 Control and coordination of team	5	0.000	5	0.000	4	0.00	1	0.00
2 Centrality within the organisation	5	0.000	4	0.000	4	0.00	5	0.00
Total score		105.000		105.000		93.00		74.00