Dissertation_Risk Management in Real Estate Development

by Ariane Haager

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by **Ariane Haager**

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How do real estate developers in Vienna consider risk management in their decision-making?

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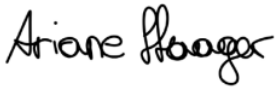
Being a dissertation submitted to the faculty of The Built Environment as part of the requirements for the award of the MSc International Real Estate and Planning at University College London:

I declare that this dissertation is entirely my own work and that ideas, data and images, as well as direct quotations, drawn from elsewhere are identified and referenced.

Signature: 

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Abstract

The real estate system consists of a space and asset market and the development industry. Further, a variety of different actors such as occupiers, developers, investors, and the broader economy are involved and contribute to the complexity and various perspectives of the real estate industry. Real estate development is associated with high risks, and particular uncertainties are involved. Therefore, certain risk factors need to be considered in the decision-making process of real estate developers.

The study in this paper examines how real estate developers identify and understand risk. The analysis should provide knowledge of how these risk factors are integrated into development strategies and how they influence real estate developers' decision-making. In-depth literature research related to the real estate development industry and the risk management process was undertaken to present a theoretical background and analyse its current knowledge pool. To contribute to the study's objectives, primary data in form of in-depth semi-structured interviews and a case study of the Viennese market were conducted.

The findings suggest that no standard risk management process exists since risk is subjective, and developers perceive and treat risk differently. Within the study, site location, construction delay, and marketing were the most common risk factors related to construction projects. Apart from a few qualitative and quantitative risk analysis, it seems that real estate developers still manage risk subjectively by relying on experiences, expertise and intuition. However, they are still following an individual risk management process, even in some cases, not on purpose. Moreover, empirical research indicated differences in the risk perception of trader-developers and investor-developers. While trader-developers are more concerned about construction delays, investor-developers perceive the marketing stage as considerably risky. This again highlights the subjectivity of risk and its various perspectives. Real estate developers could benefit from applying risk measurement tools such as simulations, scenario or sensitivity analysis, which subsequently may further comprise a positive effect on the overall economy. Finally, a model for a Bottom-Up approach has been suggested since an improvement of adequate risk measurement tools was identified.

Keywords: Real estate development, Risk management, Risk, Decision-making.

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Chapter 1 – Introduction

1.1 Background

Real estate development is considered to be a precarious and complex industry. Apart from the characteristics of tangible properties (heterogeneity and immobility), the different parties (investors, developers, and customers) involved in the real estate process influence and create challenges for successful real estate development (Graaskamp, 1982).

The activities real estate developers are responsible for range from land acquisition to construction and the sale of whole properties. Furthermore, Byrne (1996) highlighted that real estate development is a speculative business, meaning that core decisions are based on future demand anticipation. Therefore, risk and uncertainty are major components of real estate development. Isaac and O'Leary (2011) noted a cyclical pattern among the development industry and identified it as a volatile business. The crucial objective for real estate developers is to identify a community's needs and provide the right projects when needed. In other words, a developer's success depends on the right projects' availability at the right time in the right place (Miles et al., 2007).
In addition to this, real estate development is impacted by several risk factors that shape the construction project and can lead to unexpected consequences. According to Gehner (2008), real estate developers are "knowingly taking risk".

Millington (2014) and Adair and Hutchison (2005) define *risk* as a prediction of outcomes where the probability of occurrence is known. Being conscious of certain situations, issues can be prevented or reduced. De Lemos and De Almeida (2000) perceive risk as the outcome of an estimated probability of an event that could have been better anticipated. However, risk is subjective since people perceive it differently and have diverse attitudes toward risk. In contrast, *uncertainty* refers to events with low predictability, where outcomes are not known and hard to control.

Generally, risk can be categorised into systematic and unsystematic risks. Isaac and O'Leary (2011) state that risks such as economic changes are beyond the investor's control and are characterised as systematic risks, also known as market risks. On the other hand,

unsystematic risks such as financial or business risks can be controlled and minimised to a certain extent, for instance, by portfolio diversification.

Within the real estate development industry, different parties and services are involved and contribute to the sensitive nature of the development process. This means that political, economic, physical, legal and sociological factors need to be considered, which emphasise the implementation of proper management.
Furthermore, Miles *et al*. (2007, p. 6) suggest that collaborations between the different development functions such as "construction, finance, management, marketing and government" are essential, while ensuring flexibility and creativity.

Although the development process consists of various segments, the individual stages depend on each other. Therefore, real estate developers should perceive the development process from a broader perspective and consider different stages and their relations in their decision-making. This also depends on how real estate developers perceive risk and the various risk assessment tools used in the management process. However, the high risk-taking and the complexity of the development process challenge the decision-making. In addition, it is argued that the risk identification, assessment, and control within the development industry are undeveloped in some respects (Gimpelevich, 2011).

Wilkinson and Reed (2008) noted that real estate developers are often criticised for their risk perception and identification. Within the early stages, such as the planning and construction phase, real estate developers' risk is considerably high. Consequently, decisions need to be carefully examined by taking uncertainty into account while implementing risk control devices in the management process. In addition, the importance of risk management within the real estate development process, especially for the decision-making, is emphasised.

As mentioned, risk and uncertainty are integral parts of real estate development. Therefore, risk management approaches, especially for property developers' decision-making, are highly recommended by Gehner (2008). Several researchers (e.g. Godfrey 1996; Srinivas, 2019) have focused on risk management and examined the impact of risk. However, observational research, especially on risk management tools among the real estate development industry, and how risk is considered in the decision-making is comparatively scarce.

This thesis perceives risk from a real estate development perspective, meaning the probability of a negative impact, such as economic or financial loss on the anticipated value of a property development project due to uncertainty of circumstances that could occur (Gehner, 2008).

1.2 Research Aim and Objectives

This study follows a qualitative research design with a case study aspect of the Viennese market. Semi-structured interviews with a final number of ten participants were conducted to gain a better understanding of the real estate development market in Vienna, Austria.

Existing studies conducted by Kane (2001) and Hutchison *et al.* (2005) have analysed risk factors related to the built environment. Timing and the correlated risk of delay are, apart from financial risks, significant critical for construction projects. Gehner (2008) highlighted the existence of a research gap concerning risk among the real estate development field. There has been little previous empirical research investigating developers' risk awareness, especially on how real estate developers in Vienna consider risks in their decision-making process. Since 2017, Vienna's construction activities have increased drastically, and a shift in the market has been observed. Hence, to contribute knowledge in this area and to better understand the Viennese market, the **purpose** of this study is to examine the relationship between risk management and decision-making in the Viennese real estate development industry. The following research question was addressed:

- How do real estate developers in Vienna consider risk management in their decision-making?

The following research **objectives** would facilitate the achievement of the study purpose:

- To examine the role of risk within the real estate development industry and within the decision-making process of real estate developers;
- To identify the risk perception of real estate developers and examine how they diversify risk;
- To investigate the Viennese property market and to understand how real estate developers decide in which location they are going to develop and invest;
- To analyse how real estate developers consider and react to investment risks, and identify factors that influence their decision-making;
- To assess which risk management methods real estate developers apply;
- To appraise critical findings of the research and provide recommendations for further investigation.

1.3 Study Outline

The dissertation is divided into six chapters. Chapter 1 provides an introduction to the risky nature of real estate and the research purpose. The literature review and a deeper understanding of the real estate development process and the management process are presented in Chapter 2. Chapter 3 explains the methodology and data collection, followed by a case study analysis and an examination of the findings in Chapter 4. Chapter 5 provides key findings and a conclusion with further recommendations stated in Chapter 6.

Chapter 2 – Literature Review

2.1 Overview of the Real Estate Market

In the academic literature, three main characteristics of real property have been defined. Graaskamp (1982) differentiated between physical, institutional, and financial components. Moreover, real estate is delignated to a fixed geographical area and the three dimensions of space (length, width, and height), while time was identified as another fundamental dimension among the real estate industry – "space-time concept".
Apart from this, Graaskamp (1982) analysed the relationship between different parties of the real estate process and identified three main groups – "space users, space producers and public infrastructures". Those groups are the framework of the real estate industry and regularly interact with one another.

The real estate system can also be defined by the space market (supply and demand), the asset market (investment), the development industry, and the linkage to the broader economy and capital markets (see Figure 1, see Appendix for detailed explanation). Those markets are interrelated, since the asset market gives supply in the space market, and demand for space relies on rent and other external economic factors (Geltner *et al*., 2014).

Further, the real estate industry is dynamic, and various cycles exist in development, occupier, and investment markets. Barras (1994) recognised four types of real estate cycles and distinguished between short and long cycles, long swings, and long waves. All these different groups, markets, and indicators form the real estate system and illustrate the real estate industry's complexity.

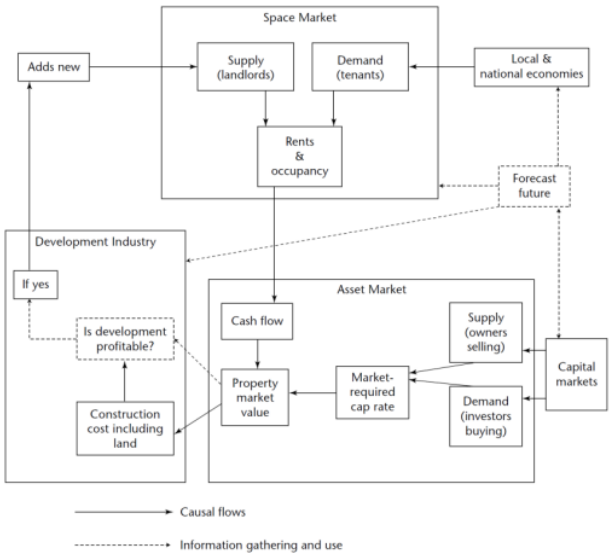

Figure 1: The Real Estate System

Source: adapted from Geltner *et al*. (2014, p. 23)

In general, direct real estate is characterised as a heterogeneous, immobile, and illiquid market. Direct properties are associated with high transaction costs, low transparency, and low turnover volumes. Although direct real estate is lumpy, it is evident that the overall portfolio risk is reduced when direct properties are added to a portfolio. Falk (2012) states that direct real estate works as an inflation hedge and generates higher yields than stock and bonds.

However, in contrast to equity and bond finance, real estate developers and investors have to deal with disparities in property rights, property tax, and liquidity issues (Lee, 2005). Keogh and D'Arcy (1999) argue that the real estate market is associated with imperfection and inefficiency. This refers to the physical characteristics of properties and the features of market activities related to market failure. Information asymmetry, however, is the key barrier identified among the acquisition process of real estate. This might be considerably challenging for investors and developers who operate internationally. Politically stable environments and highly integrated markets are preferred and facilitate decision-making. Integrated markets are characterised by international capital flows, cross-border real estate investment activities, and integrated organisational and institutional frameworks (Devaney *et al.*, 2017).

Eichholtz *et al.* (2010) documented a high correlation between international investments and the degree of transparency. He states that higher transparency reduces information asymmetry issues and makes markets more attractive to foreign real estate investors. However, he also indicated the trade-off between the costs of information and the benefits of diversification. This means that investment risk in an inefficient market would outweigh diversification benefits and diminish investors' returns. Nevertheless, government actions, such as changes in tax law or rent controls, for instance, are sometimes unpredictable. Therefore, the right market selection is crucial for international real estate investors.
Farzanegan and Fereidouni (2014) refer to a paper published by JLL, which states that foreign property laws' uncertainty may impact investors' confidence. Besides this, markets with low transparency are usually associated with higher transaction costs, while domestic investors with greater access to information gain competitive advantage.

The real estate transparency of each country is demonstrated by the Global Real Estate Transparency Index (GRETI), which measures the quality of benchmark performances and data availability, governmental and legal frameworks, transaction volume, and sustainable development of each city in over 99 countries. Since the increasing interest of global investment activities, JLL (2020) highlighted the constant improvement of real estate transparency to keep pace with other asset classes and meet the demand of offering a viable urban environment.

Overall, investments in equities and bonds can be more straightforward than direct property investments, since direct properties have a medium to long term holding period due to transaction costs and recouping value via income stream. Consequently, direct real estate investments are riskier than equities and bonds, and therefore challenge the decision-making of developers and investors. However, how developers and investors cope with these risks depends on their risk tolerance.

2.2 Real Estate Development

> *"Property development is an exciting and occasionally frustrating, increasingly complex activity involving the use of scarce resources. It is a high-risk activity that often involves large sums of money tied up in the production process, providing a product that is relatively indivisible and illiquid. Furthermore, the performance of an economy at national and at local levels both directly influence the process."*
>
> (Wilkinson & Reed, 2008, p. 2)

2.2.1 Real Estate Developers

The development market is the primary tool through which supply and demand disparities within the property market try to equilibrate in the long run. Still, they will always be out of balance due to market inefficiencies, such as lack of information or construction lags. Further, the occupier behaviour has a substantial impact on the property market and its cycles. Grover and Grover (2013) state that property cycles appear due to exogenous shocks represented by demand and supply movements. The demand side determines the supply market and influences development activities. The Four-Quadrant Model illustrates demand and supply movements and its impact on the long-run equilibrium among the space and asset market (see Appendix).

Within development markets, old properties are replaced by new ones through time. Resources are allocated by developers, who are the economic agents behind this process, creating new space and investment interests. Developers are tasked with optimizing scarce land resources through their activities, working with complex pricing mechanisms. Concurrently, their role involves identifying and activating market opportunities, and thereby providing a series of entrepreneurial services to the market (D'Arcy & Keogh, 2008).

Developers are responsible for establishing and managing different activities throughout the development process while coordinating and considering different interest groups like investors, occupiers, institutions, and local authorities (see Figure 2). This indicates the variety and complexity of the development process and highlights the importance of a good management framework to obtain a developer's objectives. Apart from this, the physical nature of properties (illiquidity, homogeneity, and high transaction costs) and market inefficiencies, emphasize the need for risk measurements within the real estate development process to encourage well-informed decision-making.

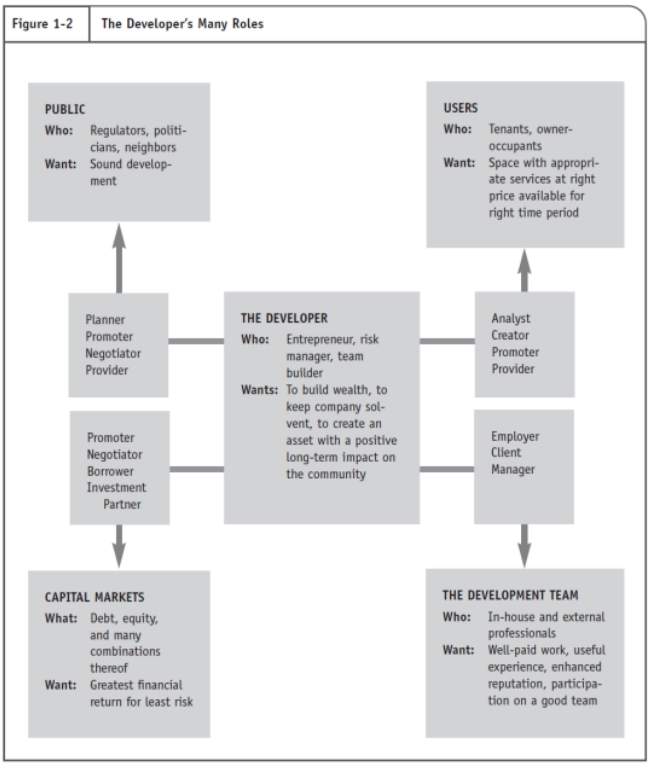

Figure 2: The Developer's Many Roles

Source: adapted from Miles *et al*. (2007, p. 10)

Overall, Wilkinson and Reed (2008) and Gann (2000) distinguished between two main types of developers, namely traders or investors. The term trader-developer refers to smaller companies as they are limited in their capital resources with the purpose to build and sell properties. With this strategy, they aim to take advantage of increasing rents and values.

However, Wilkinson and Reed (2008) pointed out the close relationship to the financial sector and noted the threat from economic crises. Investor-developers, on the other hand, construct properties to enhance their own portfolio by adopting a long-term investment timescale. Since investment activities are combined with development actions, investor-developers benefit from capital appreciation, apart from the development profits. Nevertheless, different developers have different objectives, and sometimes trader-developers might transform to investor-developers once they gained enough profit from trading to hold developed properties for their own portfolio (Wilkinson & Reed, 2008).

2.2.2 Real Estate Development Process

The increasing complexity of the real estate development sector suggests the requirement of a better understanding, for instance, of policy regulations, market research, financial factors, appraisal and valuation techniques, building methods, with an even much more efficient approach regarding time, quality, and cost management. Since the mid-1950s, researchers have established several models to facilitate the conception of the real estate development process (Ratcliffe *et al*., 2009). Healey (1991, p. 221) identified four perspectives of property and the development process:

- *Equilibrium models* suggest that economic indicators regarding sufficient demand, such as rents and yields, shape development activities. These come from neoclassical economics.
- *Event sequence models* concentrate on the coordination of different stages and phases of the development process. These mainly come from an estate management preoccupation with controlling the development process.
- *Agency models* concentrate on agents of the development process and their correlations. These have been established by scholars aiming to explain the development process from a behavioural or institutional perspective.
- *Structure models* concentrate on the forces which arrange the connections of the development process. These are based on the urban political economy.

Common real estate development processes start with an idea, followed by a feasibility analysis and land acquisition. The end of the development process is usually characterised by the occupation or sale of the property. While Gehner (2008, p. 38-39) categorised development activities in "land development, entitlement, design, financing, construction, lease and sale", Miles *et al*. (2007) present a more detailed model, namely an eight-stage model (see Appendix). Byrne (1996, p. 3) has used a 3-tier model, consisting of "acquisition, production, and disposal". Healey (1991) demonstrated that the stages of a development process could vary, and no model can thoroughly examine the dynamics of a development process. This is because developers perceive and treat processes differently. However, despite the uniqueness of the development processes, the interrelation of the stages is affirmed.

This thesis assumes the following development process stages:

- Project initiation (idea, location, and capital);
- Project conception (feasibility analysis);
- Project management (planning and control of costs, quality, and schedule);
- Project marketing (lease and sale).

2.2.3 Institutional Perspective

Healey (1994) has analysed the development process from an institutional perspective and emphasised the necessity to understand the relationship between different actors and institutions. In other words, she stated that particular attention is needed for the intricate relation between the public and private sectors in real estate development. D'Arcy and Keogh (2008, p. 22) define institutions as "rules, forms and regulations by which a society functions". For the acquisition of land, local knowledge is needed, particularly for construction and investment opportunities.

Healey (1994) discussed that the public sector has an incredible impact on the development field's structure. The public sector controls where construction takes place, when, how, and who will be responsible. Consequently, the public sector plays a key determinant in regulating economic demand and supply, since it controls the capacity and supports the

economy. Nevertheless, policies like land-use or urban policies often impede the development process, which influences the structure of building operations.

The implication of this is taken further by D'Arcy and Keogh (2008), who analysed the impact of institutional changes on development activities. In their work, they demonstrated the institutional hierarchy of property markets and distinguished between three levels. The first level is comprised of political, social, economic, and legal institutions and constitutes the institutional environment.

Then, the property market itself is categorised as an institution, while property market organisations represent the last level. It is vital to notice that the market cannot be associated with a "neutral allocator of resources and arbiter of values" (D'Arcy & Keogh, 2008, p. 23).

D'Arcy and Keogh (2008) also investigated the institutional hierarchy of the property development process, including the actors and effects of development activities (Figure 3).

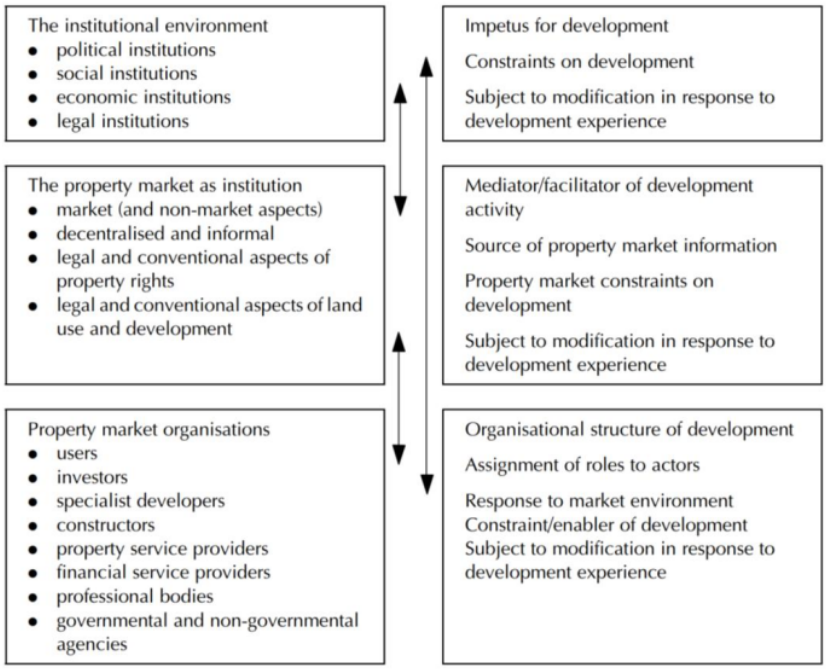

Figure 3: The Institutional Hierarchy of Property Development

Source: adapted from D'Arcy and Keogh (2008, p. 25)

Overall, success within the property market is associated with an exceptional understanding of the institutional market framework and its rules. In terms of market efficiency, Keogh and D'Arcy (1999, p. 2412) suggest that an "institutional approach allows the possibility that `property market process' may, for example, be efficient for users but inefficient for developers, or efficient for long-term investors but inefficient for short-term lenders".

2.3 Risk Management

Gehner and Peek (2008) suggest that risk management is imperative concerning an effective real estate development project. The academic literature differentiates between risk management related to projects or, in financial terms, to a company's portfolio. While the former deals with the implementation of strategies aiming to reduce individual project risks, financial risk management concentrates on the distribution of risk across a company or portfolio. Nevertheless, it has been observed that the strategies and decisions made at the beginning of a construction project received little emphasis. However, they are essential since the whole project and related consequences will depend on them. The following section will first clarify the difference between risk and uncertainty, followed by different risk types. Lastly, the risk management process is presented.

2.3.1 Risk and Uncertainty

Risk and uncertainty are essential to the decision-making process in development. Within the literature, several definitions of risk are presented and are often equivalently used with uncertainty. Though, it is important to distinguish between those two terms. According to Millington (2014) and Adair and Hutchison (2005) ***risk*** is defined as a prediction of outcomes where the probability of occurrence is known. Being conscious of certain situations, issues can be prevented or reduced. De Lemos and De Almeida (2000) perceive risk as the outcome of an estimated probability of an event that could have been better anticipated.

Risk is subjective since people perceive risk differently and have diverse attitudes toward risk. In other words, some people are more risk-averse than others, whereas some see risks as opportunities rather than threats. In a real estate investment context, risk is associated with, amongst other things, the uncertain financial results of decision-making (Khumpaisal, 2011).

In contrast, ***uncertainty*** refers to events with low predictability, where outcomes are not known and hard to control. Nnamani (2018, p. 188) states that "risk concerns situations with considerable data and well-defined boundaries for its use; while uncertainty, is synonymous with lack of knowledge and poor/imperfect information".
Outcomes can have a positive or negative impact on investor's performance. Therefore, they are characterised either as opportunities or as risks.

2.3.2 Types of Risk

Generally, risk can be categorised into systematic and unsystematic risks. According to Isaac and O'Leary (2011), risks related to economic changes are beyond the investor's control and are characterised as systematic risks, also known as market risks. On the other hand, unsystematic risk can be controlled and minimised to a certain extent, for instance, by diversification.

This study perceives risk from a real estate development perspective meaning the probability of a negative impact such as economic or financial loss on the anticipated value of a property development project due to uncertainty of circumstances that could take place (Gehner, 2008). Timing is another substantial influence on risk as property cycles or construction delays impact a project's cost and course.

2.3.2.1 Systematic Risk

Since systematic risks are caused by extrinsic factors like political or environmental issues, or changes in inflation and interest rates, the investor has no impact or control over these risks and their consequences.

Khumpaisal (2011) analysed systematic risks related to the real estate development industry and suggests that apart from the factors mentioned above, market risks and cyclical risks are also characterised as systematic risks. Market risks occur due to market fluctuations, while cyclical risks represent the cyclical nature of properties and the economy.

2.3.2.2 Unsystematic Risk

Unsystematic risks are specific risks that affect an investment or a project. In this context, real estate developers are able to control a certain degree of risk and consider it in their decision-making. Financial risks, for instance, or business risks, are characterised as specific risks. Here the developers can regulate the portion of equity or debt finance, while business risks relate to a company's structure or its management team.

Liquidity is another essential risk factor for real estate developers to be aware of. The transaction of real estate is characterised by high liquidity and usually occurs over a specific period. This affects the investment performances and the risk related to properties. Moreover, the nature of real estate has an impact on liquidity since those assets are associated with heterogeneity, information asymmetry, and high transaction costs. However, researchers found out that real estate is desired among investors as they secure stable income returns and provide opportunities for capital (value) growth (Devaney & Scofield, 2013). According to Devaney and Scofield (2015), liquidity significantly depends on the transaction time of investments and the time it takes to convert an asset into cash. Nevertheless, the institutional structure, performance, and transaction volume of markets vary. Consequently, high transaction time and information imperfection within real estate markets have a negative impact on liquidity.

The Investment Property Forum (IPF) report highlights the diversity of liquidity among international markets and proves that liquidity depends on different national markets, institutional setup, and degree of transparency. It is noted that transaction volumes impact liquidity and that the tolerance of investors' liquidity risks differs and depends on their investment horizon. Furthermore, liquidity is influenced by market imperfections that generate delays, uncertainties, and costs. It is also shown that international markets vary in transaction time, costs, and processes (IPF, 2016).

The risk of time overruns and, consequently, construction delay, are among the most critical risk factors real estate developers are exposed to. Several factors, such as insufficient planning or bankruptcy of a supplier, can cause construction delays (Ramanathan *et al.*, 2012). However, time overruns have an enormous impact on a real estate project's costs and result in further consequences.

As stated by Bond and Lizieri (2004), transaction time is a crucial determinant for risk and return. This means that delays in financial gains and uncertainty of time increase volatility. Besides this, low liquidity constraints strategic asset allocation, resulting in restrictions of investment performance.

Planning risk and viability risk also need to be considered. McAllister (2012, p. 3) states that "tests of the financial viability of development projects have become an integral part of the planning process, both at the forward planning and development control stages". Financial viability appraisals are important to ascertain the degree to which a planning policy might be attained or the degree to which development's negative effects might be reduced (Crosby & Wyatt, 2016).

All those risk factors need to be considered in the decision-making of real estate developers. Markowitz (1952) argued that due to diversification, the risk for investors and developers could be reduced while the expected return is optimised. Since the concern of cross-border investments increased during the last years, researchers, such as Hauss (2004), Lizieri and Pain (2014), and McAllister and Nanda (2016), have analysed the relation of risk and return in international markets. Reed *et al*. (2014) highlighted that developers seek opportunities in global markets; though, this also incurs additional risk factors such as currency risk or cultural risks. It can be concluded that diversification decreases a developer's risk to a certain point; however, Yardney (2019) highlights that "a good property developer learns to be risk conscious rather than risk adverse because the truth is if you never take a risk you will never make a gain".

2.3.3 Risk Management Process

Being aware of the high complexity and uncertainty within the property development industry, risk management tools are an integral part of property development. The global financial crisis in 2008 demonstrated how significant the application of precise and feasible risk management approaches in real estate development projects are. Although real estate developers are known as risk-takers, the applied risk management techniques of risk identification, evaluation, and control are relatively low compared to other industries (Nnamani, 2018). Still, the subjective nature of risk, the structure of the development

industry, and the different integrated groups (occupier, public institutions, economy, developers, investors, etc.) within the real estate market indicate the importance of a risk management process, since each group perceives and treats risk in various forms.

Godfrey (1996) argued that most of the time, property developers' decisions were taken instinctively. The author affirmed that real estate developers have to know how to cope with risk and, hence, suggested the use of systematic risk management. A systematic risk management approach aims to have control over real estate projects, which should support a developer's decision-making.

Risk management occurs in a cyclical pattern (Gehner *et al*., 2006) and is a systematic method that analyses risks and uncertainty by critically evaluating and identifying risk problems (Berg, 2010). Like the development process, the risk management processes reviewed vary in phases; however, they all address the same fundamental steps. For this research, the risk management process is assumed to compose the following four steps (Godfrey, 1996 / Chapman, 2011 / Srinivas, 2019):

- risk identification;
- risk assessment;
- risk mitigation;
- risk monitoring and controlling.

2.3.3.1 Risk Identification

The risk management process starts with the risk identification. With the application of different tools, such as brainstorming or SWOT analysis, real estate developers are able to address risk issues. This step aims to identify risk factors in a very early stage, which might impact the construction project. Therefore, it is in a developer's interest to identify potential threats as soon as possible to minimise the consequences and possible losses. However, this stage can also help to transform risks into opportunities (Godfrey, 1996). Overall, risk identification is fundamental for further actions of the risk management process. According to previous studies, SWOT analysis is a widely used method.

2.3.3.2 Risk Assessment

Risk assessment is the next step in the risk management process. In this stage, qualitative or quantitative data gathered will be reviewed and quantified.

Qualitative risk approaches are based on previous experiences and are useful if no qualitative data exist. According to Godfrey (1996), the likelihood of occurrence or the potential of the impact is measured. Scoring methods or ABC-Analysis are tools used for qualitative risk analyses.

Quantitative risk assessments, in comparison, are based on analyses. "The purpose of carrying out quantitative analysis is to estimate the impact of a risk in a project in terms of scope, time, cost and quality. The suitability of this analysis is more for medium and large projects as these projects have more complex risks as compared to smaller projects" (Srinivas, 2019, p. 8).

Sensitivity or Scenario analyses, for instance, have been observed to be the most common quantitative risk assessment methods used by real estate developers and investors (Farragher & Savage, 2008). Further quantitative risk evaluation methods are beta factor, tracking error, or simulations such as Monte Carlo.

After successfully identifying and analyzing risk factors, the implementation of sufficient risk measurements is vital for real estate developers. The academic literature distinguishes between Top-Down and Bottom-Up methods. Generally, Top-Down measures focus on risk consequences, while Bottom-Up methods represent the risk measurement based on the cause of risk. The following Figure illustrates the individual measurement methods (Preuß & Schöne, 2016).

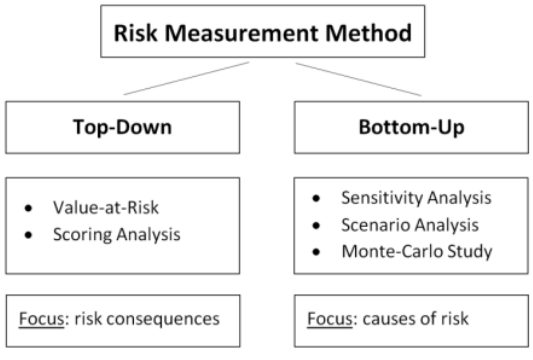

Figure 4: Risk Measurement Methods

2.3.3.3 Risk Mitigation

Risk management aims to mitigate risk factors. However, Godfrey (1996) assessed the probability of additional costs and secondary risks. Researchers have identified some useful tools and techniques applied for risk monitoring strategies. Srinivas (2019) differentiate between mitigation strategies applied to negative or positive risk. *Risk avoidance* or *risk transfer*, for instance, are two strategies regarding negative risks. Here the developer either eliminates the threat in form of changing the development plan or transfers the risk to a third party. Moreover, *risk reduction* or the *acceptance* of risk are other opportunities.

Positive risks refer to opportunities where the developer seeks to *exploit* or *enhance* the risk. In other words, developers try to eliminate uncertainty while supporting the beneficial effect of an opportunity. Developers can also *share* risks that benefit the project (Srinivas, 2019).

2.3.3.4 Risk Control

Risk control is a fundamental approach for real estate developers. It is an ongoing process that should be applied by developers regularly in terms of monitoring identified and current risks of construction projects. This tool can also facilitate the recognition of new risks during the development process. Furthermore, regular meetings assist risk management, while performance measurements can be implemented in further decision-makings (Srinivas, 2019). It has been recognised that various risk factors could occur or impact different stages. Some risks, like planning risk, are temporally specific, while financial risks, for instance, need to be considered the whole time.

2.4 Previous Studies

Lyon and Skitmore (2004) conducted an analysis of risk management techniques and concluded that qualitative methods were applied more often than quantitative approaches in terms of risk assessment. Moreover, risk reduction was the most commonly implemented risk mitigation strategy, followed by risk transfer, risk elimination, and risk retention.

Gehner *et al*. (2006) examined the Dutch real estate development market and found out that all companies surveyed rely on intuition and experience, followed by qualitative descriptions. Similar to other studies, scenario and sensitivity analyses were preferred. In contrast to prior research, Gehner *et al*. (2006) solely focused on real estate developers.

In 2008, Gehner extended her research and investigated how real estate development institutions make decisions. To provide an in-depth and adequate examination only three firms were investigated. From an organizational perspective, the researcher figured out that the application of risk analysis approaches used for investment decision-making in the real estate development industry is low.

A more recent study published by Lausberg et al. (2020) investigates the volatility of returns as a risk measurement for direct properties. It is argued that volatility is the most commonly used approach in the real estate industry. However, the researchers prove that volatility alone is insufficient for the estimation of direct real estate risks. For precise risk management, the combination of qualitative and quantitative risk measurements is suggested.

Although risk assessment approaches enable the possibility to compare competing projects, none method can efficiently be implemented in the decision-making process without accurate data, market efficiency, and transparency (Isaac & O'Leary, 2011).

Chapter 3 – Methodology

This chapter presents the methods used for the data collection within this study. First, the methodological approach is discussed, followed by the data collection, the selection criteria, and the ethical considerations.

3.1 Methods

It has been observed that quantitative research methods are common and dominant when analysing the real estate industry. This might be the case since considerably high numerical data are available. Consequentially several studies deal, for instance, with the valuation or appraisal process (Bell & Bell, 2015). Though, quantitative approaches emphasise numerical data analyses and therefore are less discursive and lack human perceptions (Creswell, 2014). Qualitative research methods, on the other hand, are used to examine and understand individuals in relation to a social problem (Creswell, 2014).

To fulfil the thesis' aim and to meet the objectives, this study follows a qualitative research design. Qualitative research methodologies empower researchers to work closely with participants, in this case, professional real estate developers, and to collect relevant data and experiences. Commonly applied research methods are interviews and open-ended questions (Creswell, 2014). For the recruitment, potential participants were contacted via e-mail. That included information regarding the research aim, followed by an ethical statement.

3.2 Data Collection

In order to acquire primary data and get a better insight into the risk management and the decision-making process within the real estate development industry, a qualitative analysis in the form of semi-structured interviews was conducted. According to Longhurst (2003), semi-structured interviews enable participants to discuss issues they consider to be relevant. Semi-structured interviews take advantage of flexibility, meaning they encourage open responses from participants. Since this study covers a broad research topic and due to the

subjectivity of risk, semi-structured interviews were chosen to generate data in the most appropriate way and to respond to the interviewees' reactions.

The key target group was Viennese real estate development companies that invest in direct properties. The interviews aimed to analyse how property developers consider and manage risk in their investment strategies. Overall, the interviews were structured into three main parts, focusing on the company structure's general information first, followed by relevant decision-making criteria, and risk measurement approaches. Depending on the responses of the participants, the interview questions might have changed slightly.

3.3 Case Study

According to Creswell (2014), case studies are primarily used in many fields as a tool to have a better understanding of the environment and evaluation. Here cases, such as programs, events, activity, process or one or more individuals, are analysed precisely. Case studies are restricted by time and activities, while researchers gather data by using different methods over a given period.

Case studies are primarily guided by research questions and can be used for both qualitative and quantitative studies. Especially descriptive or explanatory questions with little available information are suitable for case study analyses. Data can be gathered in form of observations, surveys, interviews, and other methodologies. The collected data is used to investigate research groups' behaviour, how they deal with problems, and draw comparisons to other cases (Dooley, 2002; Swanborn, 2010).

Moreover, case study approaches can be applied to generate in-depth analyses of certain situations or geographical areas. As this study contains several "how" and "why" questions, a case study on the Viennese market can facilitate to understand specific issues and provides additional insight into this research topic (Crowe *et al.*, 2011).

3.4 Selection Criteria: Participants

Participants for this study were carefully selected, meaning that topic-related development companies were chosen to gain a deeper understanding of Viennese property developers' decision-making. Those companies are experts in their field and operate as real estate developers and/or investors. This means that the participants can operate as service-, trader-, or investor-developers and vary in development types (residential and commercial).

Ten professionals were interviewed. The semi-structured interviews were conducted online and lasted between 45 and 60 minutes. The core structure of the interview questions is included in the Appendix; however, questions were tailored and modified to each interviewee where necessary.

Overall, 70% of the interviewees are investor-developers, while 30% are trader-developers. Moreover, the majority of interviewees specialize in residential properties. Four out of eight real estate developers operate solely in the residential sector, whereas two companies also operate in the hotel industry.

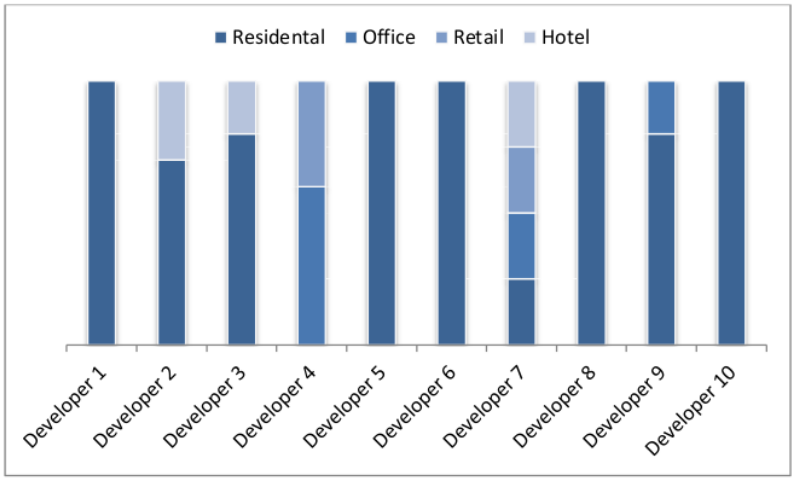

Figure 5: Real Estate Construction Categories

3.5 Ethical Approach

The study minimised the risk of harm and avoided deceptive practices. Before the interviews were conducted, an information sheet was provided to each participant with an outline of the study's purpose, followed by an informed consent form (see Appendix). Furthermore, data protection is ensured while the right to withdraw and anonymity were respected. This research secures the required permission from participants to be recorded. Lastly, a risk assessment form was completed (see Appendix).

Chapter 4 – Discussion and Analysis

This chapter presents the analysis results and discusses the significant finding in line with the research objectives. Overall, the chapter is structured into two main parts, starting with the Case Study context and followed by the risk management analysis. Within the risk management section, the main risk factors and risk management process are presented.

4.1 Case Study – Vienna

Vienna, Austria's capital city, is consecutively ranked as the top city of quality of life and living for ten years in a row. This also has a positive impact on investment volumes and building constructions. According to the market research of CBRE (2020), investment activities in Austria reached its peak in 2019, while the construction activities have been increasing since 2017. Further, a shift in the Viennese market has been observed, indicating that construction, especially of residential buildings, is booming. However, there has been little previous research investigating risk consideration in the Viennese real estate development market. Therefore, this study aims to better understand the Viennese market and contribute knowledge of how Viennese real estate developers manage risk.

4.1.1 Background

Going back in history, the so-called “Red Vienna” and its legislations had an essential impact on the Viennese housing system (Riegler, 2011).
Those restrictions had a negative impact on the built environment; hence the market became unattractive for investments and new developments. Further, the construction costs became incredibly high, and landlords could not renovate buildings (Novy *et al.*, 2001)

The first district is Vienna's heart and is one of the most expensive areas when it comes to property prices and rents. The adjoining districts (see Figure 6) provide excellent investment and construction opportunities for real estate developers since they are preferred living areas.

On the other hand, the urban fringe districts such as the 17th, 18th, 19th, and 22nd districts have many green areas and therefore, Viennese construction companies see high potential and aim to develop those areas.

Figure 6: Vienna

Source: https://de.wikipedia.org/wiki/Wiener_Gemeindebezirke

4.1.2 Supply and Demand

In the past, Vienna observed growth in freehold apartments. Nevertheless, the market has changed, and during the last years, the demand for rental apartments increased significantly (EHL, 2019). Since 2017 there has been an incredible increase in building licenses, which indicates that 2020 is likely to result in a peak of completions. More than 19,000 apartments, of which 60%–70% are residential units, will be complete. Consequently, 2020 will be a year where some urban development areas are going to be fully accomplished (Otto, 2020). Moreover, a slight increase in commercial properties has been observed. After a completion volume of 36,400 m² in 2019, commercial buildings' new construction capacity will boost in 2020 to 155,200 m².

The growth of popularity among international investors, whose investment strategies are to buy the entire real estate projects and bring them onto the market as leased apartments, is one reason for the boom of rental housing in Vienna (EHL, 2019). In addition to this, the

currently low interest rates are another appealing factor why investments in real estate are especially interesting for investors. Further, the prices of properties among the Viennese market rose sharply and became a lucrative opportunity for real estate developers (Immobilien-redaktion, 2019).

Although direct real estate is associated with low transparency, Vienna is classified as a transparent market (JLL, 2020). Hence, information asymmetry issues are low, making the market more attractive for foreign real estate investors (Eichholtz *et al*., 2010).

4.1.3 Construction Complexity

The scarce land availability in Vienna and high construction costs restrict the development of new construction projects, while new dedication categories also affect the development process (Putschögl, 2019).

Another indicator is the long construction period. Usually, the time horizon between the investment decision and the completion of a construction project lasts over several years. In Vienna, the average construction period is approximately 36 months; however, the property's size and complexity are crucial determinants (Skodacsek, 2002).

Apart from this, CBRE (2020) noted that developers are seeking to build and invest within the upcoming years more in suburban regions close to Vienna since the population prefers more green areas, and the high land prices in Vienna are another barrier.

Overall, it can be said that all these factors impact construction among Vienna and prevent the fast adaption of demand and supply.

4.1.4 Comments to the Viennese Market

> *"Vienna is one of the most desirable cities in Europe. This, especially, can be seen in the annual growth of 30,000 people per year. As a result, there always will be more demand than supply in the housing market."*
>
> *– Developer 5*

Developer 4 asserted that the Viennese market benefits from its stable demand. Compared to other countries, Vienna has no peaks or droughts of construction. Therefore, the city has no issues with over- or undersupplies.

However, *Developer 6* argued:

> *"Even before the crisis (COVID-19) there was a decline in office buildings. Although the trend has been towards so-called "office towers", many offices will be vacant, especially after the crisis, and the trend of home office will increase even more. Therefore, the challenge will lie in the restructuring of these buildings."*
>
> *– Developer 6*

Moreover, 90% of the participants agreed that the Viennese market is not saturated. According to *Developer 6,* the districts 1 to 9 and 18 to 23 are in great demand; though, *Developer 7* and *Developer 8* stated that Vienna's land availability is scarce and prices are high.

> *"Nowadays, you have to be lucky if you get the opportunity to acquire land or parcels in top locations. There are no bargains in Vienna, which is why the land purchase is one of the most important criteria for real estate development."*
>
> *– Developer 8*

Almost 90% of the surveyed real estate developers had difficulties to name any weaknesses of the Viennese real estate market. Besides the high cost and scarcity of land, only *Developer 3* suggested that the current political situation could have an impact on the Viennese real estate market. Regarding GRETI (2020), Austria is ranked at the 21st place and is categorised as a transparent market. This means that Austria benefits from strong legal and governance frameworks and transaction activities. Improvements concerning performance measures and market fundamentals data are suggested.

4.2 Risk Management

Within the study, real estate developers were asked how they define risk, and four participants responded the following:

> *"… changes in the immediate vicinity that were not planned or that you were not aware of."*
>
> *– Developer 3*

> *"It is not just about capital loss. Other parameters, such as qualitative and temporal deviations, also pose a risk."*
>
> *– Developer 4*

> *"…that over the course, the projects do not develop as planned."*
>
> *– Developer 5*

> *"… the degree between profit and loss."*
>
> *– Developer 8*

The quotes indicate the subjectivity of risk and support De Lemos and De Almeida (2000), who affirmed various risk perspectives.
Moreover, 70% of the participants said that they are more risk averse. They agree on taking certain risks; however, they are only taking those risks they are aware of and which they can control to some extent, like financial or business risks.

The answers regarding the development process's risks were straightforward: the planning and pre-development phases are the riskiest stages of the construction process, followed by the post-development phase. The construction phase itself seems less risky to all property developers. Wilkinson and Reed (2008) affirmed that within the early stages, as the planning phase, real estate developers' risk is considerably high.

Developer 4 made a statement on that and explained:

> *"The construction phase itself entails the least risk. The planning phase is essential because, in most cases, all the mistakes made during this stage cannot be compensated along the development process."*
>
> *– Developer 4*

Participants were asked to name the three most vital risk determinants among the whole development process. Figure 7 represents all risk factors that seem considerably important to the individual real estate developers. However, a clear tendency of risk awareness was recognised, relating to project initiation, construction delay, and project marketing. Among the Dutch industry, Gehner (2008) showed that planning application, sales/rental risks, and tendering were the most significant risk factors.

Figure 7: Identified Risk Factors

4.2.1 Project initiation

Since the project initiation stage, including plot and site selection, was under the top three risk factors, the following section evaluates the location criteria of new construction projects. In the study conducted by Newell and Steglick (2006), participants perceived the pre-construction phase as the most risky stage of the development process, due to high uncertainties.

Developer 5 commended:

> *"From my point of view, there are only three decisive factors in this industry, namely: location, location, location."*
>
> *– Developer 5*

According to Radcliff *et al*. (2009), market analyses are fundamental for property development processes. Apart from the macro factors (GDP and unemployment rate), all surveyed real estate developers pay great attention to micro-location criteria such as good public transport connections, local supply, and social institutions (schools and health care).

> *"First of all, there must be sufficient demand. Without demand, it makes no sense to build a new project. Therefore, examining supply and demand is one of the first steps, followed by a micro and macro analysis. When I plan to build a new project, I investigate the development plan in terms of size, because the higher or the more I can build, the cheaper is the purchase price. Furthermore, I compare the construction costs to the achievable rent. The developer must always make sure that he has the right ratio between the encumbrance of property, including additional costs and the achievable living space of the property. Otherwise, it does not pay off and he goes bankrupt."*
>
> *— Developer 2*

This reflects the real estate system and the long-term equilibrium between the space and asset market, the development industry, and the impact of the broader economy (Geltner *et al*., 2014). Healey (1994) highlighted the public sector's impact, acting as a determinant of demand and supply.

Almost 60% stated that the construction pipeline within an area is critically estimated. *Developer 6* added that around universities in Vienna, for instance, many micro-apartments are in the pipeline, so it would be counterproductive to build further micro-apartments in the same area since the demand is saturated; otherwise, it will lead to an oversupply. This reflects the demand and supply theory, where occupier behaviours and property market rents stimulate development activities and market dynamics (Garay, 2016).

> *"If you compare projects, we aim to be better than competitors. We want to stand out, and therefore, we will try to offer better qualities in form of more green space or more room height, for example."*
>
> *– Developer 3*

Developer 4 presented the competitiveness from another perspective and argued:

> *"In the office sector, an agglomeration is advantageous since office clusters attract significantly more customers and facilitate leasing. Within the retail industry, it is the opposite. As one tries to avoid direct competition, the choice of location is already quite limited."*
>
> *– Developer 4*

A contradiction was found by Jaravaza and Chitando (2013). They argue that high levels of affinity and cooperation can benefit individual retail stores' sales, as more consumer trade is created.

4.2.2 Construction Delay

Construction delay can arise for various reasons; therefore, developers first analyse why and what caused the delay. Generally, all surveyed real estate developers plan a time buffer of 1 to 3 months. To further narrow the risks, 8 out of 10 developers, especially trader-developers, work with a general contractor and try to keep the number of external partners low. In this case, the number of involved external partners ranges from 2 to 5, including banks, construction companies, architects, and rental agencies.

"Although it is much more expensive, I prefer to work with a general contractor, since it is safer and you can arrange much more."

– Developer 2

Moreover, construction delays are contractual regulated, meaning that penalties will be put in place if delay arises. This is because time overruns have an incredible impact on a real estate project's costs and result in further consequences (Ramanathan *et al*., 2012).

"The construction delay is simply regulated. According to the contract, I have to pay after construction progresses. If I notice that the schedule has been exceeded and can no longer be obtained, I will stop the general contractor's payments."

– Developer 2

"We usually deal with construction delays in such a manner that if the completion of the project cannot be obtained at deadline X, a percentage discount of Y % will be granted from the total sum."

– Developer 5

Developer 1 added that sometimes they also work with a bonus system, meaning that the construction company gets a bonus when they finish earlier or on time.
Around 70% defined the construction delay as a vicious circle. Timing is a crucial indicator that impacts individual investment decisions and attendant development activities (Gehner, 2008). Financial risks may arise and, above all, the sale is severely affected by time overruns. In order to cover the financial risk, 40% of the developers already sell the projects or parts of the building during the planning phase.

"In the event of a delay, I agree with the new owners that the furniture's total storage costs and the accommodation expenses will be covered, so they do not have to pay anything. This costs me personally nothing since I pass the expenses on to the general contractor."

– Developer 2

Investor-developers, on the other hand, perceived construction delays less threatening. Nevertheless, they have a period where the project has to be finished and also make use of contract penalties. However, if they use equity capital and do not prelease the property, the impact of construction delay is relatively low.

This contradicts with the perspective of *Developer 4*, who argued:

> *"In the retail sector, construction delays are much riskier. […] shopping centres generally have two opening periods, namely spring and autumn. Accordingly, depending on the period, fashion tenants have to order their collections in advance. That means that if the opening does not take place as planned, we have a problem."*
>
> *– Developer 4*

4.2.3 Marketing Risk

A frequently mentioned risk was the sale or lease of the construction project. This contradicts Newell and Steglick's (2006) study, where developers perceived the post-construction phase as the least risky development process phase. Ratcliffe *et al*. (2009) argue that too little attention is paid to project marketing. They suggest that developers should decide on the form of leases already at the planning stage to ensure the optimum return on investment. Within this thesis, in comparison to investor-developers, trader-developers only have the problem of sale, while for investor-developers, the risk of lease is very significant. The study found out that both trader- and investor-developers are trying to sell the projects as early as possible, i.e. during the construction phase, thus reducing the risk of acceptance. If this is not possible, *Developer 2* commented as follows:

> *"If I cannot sell the property, I have to keep it in my own portfolio. At this point, the rent and my break-even point are especially important."*
>
> *– Developer 2*

Developer 5 deals similar to this risk. He argued that he would try to rent them out if he cannot sell the apartments individually. According to Ratcliffe *et al*. (2009), long-term leases are favoured among institutional investors as the risk of vacancy and revenue loss is reduced.

> *"It is important that these risks were already taken into account during the planning phase, that in such a case, the project would still be profitable."*
>
> *– Developer 5*

Furthermore, all developers agreed to take further measures and to intensify the marketing. This includes additional marketing activities, media advertising, and events. Investor-developers with a high capital-asset ratio affirm that they have no issues to keep the building empty for a period and sell it later on according to their high financial standing.

> *"If I want a certain amount, I can wait. However, this only applies to developers with high equity. If my debt finance is high, I would have to give in and rent out cheaper."*
>
> *– Developer 8*

Therefore, the size and scale of operators also influence the liquidity risk. For small scale businesses, liquidity is more important, and they depend much more on cycles than other operators. For example, investors-developers can be more patient, while trader-developers depend more on liquidity and how quickly they can obtain cash.

For the hospitality industry, prelease is incredibly crucial. According to *Developer 4*, this can sometimes turn out to be very tedious and risky, especially for hotels, since the hotel manager is acquired after the hotel has been built. After this step, the whole bundle, including a rental agreement, will be sold to an investor. Here, disagreements can arise, starting with currency differences and the associated fall in exchange rates.

4.2.4 Systematic Risk

Apart from the specific risks, systematic risks pose a significant problem for developers. Especially the current situation due to COVID-19 presents the developers with a big challenge. Although the impacts to date are still relatively small, future effects are unpredictable. Similar results are presented by Newell and Steglick (2006), where economic risks pose the highest risk factor among the development process.

> *"At the moment, it is like reading in the glass ball. No one can estimate the near future. Due to COVID-19, the current situation is very risky and unpredictable."*
>
> *– Developer 3*

> *"We have been working on reserves. However, this was only possible through monthly risk analyses and the valuation of the existing properties. "*
>
> *– Developer 5*

In comparison to *Developer 5,* 70% of the respondents tried to reduce costs, while 30% cooperated and supported construction companies. *Developer 9* stated that they would have taken a temporary loan to cover some risks.

> *"No one could have calculated the Corona crisis. I see it as a learning process. People will build up better reserves in the future."*
>
> *– Developer 9*

For the hotel industry, COVID-19 represents a much higher risk. *Developer 4* relies on early indicators that are identified in regular meetings by accurately analysing online booking platforms. In order to determine how the industry is developing, travel data, changes in hygiene measures, and online bookings are monitored with the utmost care.

> *"We have already looked at how we can deal with COVID-19 and how we can develop a forecast for the future. We pay special attention to early indicators and think that affordable but relatively good hotels will be preferred."*
>
> *– Developer 4*

Besides this, 80% highlighted the risk of changes in the market or bank conditions. Unforeseeable changes in the environment also pose a threat. In this case, *Developer 10* suggested the importance of market research once again because if they believe, for instance, that within the next few years, the economy of a city will collapse, they will not construct any projects there.

4.2.5 Financial Risk

The financing risk is not particularly threatening for the surveyed developers. As Figure 8 shows, the construction projects' financing forms vary from 100% equity financing to 100% debt financing. Two of the interviewees even have mixed debt financing, where shareholders hold about 30%.

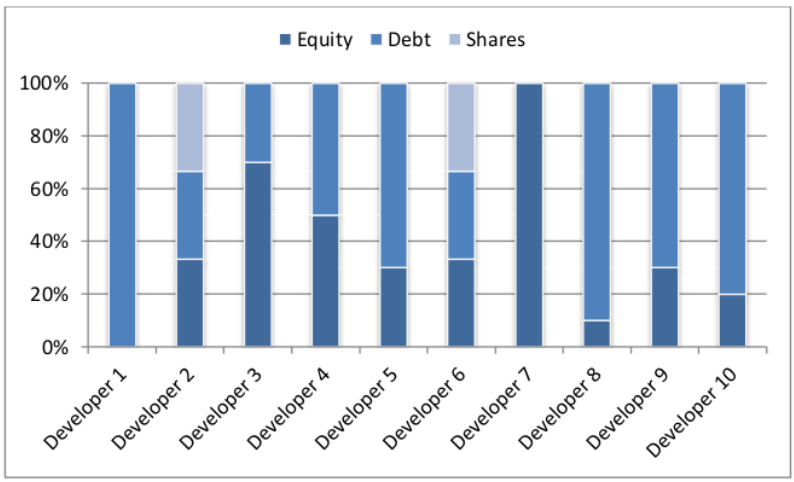

Figure 8: Distribution of Project Funding

Since the creditworthiness of all external partners and companies is precisely evaluated, the financial risk is, according to *Developer 3*, *Developer 8,* and *Developer 10* minimised. Financing may also be influenced by property cycles. Still, the study clearly demonstrated that trader-developers particularly consider cycles, while property cycles are less relevant to investor-developers since Vienna's land availability is scarce. Furthermore, as Crosby and Wyatt (2016) suggested, financial viability appraisals are useful to mitigate development risks.

4.2.6 Legal Risk

A total of five interviewed real estate developers mentioned legal risks and highlighted the importance of Due Diligence. Some risks are difficult to outsource; hence *Developer 4* insures himself with partial insurance. Gehner (2008) argued that there is little insurance within the development industry due to each project's distinctiveness and required insurance premium.

Moreover, transparency and agency issues could arise; therefore, 60% work with internal and external legal advisers to identify potential risk factors that could cause troubles.

4.3 Risk Management Process

> *"The risk management in the development industry is so insufficient because a deficient level of standardised processes actually characterises the development sector, and a standardised process is a precondition that one can operate reasonable risk management."*
>
> *– Developer 9*

Based on this statement, the respondents were asked how they manage their risks. Interestingly, the assessment and applications of risk management processes were very different. Nevertheless, surprisingly, all respondents confirmed that gut feeling and intuition play an essential role in their decision-making. Furthermore, 80% confirmed that SWOT analyses were the most frequently used measurement tool related to risk identification, followed by brainstorming. In a previous study, Gehner (2006) supported the influence of developer's intuitions and experiences.

The interviewed real estate developers also think differently regarding risk measurements. While some place emphasis on sensitivity and scenario analysis, others do not apply any risk measurement approaches. Nevertheless, it became apparent that sensitivity and scenario analysis are useful quantitative methods, whereas simulations such as the Monte Carlo simulation are not applied at all.

These results are consistent with Farragher and Savage's (2008) findings. They state that the infrequent application of Monte Carlo simulations refers to the inefficiency of handling interdependencies among essential parameters.

> *"Sufficient quantitative measurements are difficult. We are trying to capture risks more quantitatively, but we do not have enough historical data to do so."*
>
> *– Developer 10*

> *"We try to keep it simple and proceed according to the principle of 'Probability of Occurrence x Magnitude'. Time delay is tried to be quantified as far as possible, but there is no need for simulations."*
>
> *– Developer 7*

One-third of the respondents work with a risk catalogue, where potential risks are identified and analysed. According to *Developer 9,* risks are clustered in a matrix and are tracked monthly. Those with a higher potential of occurrence are monitored more intensively. He stated that 98% of all risks that occur in a project are already known at the beginning of the project and that sudden appearance of risk is rather unlikely.

> *"It is important to react quickly to identified risks, make compromises, and find solutions."*
>
> *– Developer 8*

The interviewed developers act similarly concerning risk mitigation. Around 90% of the developers confirmed that they primarily try to avoid risks or aim to transfer them to other parties. This is congruent with the study conducted by Baker *et al.* (1999), where risk reduction and risk transfer were the most prevalent risk mitigation strategies. As long as risks are calculable and controllable, they will be accepted, while insurances and contracts minimise them. However, should the risk be too high, the project will be rejected. Risk monitoring applied by the interviewed real estate developers occurs every month. Especially trader-developers highlighted the importance of risk tracking.

Chapter 5 – Key Findings

It is evident that real estate developers analyse risk factors and consider them in their decision-making process. In the literature section (2.3.3), two different risk measurement techniques were presented. The analysis of this dissertation has demonstrated that the interviewed real estate developers follow a Bottom-Up approach.

The model represented in Table 1 considers the critical risk factors based on the Viennese market from a Bottom-Up perspective and can be used as a foundation for further research of development risks in other cities. This model summarises the most crucial risk factors within different stages and illustrates individual risk mitigation strategies. Since the model is based on data generated for the Viennese market, actors in other markets might have different perspectives. Moreover, risk among a Top-Down measurement method might be assessed differently.

Within the pre-development stage, the planning risk, including land acquisition and market transparency, is predominant. Precise market analyses, legal and environmental investigations are recommended. For risk mitigation, local external partners and legal advisors are suggested.

The construction risk is straight forward; however, time overruns need to be considered. This stage is perceived as less risky since developers reduce risks due to general contractors, due diligence, and contract penalties. Nevertheless, regular monitoring of company and project performances is advised.

The post-development stage is, to the contrary, considered as very risky. For this stage, scenario and sensitivity analyses are highly recommended to deal with marketing risks in the best possible way, since the risk of lease/sale also impacts the construction process's liquidity.

Financial risk is a constant risk factor of which developers have to be aware of. However, within this study, financial risk was perceived as moderate. Real estate developers have to establish a detailed feasibility study within the pre-development stage and need to meet certain bank conditions. Apart from regular meetings, observations of property cycles could reduce financial risks.

Table 1: Bottom-Up Model for Real Estate Developers in Vienna

Bottom-Up Risk Management Model for Real Estate Developers

Step 1: Pre-Phase

Land Acquisition

Identification	Assessment
• Market Analysis • SWOT Analysis • Site Selection • Land Ownership Investigation • Zoning Plan Investigation	• Site Investigation • Soil and Noise Examination • Feasibility Analysis • Investigation of Environmental Effects
Mitigation	**Control**
• Agency Company (*reduction*) • Insurance (*transfer*) • Contracts (*transfer*) • Legal Adviser (*reduction*)	• Legal Adviser

National/International Market

Identification	Assessment
• Market Analysis • Political/Environmental Investigation • Transparency Analysis	• Portfolio Analyse • Sensitivity Analysis
Mitigation	**Control**
• International Companies • External Partners • Insurance (*transfer*) • Contract (*transfer*) • Legal Adviser (*reduction*)	• Market Monitoring

Finance/Liquidity

Identification	Assessment
• SWOT Analysis • RIM • Market Analysis • Economy Analysis • Transparency Analysis • Financial Viability Test	• Scenario Analysis • Sensitivity Analysis • Monte Carlo Simulation • Observation of Property Cycles • Feasibility Analysis • Operative/Strategic Analysis
Mitigation	**Control**
• Contracts (*transfer*) • Shareholders (*reduction*) • Legal Adviser (*reduction*)	• Bank Meetings • Controlling Budget • Internal Meetings • Monthly Analysis • Project documentation

Step 2: Construction -Phase

Construction Delay

Identification	Assessment
• Due Diligence • SWOT Analysis • RIM	• Scenario Analysis • Sensitivity Analysis • Viability Assessment
Mitigation	**Control**
• General Contractor (*reduction*) • Insurance (*transfer*) • Contracts (*transfer*) • Penalties (*reduction*) • Time Buffer (*reduction*)	• Internal meetings • Supervision of Construction • Monthly risk control • Project documentation

Bankruptcy of External Companies

Identification	Assessment
• Due Diligence • Liquidity Analysis • SWOT Analysis of individual companies	• Scenario Analysis
Mitigation	**Control**
• General contractor (*reduction*) • Further Companies (*acceptance & reduction*) • Contracts (*transfer*)	• Monitoring Performance of Companies

Step 3: Post-Phase

Marketing

Identification	Assessment
• Market Analysis • Pre-Lease/Pre-Sale • Market Feasibility Analysis • Watching Market Trends	• Scenario Analysis • Sensitivity Analysis
Mitigation	**Control**
• Agency Company (*transfer*) • Promotional Activities (*reduction*)	• Market Analysis • Marketing Plan • Market Monitoring • Meetings • Comparative Analysis

Chapter 6 – Conclusion

This study aims to gain insight into the implementation of risk management in the real estate development industry and how risk influences Viennese property developers' decision-making. Qualitative analysis in form of in-depth semi-structured interviews was applied to generate primary data. Academic insight proved the real estate industry's complexity and the scarcity of proper risk management tools among the development sector. However, this study demonstrated that the awareness towards real estate developers' risk management increased since various risk factors are mainly evaluated and considered in the decision-making process. Based on the findings, Viennese real estate developers are most aware of location risks, construction delays, and the risks of lease/sale. The case study provided insight into the Viennese market, and it can be said that although the scarce land availability in Vienna, the market is not saturated yet and there is an ongoing high demand for residential buildings.

Empirical research indicated differences in the risk perception of trader-developers and investor-developers. While trader-developers are more concerned about construction delays, investor-developers perceive the marketing stage as considerably risky. The survey showed that developers consider identified risks accurately, look for solutions, and deal with risks in the best possible way. Specific measures (e.g. sensitivity analyses) are also taken into account to minimise risks and to facilitate decision-making.

Furthermore, in line with the academic literature (Godfrey, 1996; Gehner, 2008), the study proved that systematic risks pose a significant threat to real estate developers. At the moment, COVID-19 constitutes a challenge for the construction industry, whose impact is unknown and cannot be controlled.

It became evident from the research that although the risk perception of real estate developers has changed, and more risk management activities are applied, there still remains great potential for risk management improvements among the development process. Apart from a few qualitative and quantitative risk analyses, a notable finding of the research is that real estate developers still manage risk subjectively by relying on experiences, expertise and intuition. This is in line with Lyons and Skitmore (2004) study, who came to similar results. The dissertation provides evidence that there is no overall

applicable risk management process since real estate developers lack on historical data, and developers perceive risks differently. This tends to be the reason why risk management processes are less structured; thus, the establishment of sufficient risk management measures is problematic. However, it seems that precise market analyses and the implementation of scenario and sensitivity analyses are adequate to evaluate the risk factors for construction projects.

6.1 Limitations and Future Research Recommendations

Although semi-structured interviews were conducted, this study faced limitations on the quality and usability of the interviewees' statements, since the analysis solely bases on the eligibility responses of the generated interviews. Therefore, some findings were stronger and more beneficial than others.

Furthermore, there is a lack of high-quality academic literature available used as a framework of strategies and risk management tools related to risk management in real estate development. Therefore, it is suggested that academics share their data and knowledge to generate a better understanding of the real estate development industry.

Besides this, the following recommendations could be considered for future research within the real estate development industry:

1. Additional research can be carried out to understand the relationship between advanced risk management and a company's success. That could contribute knowledge about how a company's performance is impacted by successful risk management.

2. The real estate development sector could benefit if the most effective risk management methods are analysed and put into an evaluation model. That could facilitate the assessment and monitoring of relevant risk factors for real estate developers.

3. An analysis of risk management within the real estate sector from an international perspective could be useful to provide further information,. The comparison of global markets could help to identify similarities and differences between international companies and could be used to improve the risk management process.

4. It could also be interesting to compare the risk management of different branches with the real estate industry, evaluate parallels and investigate if the tools used in those branches can be applied in the development sector as well. Overall, this extension would allow researchers to provide additional data related to the risk management process and further develop the risk management concept.

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Appendices

Appendix A: The Real Estate System

The graph on page 13 shows the different markets of a real estate system and how they interrelate. The real estate system's three main elements are “the space market, the asset market, and the development industry” (Geltner *et al*., 2014, p. 22). Rents and the level of occupancy are determined by supply and demand within the space market. The local and national economies stimulate the space market's demand side, while development activities drive the supply side.

Further, the space market influences the cash flows of the real estate asset market. The cash flows correlate with investors' required cap rates, influenced by investors' forecasts and perceptions regarding future rents of the space market. Investors, both supply and demand side, often interact with broader capital markets. Cap rates define property market values in the asset market, which link the asset market to the development industry.

Within the development industry, “current development costs, including construction and land costs (incorporating necessary profit for the developer), are compared against current asset values. If asset values equal or exceed development costs, then development will proceed, thereby adding to the physical stock on the supply side of the space market” (Geltner *et al*., 2014, p. 24). The development of properties is very time consuming, and good forecasting is essential. Apart from the construction time, developers also need to consider the forecast of the space market and the future streams of cash flows in the asset market. This indicates that investors have to forecast the demand side impacted by the economy and the supply side determined by development activities. Moreover, additional macroeconomic factors, such as interest rates and inflation, need to be considered (Geltner *et al.*, 2014).

Appendix B: Four-Quadrant Model

The Four-Quadrant Model established by DiPasquale and Wheaton (1992) represents the long-run equilibrium between the space market and the asset market of the real estate system. The quadrants on the right side represent the property market for space use, and the quadrants on the left side demonstrate the asset market.

Property market rent: the intersection supply and demand of space determines the equilibrium rental rate, while in the short-run supply of space is fixed. Demand is influenced by the economic and the aspects of the property.

Asset market value: the rent equilibrium from the first quadrant regulates the generated value of a property. In the short run, the market value of a property can be estimated by the present value of future cash flows by dividing the net operating income by the required cap rate. The net operating income is determined by rental income, while the cap rate is determined by the economic and rate of return.

Construction activities: the construction activities within the development industry are determined by comparing the market value given by the equilibrium of property values in the quadrant above to construction costs. In addition to this, other factors (economic, creditworthiness) impact development activities.

Property market: development activities determine changes in the supply and perhaps the supply space. This indicates that within the short-run supply is fixed, the rental income will affect the construction industry and, consequently, impact the supply of space after a certain time lag (Garay, 2016).

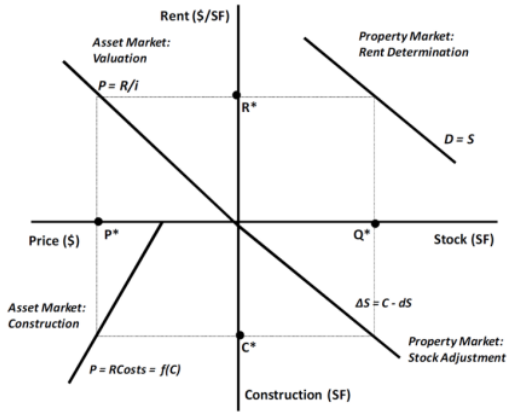

Figure 9: Four-Quadrant Model
Source: adapted from Garay (2016, p. 17)

Appendix C: Eight Stage Model

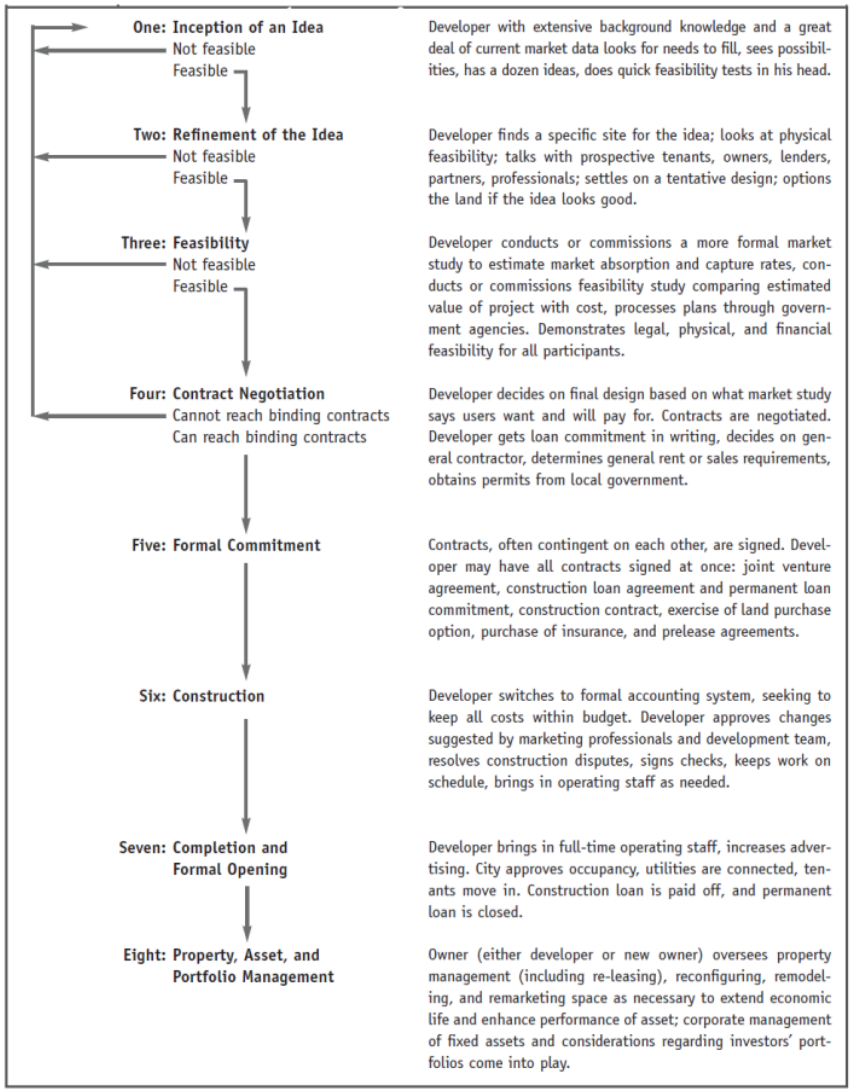

Figure 10: The Eight-Stage Model of Real Estate Development

Source: adapted from Miles *et al.*, 2007, p. 6

Appendix D: Interview Details

Table 2: Interview Details

Participants	Type of Developer	Date and Duration of the Interview
Developer 1	Investor-Developer National	23.06.2020 45 minutes
Developer 2	Trader-Developer International	20.06.2020 55 minutes
Developer 3	Investor-Developer National	25.06.2020 45 minutes
Developer 4	Investor-Developer International	26.06.2020 52 minutes
Developer 5	Investor-Developer National	15.06.2020 60 minutes
Developer 6	Investor-Developer National	18.06.2020 65 minutes
Developer 7	Trader-Developer International	30.06.2020 57 minutes
Developer 8	Investor-Developer National	24.06.2020 38 minutes
Developer 9	Investor-Developer National	19.06.2020 30 minutes
Developer 10	Investor-Developer National	08.07.2020 50 minutes

Appendix E: Interview Questions

Company Structure

1. Could you please give me a short overview of your company?
2. Under which developer category would you mainly classify the development activities of your company?
    a. Service-developer
    b. Trader-developer
    c. Investor-developer
3. What kind of construction projects does your company implement?

   Housing/Office/Retail/Hotel/Logistics
4. How large, measured by usable living space, are the projects you realize on average?
5. Are there development types that are favoured?
6. How many buildings are usually realised in construction projects?
    a. Are they individual buildings or multi-building projects?
7. How many external partners are usually involved in the project and what services are covered by them?
8. Where does the capital come from and how is the percentage distribution?

Site Selection

9. Which market/scope are you considering for new investments?
    a. Regional, national, international
10. What factors impact your choice of location?
11. Which criteria are used to assess the attractiveness of a place?
12. What are the 3 most important factors of the micro-location?
13. What are the 3 most important factors of the macro-location?

14. Do you pay attention to the spatial distribution of your projects? (diversification, concentration)
15. Are construction activities of other companies are taken into account? If so, how?
16. Do you consider the cycles in the real estate market? If so, to what extent?
17. How long does the construction phase take on average?

Vienna

18. Could you please give me a brief overview of the Viennese real estate market.
    a. What opportunities and potential does the Viennese market offer?
    b. Are there weaknesses?
19. How saturated is the Viennese market?
20. Is there a trend that you have recognised in the Viennese real estate market?

Risk

21. From your perspective, how do you identify risk?
22. Could you explain the different types of risk of your developments and at which stage of the process do these risks emerge?
23. When you think about the whole process, what do you think are the 3 biggest risk factors, and can you sort them by importance?
24. Does the company overall regard itself as having a risk-taking or risk-averse culture, and why?
25. How do the risks differ between the different types of construction?

Risk Management

26. In the literature, real estate developers are often criticised for the fact that compared to other industries, the application of risk management is very low and most decisions are made intuitively. How do you feel about that?

27. Concerning the risk management process:
    a. How do you identify risks?
    b. What tools/methods are used for risk identification?

28. A further step is risk assessment:
    a. What methods are used for risk measurement?

29. What are the measures in relation to identified and analysed risks?
    a. Has the company formulated an overall strategy for managing risks yet?

30. How do you control risks?

31. How do you consider risks in your decision-making?

32. How do you diversify risks?

33. In terms of systematic risks (risks you cannot control, e. g. market risk, COVID-19), how do you deal with such risks and how effective is your risk management process in dealing with such risks?

34. How do you manage the risk of construction delay?

Appendix F: Consent Form

Dissertation Project Information

Risk Management in Real Estate Development

Real estate development is very risky and involves certain uncertainties. Therefore, it is particularly important to consider these risk factors in the decision-making process. This study aims to analyse how real estate developers and investors identify risks and how they consider them in their decision-making process.

Interviews are expected to take no longer than one hour and are recorded. All participants will be anonymised in the findings and the researcher will ensure that no participant can be identified from any comments. All interview data will be securely stored by the researcher and will be processed in line with the Data Protection Act (1998). Participation in the interview process is entirely voluntary and can be withdrawn at any time if the interviewee does not wish to continue.

The interviews are structured as follows:

- Company structure and real estate development types
- Decision criteria and overview of the Viennese market
- Risk Management

The research is supported by the University College London. If you have any further questions regarding the research, please feel free to contact the researcher through the contact information overleaf.

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Informed Consent:

Risk Management in Real Estate Development

Thank you for agreeing to be interviewed and sharing your experiences.

As an interviewee I am aware that:

- All information and data I provide will be treated confidentially.
- My identity will be protected and remain anonymous at all times throughout the research.
- Extracts from the interview may be used in quotes in the research reports and outputs.
- I have the right to refuse to answer questions.
- My interviewer can provide any additional information and will answer any relevant queries I might have regarding the research.
- The interview will be recorded to ensure that recall is accurate and I give my permission for this information to be used for research purpose.

Name of interviewee: .....

Signature: .....

Date: .....

Name of interviewer: .....

Signature: .....

Date: .....

Appendix G: Risk Assessment Form

RISK ASSESSMENT FORM

FIELD / LOCATION WORK

The Approved Code of Practice - Management of Fieldwork should be referred to when completing this form

http://www.ucl.ac.uk/estates/safetynet/guidance/fieldwork/acop.pdf

DEPARTMENT/SECTION INTERNATIONAL REAL ESTATE AND PLANNING – BARTLETT SCHOOL OF PLANNING

LOCATION(S)

PERSONS COVERED BY THE RISK ASSESSMENT Ariane Haager

BRIEF DESCRIPTION OF FIELDWORK Interviews with rea estate developers

Consider, in turn, each hazard (white on black). If **NO** hazard exists select **NO** and move to next hazard section.

If a hazard does exist select **YES** and assess the risks that could arise from that hazard in the risk assessment box.

Where risks are identified that are not adequately controlled they must be brought to the attention of your Departmental Management who should put temporary control measures in place or stop the work. Detail such risks in the final section.

ENVIRONMENT	**The environment always represents a safety hazard. Use space below to identify and assess any risks associated with this hazard**
e.g. location, climate, terrain, neighbourhood, in outside organizations,	Examples of risk: adverse weather, illness, hypothermia, assault, getting lost. Is the risk high / medium / low ?

pollution, animals.	low, as interviews are conducted indoors or online

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	work abroad incorporates Foreign Office advice
	participants have been trained and given all necessary information
	only accredited centres are used for rural field work
	participants will wear appropriate clothing and footwear for the specified environment
	trained leaders accompany the trip
	refuge is available
	work in outside organisations is subject to their having satisfactory H&S procedures in place
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

EMERGENCIES	**Where emergencies may arise use space below to identify and assess any risks**
e.g. fire, accidents	Examples of risk: loss of property, loss of life

low risk of emergency, fire could arise in building but highly unlikely.

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	participants have registered with LOCATE at http://www.fco.gov.uk/en/travel-and-living-abroad/
	fire fighting equipment is carried on the trip and participants know how to use it

x	contact numbers for emergency services are known to all participants
x	participants have means of contacting emergency services
	participants have been trained and given all necessary information
	a plan for rescue has been formulated, all parties understand the procedure
	the plan for rescue /emergency has a reciprocal element
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

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EQUIPMENT	**Is equipment used?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any** **risks**
e.g. clothing, outboard motors.	Examples of risk: inappropriate, failure, insufficient training to use or repair, injury. Is the risk high / medium / low ?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	the departmental written Arrangement for equipment is followed
	participants have been provided with any necessary equipment appropriate for the work
	all equipment has been inspected, before issue, by a competent person
	all users have been advised of correct use
	special equipment is only issued to persons trained in its use by a competent person
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

LONE WORKING	Is lone working a possibility?	NO	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. alone or in isolation *lone interviews.*	Examples of risk: difficult to summon help. Is the risk high / medium / low?		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	the departmental written Arrangement for lone/out of hours working for field work is followed
	lone or isolated working is not allowed
	location, route and expected time of return of lone workers is logged daily before work commences
	all workers have the means of raising an alarm in the event of an emergency, e.g. phone, flare, whistle
	all workers are fully familiar with emergency procedures
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

ILL HEALTH	**The possibility of ill health always represents a safety hazard. Use space below to identify and assess any risks associated with this Hazard.**
e.g. accident, illness, *personal attack, special personal considerations or vulnerabilities.*	Examples of risk: injury, asthma, allergies. Is the risk high / medium / low? low

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**
	an appropriate number of trained first-aiders and first aid kits are present on the field trip
	all participants have had the necessary inoculations/ carry appropriate prophylactics
	participants have been advised of the physical demands of the trip and are deemed to be physically suited
	participants have been adequate advice on harmful plants, animals and substances they may encounter
	participants who require medication have advised the leader of this and carry sufficient medication for their needs
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

TRANSPORT	**Will transport be required**	**NO**	**X**	**Move to next hazard**
		YES		**Use space below to identify and assess any risks**
e.g. hired vehicles	Examples of risk: accidents arising from lack of maintenance, suitability or training Is the risk high / medium / low? LOW			

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
x	only public transport will be used
	the vehicle will be hired from a reputable supplier
	transport must be properly maintained in compliance with relevant national regulations
	drivers comply with UCL Policy on Drivers http://www.ucl.ac.uk/hr/docs/college_drivers.php
	drivers have been trained and hold the appropriate licence
	there will be more than one driver to prevent driver/operator fatigue, and there will be adequate rest periods
	sufficient spare parts carried to meet foreseeable emergencies
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

DEALING WITH THE PUBLIC	Will people be dealing with public	YES	If 'No' move to next hazard If 'Yes' use space below to identify and assess any risks
e.g. interviews, observing	Examples of risk: personal attack, causing offence, being misinterpreted. Is the risk high / medium / low?		
	low		

CONTROL MEASURES	Indicate which procedures are in place to control the identified risk
	all participants are trained in interviewing techniques
	interviews are contracted out to a third party
	advice and support from local groups has been sought
X	participants do not wear clothes that might cause offence or attract unwanted attention

x	interviews are conducted at neutral locations or where neither party could be at risk
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

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WORKING ON OR NEAR WATER	**Will people work on or near water?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. rivers, marshland, sea.	Examples of risk: drowning, malaria, hepatitis A, parasites. Is the risk high / medium / low?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	lone working on or near water will not be allowed
	coastguard information is understood; all work takes place outside those times when tides could prove a threat
	all participants are competent swimmers
	participants always wear adequate protective equipment, e.g. buoyancy aids, wellingtons
	boat is operated by a competent person
	all boats are equipped with an alternative means of propulsion e.g. oars
	participants have received any appropriate inoculations
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

MANUAL HANDLING (MH)	**Do MH activities take place?**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**
e.g. lifting, carrying, moving large or heavy equipment, physical unsuitability for the task.	Examples of risk: strain, cuts, broken bones. Is the risk high / medium / low?		

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	the departmental written Arrangement for MH is followed
	the supervisor has attended a MH risk assessment course
	all tasks are within reasonable limits, persons physically unsuited to the MH task are prohibited from such activities
	all persons performing MH tasks are adequately trained
	equipment components will be assembled on site
	any MH task outside the competence of staff will be done by contractors
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

SUBSTANCES	**Will participants work with substances**	**NO**	**If 'No' move to next hazard** **If 'Yes' use space below to identify and assess any risks**

e.g. plants, chemical, biohazard, waste	Examples of risk: ill health - poisoning, infection, illness, burns, cuts. Is the risk high / medium / low?

CONTROL MEASURES	**Indicate which procedures are in place to control the identified risk**

	the departmental written Arrangements for dealing with hazardous substances and waste are followed
	all participants are given information, training and protective equipment for hazardous substances they may encounter
	participants who have allergies have advised the leader of this and carry sufficient medication for their needs
	waste is disposed of in a responsible manner
	suitable containers are provided for hazardous waste
	OTHER CONTROL MEASURES: please specify any other control measures you have implemented:

OTHER HAZARDS	**Have you identified any other hazards?**	**YES**	**If 'No' move to next section** **If 'Yes' use space below to identify and assess any risks**
i.e. any other hazards must be noted and assessed here.	Hazard: COVID-19 Risk: is the risk	**HIGH**	

CONTROL MEASURES	**Give details of control measures in place to control the identified risks**
Interviews will be conducted online	

Have you identified any risks that are not adequately controlled?	**NO**	**X**	**Move to Declaration**
	YES		**Use space below to identify the risk and what action was taken**

Is this project subject to the UCL requirements on the ethics of Non-NHS Human Research?	Yes
If yes, please state your Project ID Number	**19046211**

For more information, please refer to: http://ethics.grad.ucl.ac.uk/

DECLARATION

The work will be reassessed whenever there is a significant change and at least annually. Those participating in the work have read the assessment.

Select the appropriate statement:

x	I the undersigned have assessed the activity and associated risks and declare that there is no significant residual risk
X	I the undersigned have assessed the activity and associated risks and declare that the risk will be controlled by the method(s) listed above

d

NAME OF SUPERVISOR **Dr Nicola Livingstone**

SIGNATURE OF SUPERVISOR DATE Nicola Livingstone 7th July 2020

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