THE FUTURE OF OFFICE DISTRICTS

HOW SHIFTING URBAN DYNAMICS CREATE OPPORTUNITIES FOR MULTI-PURPOSE DESTINATIONS

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PREFACE

This master's thesis, titled "Maximizing the Benefits of Hybrid Working," has been written to fulfill the graduation requirements of the Spatial Planning master program at Radboud University. I was engaged in researching and writing this thesis from February to July 2023.

Reflecting upon my previous academic endeavors, I recognized a tendency to remain within my comfort zone. This year, however, I aimed to approach the thesis with a different mindset, deliberately selecting a subject that would challenge and expand my skill set. Consequently, I engaged with unfamiliar mapping platforms, datasets, and design tools such as Canva. Additionally, I deepened my proficiency in programs that I had previously encountered. Throughout this process, I have come to appreciate the inherent struggles and obstacles that accompany academic pursuits, recognizing them as integral to personal and professional growth.

I would like to express my sincere gratitude to my supervisor, Prof. P.M. Ache, whose excellent guidance supported me during the process. I am appreciative of the challenges you presented, as they maximized my opportunities for learning. I am also indebted to Timo Jacobse, my manager at JLL, for accommodating and supporting my simultaneous work on this thesis. Furthermore, I extend my gratitude to all the real estate agents in Amsterdam who contributed to the data collection for this study.

Finally, I would like to acknowledge the unwavering support of my family and friends throughout this undertaking. Their presence and encouragement have been invaluable. To you, my reader, I extend my appreciation and hope that you find this thesis both engaging and insightful.

Sincerely,

Lynn Veerman
Amsterdam, July 2023

ABSTRACT

This research focuses on uncovering the transformation potential of vacant office space in Amsterdam's business districts towards residential use. The increasing trend of remote work, particularly hybrid work arrangements, is anticipated to continue beyond the pandemic, leading to downsizing of office spaces and subsequently increasing vacancy rates. The presence of vacant buildings has negative implications. On a societal level, vacant buildings can accelerate neighborhood deterioration, giving rise to feelings of insecurity and social uncertainty, and contributing to criminal activities such as vandalism, graffiti, trespassing, and fires (MacDonald et al., 2023; Branas, Rubin & Guo, 2012). Moreover, vacancy indirectly affects the surrounding areas and other buildings, as it creates an unfavorable impression that can lead to increased vandalism, technical deterioration, and the devaluation of nearby properties (Suzuki, Hino, & Muto, 2022). The decline in office and adjacent retail real estate poses a significant concern, as it can trigger a detrimental fiscal cycle, leading to a decline in the quality of life for residents and exacerbating challenges in the business environment (Gupta, Mittal, & Van Nieuwerburgh, 2022; Geraedts & van der Voordt, 2007). The shift in work patterns and the resulting vacant office spaces have the potential to influence various aspects of the urban landscape, such as commuting patterns, spatial needs, office space utilization, and socioeconomic dynamics. Urban planners, policymakers, and businesses need to adapt to these trends to ensure sustainable and prosperous urban environments.

Given Amsterdam's high vacancy rate of 7.1%, it is crucial to examine intervention techniques to address this issue. These intervention techniques include doing nothing, maintaining the current state, renovation, short-term and long-term transformation, demolition and new construction. Each technique has its own advantages and disadvantages, and the choice depends on various factors such as financial feasibility, market demand, sustainability objectives, and long-term planning considerations. For this research, the focus is on transformation as the preferred intervention technique.

Using this intervention technique, office vacancy may be reduced, supply is added to its overheating housing market and mixed-use developments can be created. Mixed-use development has several benefits (Hoppenbrouwer & Louw, 2005). The first general reason for encouraging mixed-use development is to reduce the need for travel by serving a variety of needs in close proximity. A concentration of activities allows for the integration of activities while simultaneously allowing for the combination of potential traffic movements between these concentrations through the use of efficient traffic systems (Priemus et al., 2000). Nonetheless, the concentration of various urban functions does not only effect mobility patterns, but also the urban territory itself. The second reason for promoting mixed-use development is its contribution to the diversity and vitality of urban areas.

Mixed-use development provides opportunities to enhance the quality and desirability of urban areas, for example by increasing usage, activity, and vitality during the day, evening, and weekends (Hoppenbrouwer & Louw, 2005).

However not all buildings are suitable for transformation. The Ministerie concludes that 30% of unused office space on business districts can be converted to residential use in the future (Ministerie van Binnenlandse Zaken, p.12, 2022). This is related to several influencing factors: like market-, location-, and building characteristics. The Amsterdam office market may offer possibilities to reduce vacancy by way of transformation due to possible favorable characteristics. Many tools have been developed aiming to incorporate these factors. To test this transformation potential of Amsterdam’s vacant office space with an improved assessment tool which combines among others the aforementioned influencing factors the following main question is posed:

To what extent can we make advantage of the shifting working patterns and transform current vacant office space in Amsterdam’s business districts to create live-work mixed neighborhoods?

After a comprehensive analysis of various transformation tools, the Transformation Meter 2017 developed by Geraerdts et al. (2017) has been identified as the most suitable tool to assess the transformation potential of vacant office space in Amsterdam for conversion into housing.

This tool enables the assignment of scores based on market, location, and building characteristics. The adaptations made to the original tool primarily involve modifications to the content of each step, while maintaining the same systematic step-by-step approach from a broad to detailed assessment. One significant adaptation was the separation of the feasibility scan for location and building, as the location plays a crucial role in the success of transformation projects compared to the building itself. It is worth noting that a transformation project with a favorable location but a ‘bad’ building has the potential to be successful, whereas a project with a ‘good’ building in a less desirable location is likely to yield unfavorable results.

By using the Transformation Meter, an inventory of all vacant office spaces in Amsterdam was created, comprising 41 buildings in the research area. After evaluating all 41 buildings using the Transformation Meter, 17 were found to have the potential for successful transformation into residential spaces. Among these, five were classified as having excellent transformation potential and 12 as having high potential. These findings align with the notion that approximately 30% of vacant office spaces in business districts can be converted to residential use.

The Transformation Meter functions as a checklist, guiding users to consider all aspects necessary for initiating a transformation project. Its step-by-step approach, simplicity, and required input contribute to its strength and usability.

The relevance and usability of the research were evaluated by experts, specifically professional real estate developers specializing in transformation projects. Their feedback provided input for further adaptation of the Amsterdam Transformation Meter 2023, particularly in giving higher importance to the building factor. After the second adaptation, the entire Amsterdam office vacancy portfolio was reevaluated, resulting in 21 buildings identified as having excellent to high potential for transformation. This challenges the statement that a transformation project with a less desirable location and good building cannot be successful.

The transformation of office buildings with excellent to high potential into residences presents an opportunity to convert monofunctional office areas into mixed-use development areas. According to theory, mixed-use development involves the combination of two or more functions, and in this case, the transformation of office spaces to include residential use expands the functions beyond just work (Hoppenbrouwer & Louw, 2005). By incorporating residential components, these areas have the potential to become vibrant mixed-use environments, accommodating a variety of activities and creating a more diverse and dynamic urban setting.

KEYWORDS: Remote Working - Office Sector – Vacancy - Transformation – Mixed-Use Development

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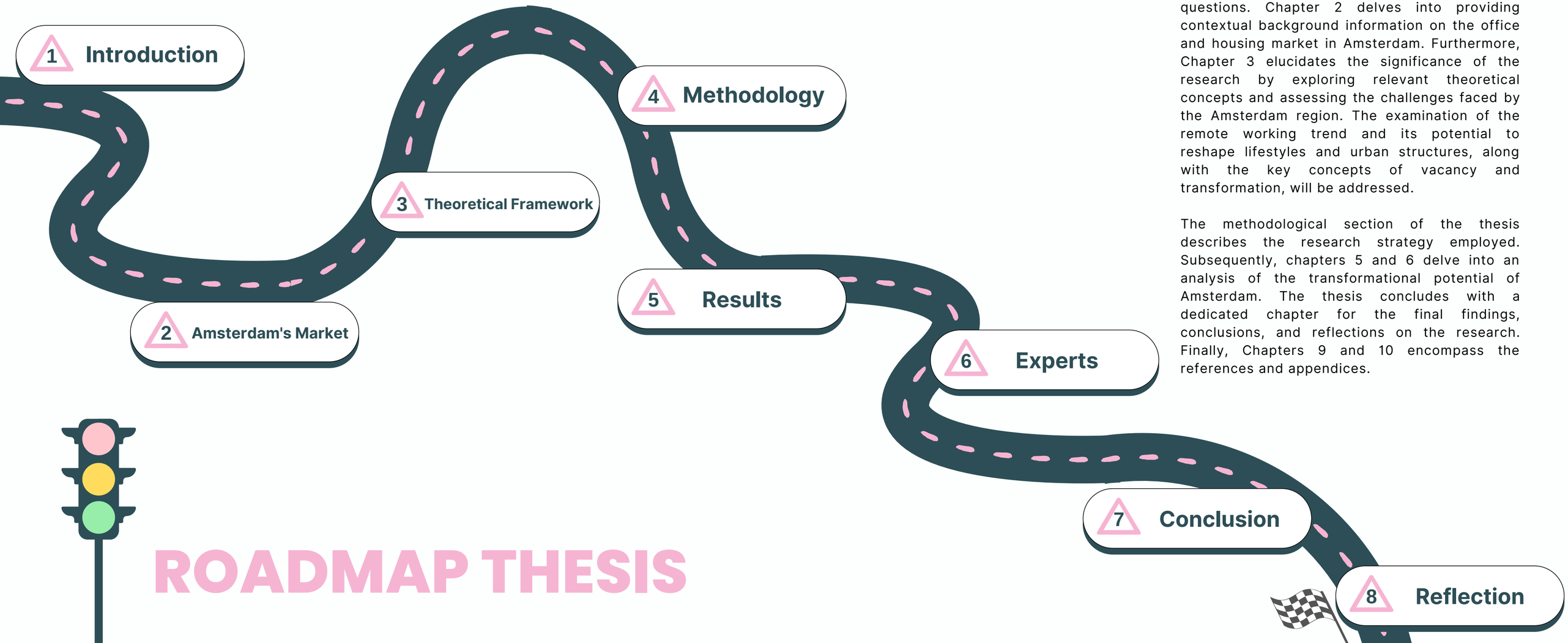
ROADMAP THESIS



The structure of this research encompasses eight chapters. Each chapter within this research is dedicated to answer a specific sub-question and concludes with a comprehensive summary of the findings pertaining to that sub-question.

The thesis commences with an introduction that establishes the subject matter, presents the problem statement, and outlines the research questions. Chapter 2 delves into providing contextual background information on the office and housing market in Amsterdam. Furthermore, Chapter 3 elucidates the significance of the research by exploring relevant theoretical concepts and assessing the challenges faced by the Amsterdam region. The examination of the remote working trend and its potential to reshape lifestyles and urban structures, along with the key concepts of vacancy and transformation, will be addressed.

The methodological section of the thesis describes the research strategy employed. Subsequently, chapters 5 and 6 delve into an analysis of the transformational potential of Amsterdam. The thesis concludes with a dedicated chapter for the final findings, conclusions, and reflections on the research. Finally, Chapters 9 and 10 encompass the references and appendices.

1

INTRODUCTION

1.1 CONTEXT

Three years on from the beginning of the pandemic, cities are at an inflection point (JLL, 2023). A transformation in how people live and work and a greater desire to address broader urban issues mean that to a varying extent, and often defined by a city's individual character, significant change is about to take place in urban cores across the world. The shift in urban dynamics is being felt strongly in business districts, which face a fundamental need to reinvent themselves to remain attractive and competitive in an environment of subdued demand for office space, more variable commuting and travel patterns, and a desire for amenities and 'experience-based' spaces. As a result of the surplus of space, users of the Dutch office market can choose to rent offices of the highest quality in the best locations. When building an office building in the past, the question was, 'How can we fit as many people as possible on a certain square footage?'. The question now is: 'How can we make an office building as energy-efficient as possible and as comfortable as possible for employees?' (Gupta, Mittal, & Van Nieuwerburgh, 2022).

Hybrid working provides offices with the opportunity to utilize office space more effectively. They can thus contribute significantly to the reduction of CO2 emissions. More organizations can occupy a single building, and the partially vacant office is no longer required to be heated or cooled. In the end, fewer new offices are required, and there is no need for construction (NOS, 2021).

The aforementioned trends raise questions regarding the current office space on the market and the market's ability to absorb this available office space. Due to quantitative and qualitative mismatch of the replacement market and hybridization, large public and private entities are relocating to newer, safer, and healthier buildings. Additionally, they are occupying a smaller surface area in those buildings. For example, major players on the Dutch office market, such as Accenture and AEGON, have expressed a desire to reduce the occupancy of their properties as a result of their employees increased remote work (NOS, 2021). Accenture anticipates using at least 20 to 30 percent fewer square meters, while AEGON Nederland is considering a 30 to 40 percent reduction. As a result of large employers abandoning office space, a substantial amount of office space will become available.

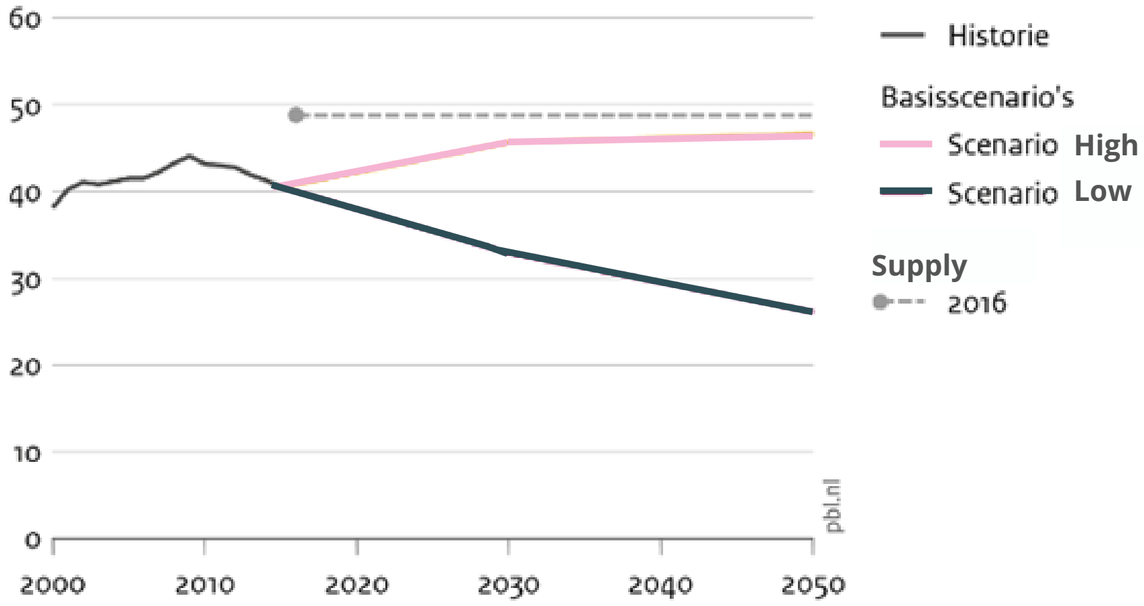
Research by PBL and CPB '*De toekomst van kantoren*' states that increase or decrease in office demand also depends on economic growth, sectoral developments, the share of office jobs and the number of square meters of office per job (Buitelaar et al., 2017). If a scenario of robust economic growth is envisaged, the need for office space in 2050 will be approximately 48 million square meters. This represents 95% of the current office inventory. In the low baseline scenario, both the total number of jobs and the proportion of office occupations decline due to slower growth in business services.

As a result, the demand for office space decreases to fewer than 30 million square meters. This is equivalent to 67% of the present supply in 2030 and 54% in 2050 (figure 1).

In short, office use has lagged behind inventories for years. Taking the aforementioned trends and scenarios into consideration, it seems doubtful that (medium- to long-term) demand will exceed current inventory levels (figure 2).

The mismatch between demand and supply affects not only the Dutch office market but also the housing market. The difference between the two markets is that the office market is experiencing an oversupply while the housing market is experiencing a shortage. Especially in the Randstad region, where space is scarce (BPD, 2021). The rising demand for houses is the result of urbanization, decreasing household size, and insufficient housing construction in recent years (CBS, 2021a).

Figure 1: Office demand according to baseline scenarios



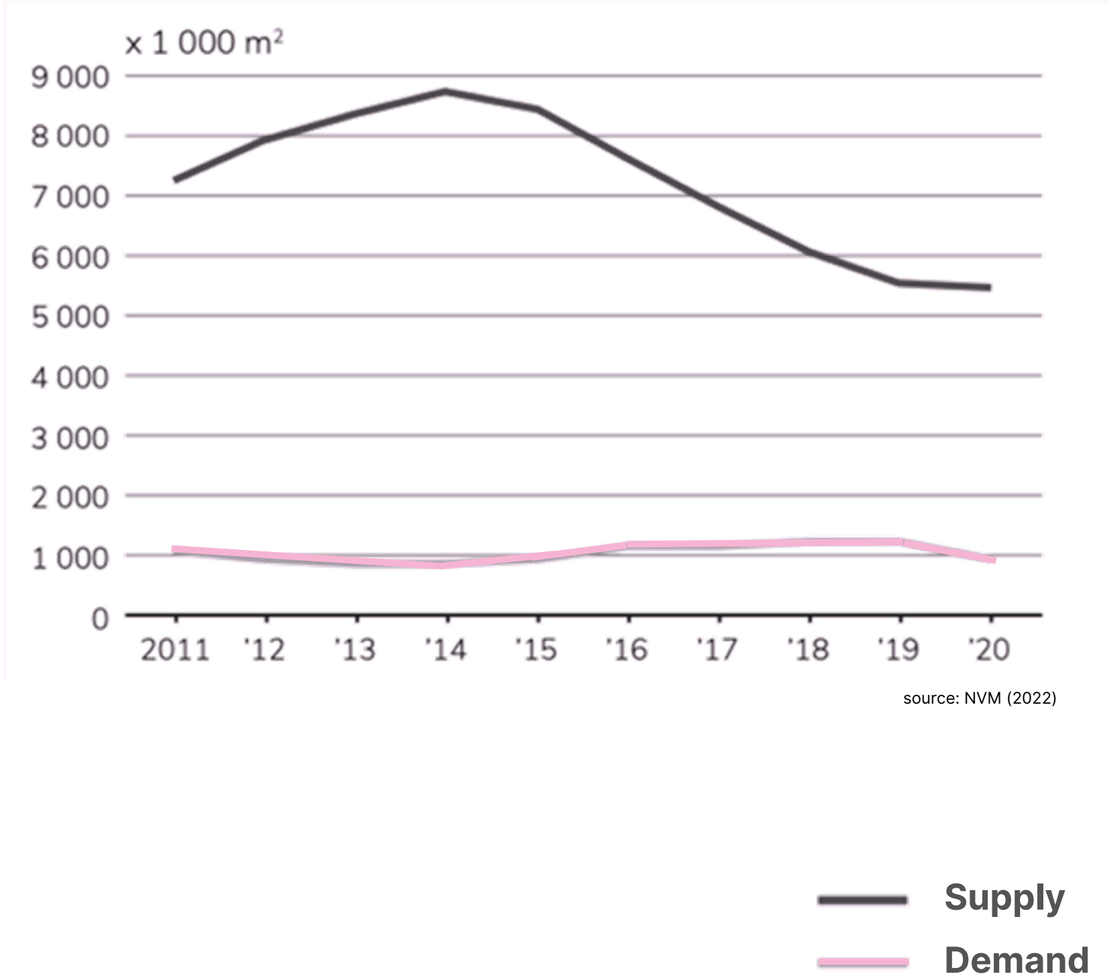
Source: (Buitelaar et al., 2017)

The city of Amsterdam, which is located within the Randstad, is also experiencing an overheated housing market. Here prices have risen sharply, and housing costs are the highest in the Netherlands (Gemeente Amsterdam, 2022).

These trends and scenarios should not be considered as a threat to the real estate market, but as an opportunity that requires additional research. To successfully adapt to the future, business districts need to transform. Key to unlocking the future potential is finding alternative uses for existing properties where possible. In the Netherlands, there are millions of square meters of unoccupied space that may be used for different purposes (CBS, 2021). New urban dynamics present a chance for repurposing and redevelopment, such as transformation to residential or mixed-use properties, which can contribute to the revitalization of urban areas and improve the quality of life in the local community. It is crucial to take the opportunity presented by the shifting working patterns to reevaluate the current working-living environment and the way neighborhoods and cities function. This thesis examines the potential for transformation of vacant office buildings in Amsterdam's business districts, moving the focus from offices towards a multi-purpose destination.

"It is crucial to take the opportunity presented by the shifting working patterns to reevaluate the current working-living environment and the way neighborhoods and cities function."
(JLL, 2023, p.10)

Figure 2: Demand and Supply Office Market in the Netherlands



source: NVM (2022)

1.2 PROBLEM STATEMENT

New hybrid and remote-working arrangements, aging real estate across all property types, competition with emerging and non-traditional submarkets and long commutes continue to weigh on the short-term outlook for many business districts (JLL, 2023; Phillips, 2020). As a consequence, numerous organizations have commenced to downsize their physical office spaces, leading to a significant shift in office demands and subsequently resulting in increased vacancy rates. The presence of vacant buildings carries negative externalities on various levels. From an economic perspective, vacancies directly impacts the building owners, causing financial repercussions. On a societal level, vacant buildings can accelerate neighborhood deterioration, giving rise to feelings of insecurity and social uncertainty, and contributing to criminal activities such as vandalism, graffiti, trespassing, and fires (MacDonald et al., 2023; Branas, Rubin & Guo, 2012). Moreover, vacancy indirectly affects the surrounding areas and other buildings, as it creates an unfavorable impression that can lead to increased vandalism, technical deterioration, and the devaluation of nearby properties (Suzuki, Hino, & Muto, 2022). The decline in office and adjacent retail real estate poses a significant concern, as it can trigger a detrimental fiscal cycle, leading to a decline in the quality of life for residents and exacerbating challenges in the business environment (Gupta, Mittal, & Van Nieuwerburgh, 2022; Geraedts & van der Voordt, 2007).

In light of this, exploring the potential of transformation becomes imperative, considering its ability to mitigate these negative effects. Transformation, as a prospective solution, emerges from the surplus of vacant buildings and holds the promise of enhancing the quality of life and fostering the development of live-work mixed neighborhoods (Gemeente Amsterdam, 2022). Given that Amsterdam currently experiences the highest vacancy rates in the Netherlands, it becomes crucial to examine the transformation potential within the context of this city to tackle the problem of office vacancy.

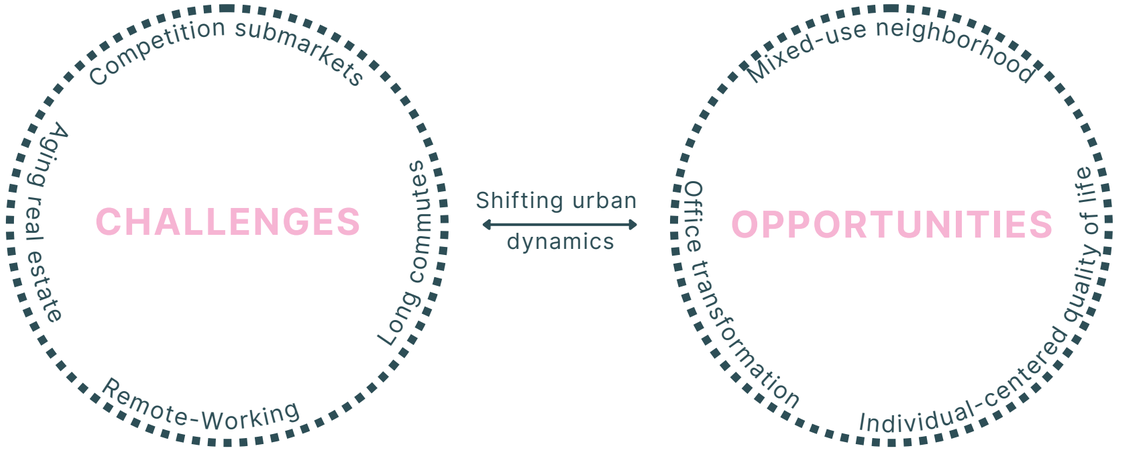
1.3 RESEARCH AIM

The primary research objective of this study is to address the existing dearth of scientific knowledge regarding the potential of transformation in Amsterdam's business districts, a yet unstudied area that faces a lot of challenges regarding the shift in urban dynamics.

The aim is to identify and assess the potential of vacant office buildings in Amsterdam for mixed-use densification, which holds the promise of addressing the prevailing crises in both quantity and quality of housing, facilitating the realization of a live-work lifestyle, and enhancing the overall quality of life for local residents.

By thoroughly examining the extent of office transformation potential in monofunctional office districts in Amsterdam, this research seeks to expand the current academic knowledge base and fill the gaps in empirical data concerning the transformation potential in the Netherlands. Ultimately, the research aspires to inform policy discussions and development strategies, empowering policymakers and stakeholders to make well-informed decisions regarding the effective utilization of vacant spaces and the creation of dynamic, sustainable communities. Through an exploration of shifting working patterns, this research endeavors to transform urban challenges into unique opportunities.

Figure 3: Challenges and opportunities office districts



source: by author, 2023

1.4 RESEARCH QUESTIONS

The transformation of current vacant office space into live-work mixed neighborhoods can be a promising opportunity that follows from the new working trends to increase the quality of living and address the city's housing shortage. Amsterdam is a densely populated city where demand for housing is high, and repurposing vacant office buildings for residential use can provide much-needed housing while also revitalizing underutilized properties. This research will investigate the transformation potential for Amsterdam's vacant office space. In order to determine this, the following main question is posed;

To what extent can we make advantage of the shifting working patterns and transform current vacant office space in Amsterdam's business districts to create live-work mixed neighborhoods?

In order to operationalize the main question, the following 7 sub-questions are formulated:

1. What does the office and housing market look like in Amsterdam?
2. What are the new working trends and how do they affect office districts?
3. How does the commercial real estate market function?
4. What are intervention techniques to tackle vacancy?
5. Which factors influence the transformation potential of an office building?
6. What are the benefits of mixed-use development?
7. What percentage of vacant office space in monofunctional office districts in Amsterdam has the potential to be effectively transformed into houses?

Image 1: City of Amsterdam

1.What does the office and housing market look like in Amsterdam?
Sub-question one permits an examination of the current office and housing markets in Amsterdam, including vacancy rates, demand-supply dynamics, pricing trends, living requirements and other pertinent market indicators. By addressing this sub-question, it is possible to develop an in-depth comprehension of the specific characteristics and trends that shape the office and housing markets in Amsterdam.

2.What are the new working trends and how do they affect office districts?
The second sub-question focuses on the impact of emergent work patterns as a result of the shifting urban dynamics, such as remote work and hybrid work models, on the urban environment. The purpose of addressing this sub-question is to investigate the changes brought about by these working trends, including their impact on office demand, physical space utilization, commuting patterns, and overall socioeconomic dynamics. To optimize the urban environment and make advantage of changing work patterns accordingly, policymakers, urban planners, and other stakeholders must comprehend the effects of new working trends on the urban environment.

3.How does the commercial real estate market function?
This sub-question examines the operation and dynamics of the commercial real estate market, including leasing practices, investment trends, and market players. To fathom the impact of a decline in office demand brought on by new working patterns, it is necessary to comprehend how the commercial real estate market functions
Examining the commercial real estate market reveals the mechanisms that influence supply and demand, rental prices, property transactions, and market performance as a whole. This knowledge is crucial for stakeholders, investors, and policymakers to make informed decisions and formulate strategies regarding Amsterdam's commercial real estate.

4.What are intervention techniques to tackle vacancy?
The fourth sub-question concentrates on strategies and approaches that can be employed to address the vacancy issue in the Amsterdam real estate market. By addressing this sub-question, researchers can investigate the various intervention techniques and initiatives that have been implemented or proposed to reduce vacancy, revitalize derelict properties, and maximize land and building utilization. This thesis will concentrate on the intervention strategy of transformation.

5.Which factors influence the transformation potential of an office building?
This sub- question investigates the factors that determine the potential of transforming an office building to a different use or function. By addressing this sub-question, researchers can identify and look into a variety of influential factors, including architectural design, building infrastructure, location, market demand, zoning regulations, financial feasibility, sustainability considerations, and stakeholder preferences. Understanding the major factors that influence the transformation potential of office buildings is necessary to properly answer the main question.

6.What are the benefits of mixed-use development?
Sub-question six focuses on understanding the benefits and positive outcomes of mixed-use development, which combines residential, commercial, and recreational functions within a singular development or neighborhood. Understanding the advantages of mixed-use development is essential to inform urban planning strategies, development policies, and decision-making processes that seek to create vibrant, inclusive, and sustainable urban environments.

7.What percentage of vacant office space in monofunctional office districts in Amsterdam has the potential to be effectively transformed into houses?
The last sub-question will be answered in the empirical part of the thesis. This sub-question aims to quantify the feasibility of repurposing vacant office spaces in monofunctional office districts for residential use. By answering this sub-question, a comprehensive analysis is conducted to determine the proportion of vacant office spaces that have the potential to be effectively converted into housing units. This investigation involves evaluating a variety of influencing factors, including building, location and market characteristics.

1.5 SOCIETAL RELEVANCE

Vacancy as a result of oversupply is a critical issue that significantly affects the quality of life in surrounding areas, impacting individuals, families, and communities negatively (Geraedts & van der Voordt, 2007). Addressing and resolving vacancy is crucial for creating safer, healthier, and more vibrant neighborhoods. The transformation of vacant buildings presents an opportunity to improve the quality of life and establish live-work mixed neighborhoods (Gemeente Amsterdam, 2022). Moreover, transforming vacant office space into alternative functions offers a more sustainable approach to tackling office vacancy compared to demolition and new construction (RNHB, 2023). Additionally, the transformation of vacant office buildings into residences can alleviate the mounting pressure on the Dutch housing market. The housing deficit is projected to reach 400,000 units by 2025, despite the fact that 325,000 dwellings are already required (Capital Value, 2023). Many municipalities, particularly Amsterdam, face a shortage of thousands of homes, amounting to 45,000 homes in Amsterdam alone (AT5, 2023). This scarcity contributes to significant social problems, including overcrowding, homelessness, and unstable living conditions, which negatively impact physical and mental health, educational outcomes, and overall quality of life. Transforming vacant office buildings offers a potential solution that addresses both the office and housing markets. By repurposing office space into residential units, the supply of office space decreases while the supply of housing increases.

In fact, 11% of all new homes added to the housing stock in the Netherlands by 2020 were created through the transformation of existing office buildings (CBS, 2021b). In essence, both markets are aligned with a single solution. This convergence of interests between the two markets underscores the importance of researching and understanding the causes, impacts, benefits, and challenges of office transformation. Notably, Minister De Jonge (Housing and Spatial Planning) has expressed intentions to achieve an annual transformation of 15,000 homes through office buildings (2022). However, a CBS study reveals a decline in transformation rates, with approximately 9,000 residences added through transformations in 2020 compared to over 12,000 in previous years (CBS, 2021b). This decline underscores the need for further investigation into the transformation potential of properties. Therefore, comprehensive research on office transformation is crucial to grasp the causes and effects of the trend of hybrid working, explore the potential benefits and challenges of repurposing office spaces, and inform policy decisions and development strategies aimed at addressing the problem in Amsterdam and finding effective solutions. Moreover, this research contributes to a broader dialogue on urban rehabilitation and sustainable development. A study on the transformation of vacant office space in Amsterdam can serve as a driving force for the development of sustainable and equitable solutions that benefit both the city and its citizens.

1.6 SCIENTIFIC RELEVANCE

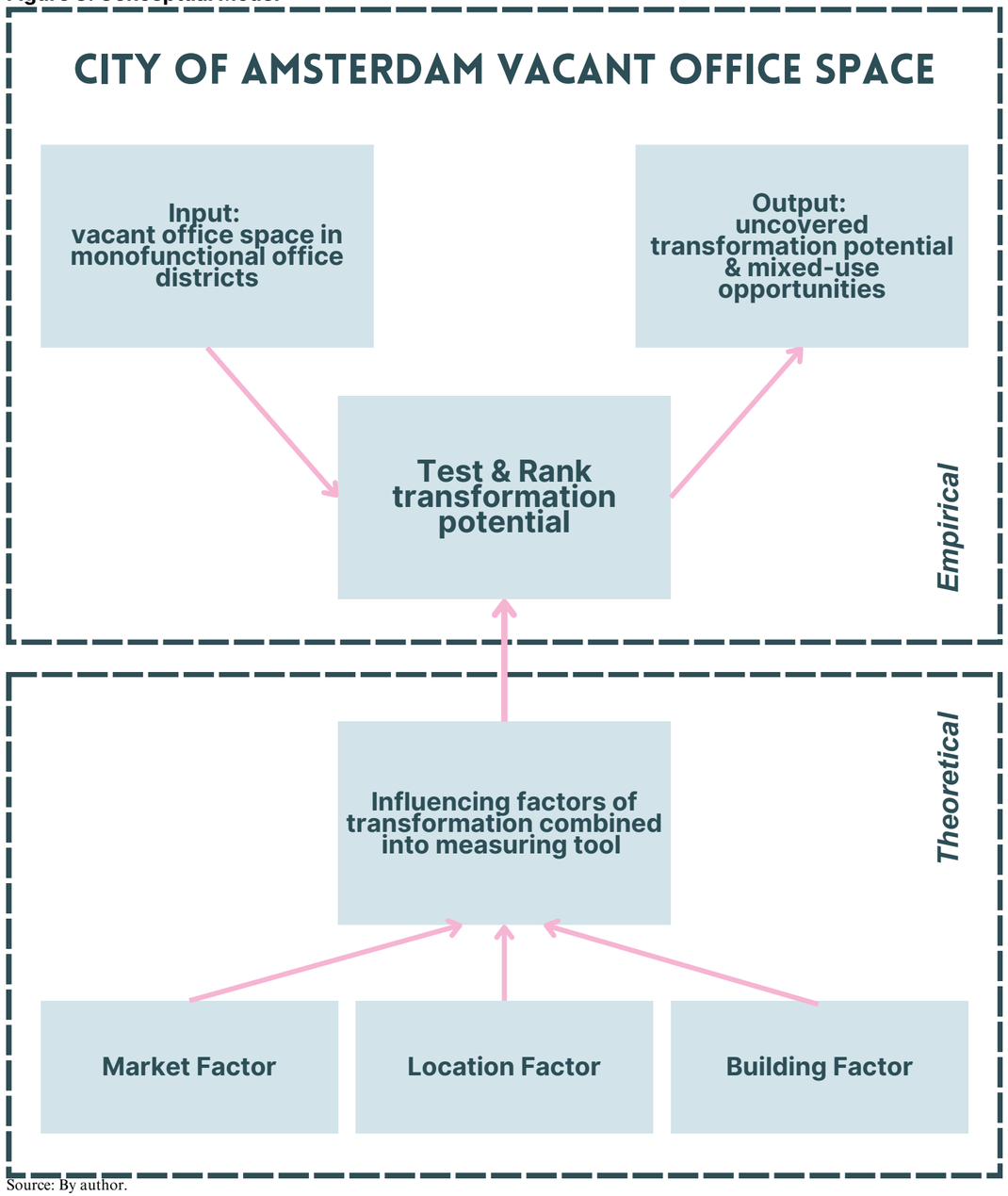
In recent years, several studies have been conducted on the negative externalities brought up by vacant properties. For instance, studies have been conducted on the extent to which vacant buildings affect rental prices of housing in the area (Gupta et al., 2022; Baba & Shimizu, 2022; Hofe, Parent & Grabill, 2019), and the extent to which they affect social cohesion within a neighborhood (Kvit, Corrigan, Locke, Curriero & Mmari, 2022; Sivak, Pearson, & Hurlburt, 2021). In response, transformation of vacant buildings and benefits of the concept of transformation have been the topic of research. For instance, Clifford, Ferm, Livingstone and Canelas (2019) demonstrate how transformation could provide a solution to the housing crises, Al Dakheel et al., (2020) examine how transformation is sustainable because materials can be reused, and Geraedts and van der Voordt (2007) state how transformation reduces construction time and could be interesting for projects with a short-time span. Vacant offices and their transformation potential are also a specific topic that features in many studies (Duinen et al., 2026; Geraedts, Remøy & van der Voordt; 2017; Rodermond & Van Gool, 2011; Djajadiningrat, 2013; Brink, 2017). These studies demonstrate that the transformation of vacant buildings such as offices is gaining prominence in academic discourse. Duinen et al., suggest in 2016 in the name of PBL that the discussion on transformation potential in the Netherlands is largely *fact-free*, or at least *fact-poor*.

Due to a dearth of empirical data on transformation potential, there is little quantitative evidence to support ideas and opinions. According Binnenlandse Zaken en Koninkrijksrelaties (2022), it does not appear that the debate on transformation potential has become significantly more fact-based by the year 2022. There are still numerous assumptions being made, resulting in conflicting opinions and estimations of transformation potential. This is also the conclusion of the VNG, which claims that the potential for housing development within offices is underestimated and that more is conceivable than is often believed. According to the Ministerie van Binnenlandse Zaken, *'low hanging fruit'* in desirable locations has already been picked, and it is essential to focus on *'ripe fruit'* in less desirable locations such as office districts (2022). This thesis responds to this claim by investigating the extent of transformation of *'ripe fruit' offices*. These areas have not yet been thoroughly investigated, limiting our understanding of the full potential and benefits of transformation. This research aims to address these gaps by examining the extent of office transformation in Amsterdam. By investigating these underexplored aspects, this thesis contributes to the scientific conversation, expands existing academic knowledge, and fills the gaps in empirical data on transformation potential in Amsterdam.

1.7 CONCEPTUAL MODEL

The conceptual model presented in this research illustrates the comprehensive empirical and theoretical process employed. Within the theoretical framework of this thesis, the identification of three distinct factors that impact the transformation potential of office buildings will be explored: building factors, location factors, and market factors. These factors will provide a foundation for understanding and analyzing the transformation potential of vacant office spaces in Amsterdam's monofunctional office districts in the empirical phase of the study. Through the empirical investigation, the research will assess the transformation potential of these office buildings based on the aforementioned factors. The ultimate outcome of this research will be a comprehensive evaluation of the transformation potential of these office buildings and the identification of opportunities to develop mixed-use developments within the existing monofunctional business areas.

Figure 3: Conceptual Model



Source: By author.

2

AMSTERDAM'S MARKET

2.1 OFFICE SUPPLY
2.2 OFFICE DEMAND
2.3 HOUSING SUPPLY
2.4 HOUSING DEMAND

Amsterdam is the capital of the Netherlands and a densely populated city where demand for housing is high, and repurposing vacant office buildings for residential use can provide much-needed housing while also revitalizing underutilized properties. Transformation of vacant office buildings into residences is only feasible if the created residences satisfy a need. The supply must correspond to the demand, both in terms of location and living environment, as well as building characteristics and individual residences (Geraedts, van der Voordt & Remøy, 2017). In order to determine whether a converted building in an office district satisfies the needs of the prospective target groups, their desires and preferences must be analyzed. The objective of this chapter is to describe the market supply (vacancy of office buildings), the demand (target groups, living requirements) and the match between the two in Amsterdam.

2.1 OFFICE SUPPLY

Office stock

In Amsterdam, there are 1,037 offices (≥ 500 square meters) with a total of 5,6 million square meters of office space. As with the tiny offices, the majority of these offices are located in the districts 'Centrum' and 'Zuid'. The average size of the largest offices is approximately 5,500 square meters. This exceeds 3,200 square feet in the center and 8,500 square feet in 'Zuidoost'.In the second half of 2021, the supply increased in 'Nieuw-West' and 'Zuid'. In 'Noord', the stock increased marginally, whereas it decreased in 'Centrum' and 'Westpoort' (Gemeente Amsterdam, 2022).

Office districts

The 22 office locations in Amsterdam contain 3.71 million square meters (sqm) of office space, or 65% of the total office stock (offices ≥ 500 sqm). The majority of office space is located in the Zuidas district, followed by Sloterdijk and Amstel III. The office stock increased by approximately 85,000 sqm in the second half of 2021, particularly in Zuidas and Sloterdijk (due to the completion of large office buildings). In Zuidas, the average size of large office buildings is highest (over 16,600 sqm), while in Amsterdam Science Park, the average office size is about 3,400 sqm (Gemeente Amsterdam, 2022).

Office vacancy

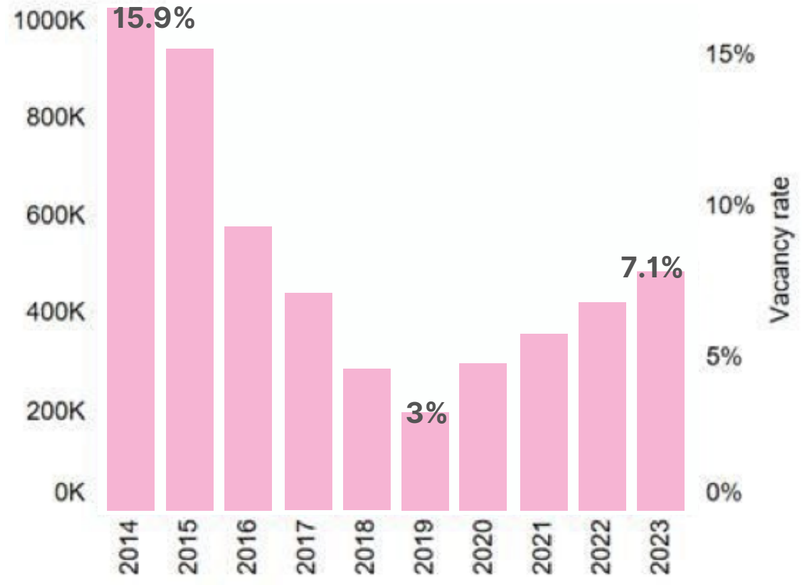
Due to their popularity, the vacancy rates in the largest cities of the Netherlands tend to be lower than the national average. Utrecht and The Hague have vacancy rates below the friction level, and for the first time in a very long time, Rotterdam also has a vacancy rate substantially below the Dutch average. In Amsterdam, however, the opposite trend can be observed: vacancy rates rose from 6.4% to 7.1% over the course of the year, as a number of new construction projects were completed over the previous six months. (Cushman & Wakefield, 2023).

Currently (22 April 2023) there are 161 offices available for rent in Amsterdam. As shown in figure 6, these 161 vacant offices seeking new tenants are totaling approximately 400,000 unused square meters (Gemeente Amsterdam, 2022).

Figure 4: Total office stock in Amsterdam (in square meters)

Source: Gemeente Amsterdam (2022), illlustrated by author.

Figure 5: Vacancy rates Amsterdam (in %)



Source: Gemeente Amsterdam (2022), illustrated by author.

According the municipality of Amsterdam (2022), from all business districts, Amstel III has the most office space available in the sub-500 m2 category at the beginning of 2022 (approximately 71,000 square meters), followed by Sloterdijk and Zuidas. In the second half of 2021, the vacancy rate at the majority of office locations increased. Except for Minervahaven, there was a decline in vacancy rates.

2.2 OFFICE DEMAND

According to Savills (2022), the net influence of hybrid working on office space demand is negative. In Europe, the meeting function and the expansion of autonomous working will increase the demand for space per employee by 10 to 15%. On the other hand, there will be an average of 30% fewer persons in the office. Savills anticipates an 8% decline in demand for office space in Amsterdam by 2026.

Office user demand shifts (this will be further elaborated in the Theoretical Framework chapter). To summarize briefly:

- Office users no longer want to be tucked away along the highway, but want to settle in the heart of society;
- Office users want to settle in an environment where working and recreation are possible;
- Urban dynamics, a wide variety of facilities, and a high quality of life are essential to attract office users.

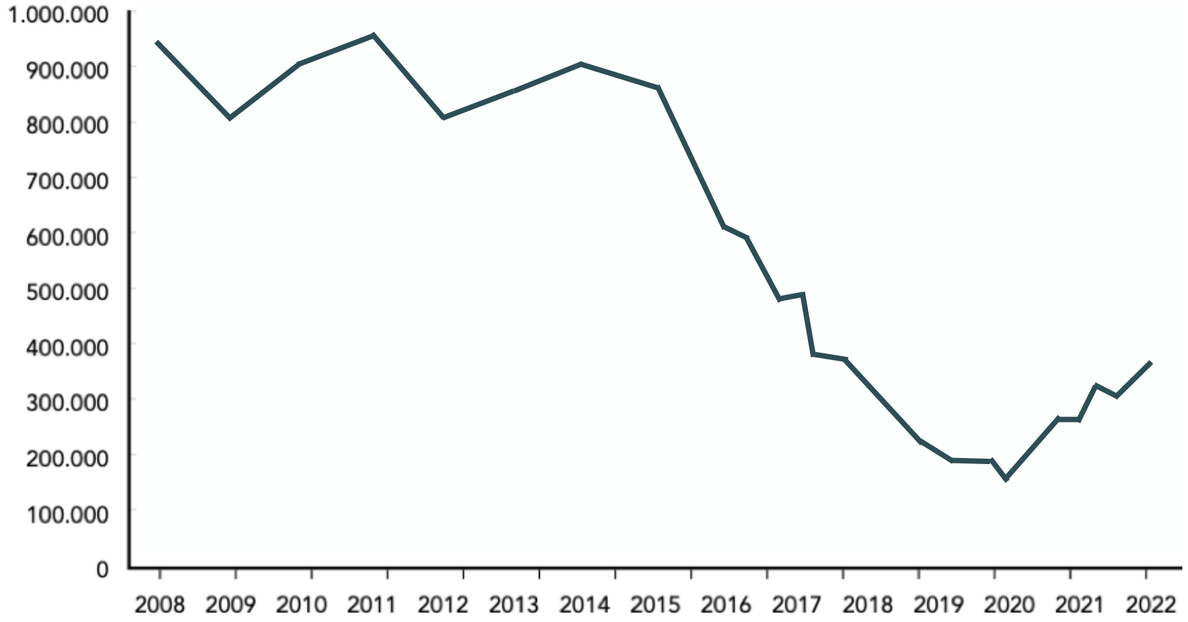
Consequently, hybrid working results in new location requirements. The combination of multimode locations and high-quality office spaces is of utmost importance, and future location decisions will be made differently due to sustainability concerns. For example, offices near public transport locations will become (even) more important.

2.3 HOUSING SUPPLY

As mentioned in the introduction, the Dutch housing market is stressed. The Netherlands has experienced a recurrence of the "one million homes" housing crisis over the past few decades (Zonneveld & Nadin, 2021), but the housing shortage is becoming more urgent than ever due to the pandemic and nitrogen policies. In 2022, the severe scarcity of (new) real estate resulted in an average housing price in Amsterdam of €400,000 (NVM, 2022). As the market is slightly cooling down, a CBS research, commissioned by the government, expected a population growth of 849,000 by 2035, which will lead to a need for approximately 1,160,000 dwellings (CBS, 2022b).

In Amsterdam, the private rental sector in Amsterdam's housing stock was in 2022 larger than the privately-owned stock. This is also evident in the housing supply, as the supply of owner-occupied homes has contracted further over the past two years, while the supply of private rental housing has grown substantially (Gemeente Amsterdam, 2022).

Figure 6: Total available office supply in Amsterdam (in sqm)



Source: Gemeente Amsterdam (2022), illustrated by author

Newcomers in the housing market must contend with costly rents and a dearth of owner-occupied homes priced below €314,000. The supply of social housing from housing associations is limited and there is a lengthy waiting list, and an increasing number of vacant social rental properties owned by private individuals are reserved for a particular group of people primarily students and young adults (Gemeente Amsterdam, 2021).

2.4 HOUSING DEMAND

As the quantity housing crisis worsens due to a growing shortage, the remote working pattern necessitates more space and the capacity to transform spatial usage, thereby contributing to the quality aspect and creating the "double housing crises." By analyzing pre-pandemic conditions, Harvard researchers determined that the share of housing expenditures for remote households is more than 7% higher than for other households in the same zone, with a 5 to 7 percent increase in space (Stanton & Tiwari, 2021). In addition, more people are willing to divert the cost of commuting into housing, intensifying competition on the housing market and driving up prices even further (Doling & Arundel, 2022). When people are going to look for a new house, there are some factors that influence their decision.

Decision factors

The type of residence, its size, an attractive and secure living environment, and a price that is affordable are essential decision factors for every target group. Price and level of quality, preference for a single-family home versus an apartment, and living in a lively environment with many amenities versus a quiet area are the primary differences. According to the studies consulted regarding wishes and preferences (Remøy, 2010; Stanton & Tiwari, 2021; Doling & Arundel, 2022), the decision points on the demand side varies considerably in importance individually.

Living environment

People make decisions about their living environments based more on the overall impression – for instance, an urban environment with many amenities or a peaceful, suburban environment with a lot of greenery – than on the explicit availability of particular amenities. However, it appears that many people are highly satisfied with the proximity of shops for daily duties, greenery, and parking right outside the door.

Public transport

Even though a high frequency and lengthy "opening hours" of public transportation frequently contribute to a person's satisfaction with their living situation, these factors rarely, if ever, play a role in the decision-making process of home-seekers. People are primarily concerned with the proximity to public transportation stations. Therefore, the distance to a tram, bus, or metro stop and a train station are significant demand profile variables, whereas the frequency and periods of public transportation are not.

Homes

When deciding whether to rent or buy, the type of home, its openness, and its size (especially the size of the living room and the number of rooms) are determining factors for many home-seekers. Costs, the ratio of price to quality, renting versus buying, and the nature of the environment are also crucial factors.

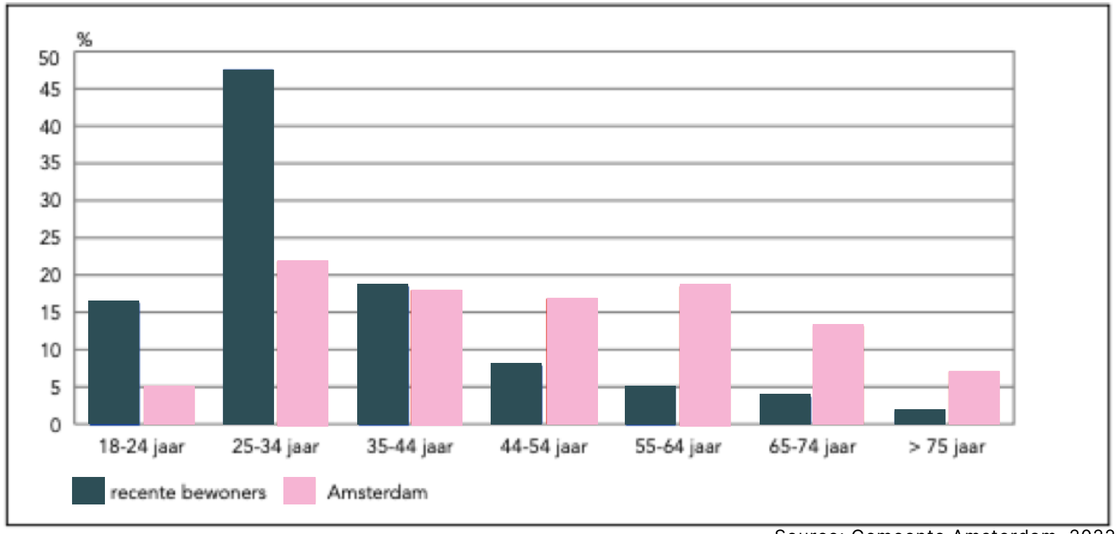
Depending on age, income, and stage of life, each target group's preferences for these variables and their relative importance vary. The home's layout, degree of relaxation, environmental factors, and general conditions appear to rank second.

Because almost half of the people looking for accommodation in Amsterdam are 18-34 years old (figure 7) and more than 50% of the residents has a low income, transformation to cheap, small homes can be a suitable choice (CBS, 2022a; NVM, 2021; Gemeente Amsterdam, 2022). When it comes to the transformation of vacant office buildings into homes, one-parent families with young children and traditional families with young children come less into the picture (Geraedts & Van der Voordt, 2003). Therefore, the target group in this research will be students and newcomers.

Target group

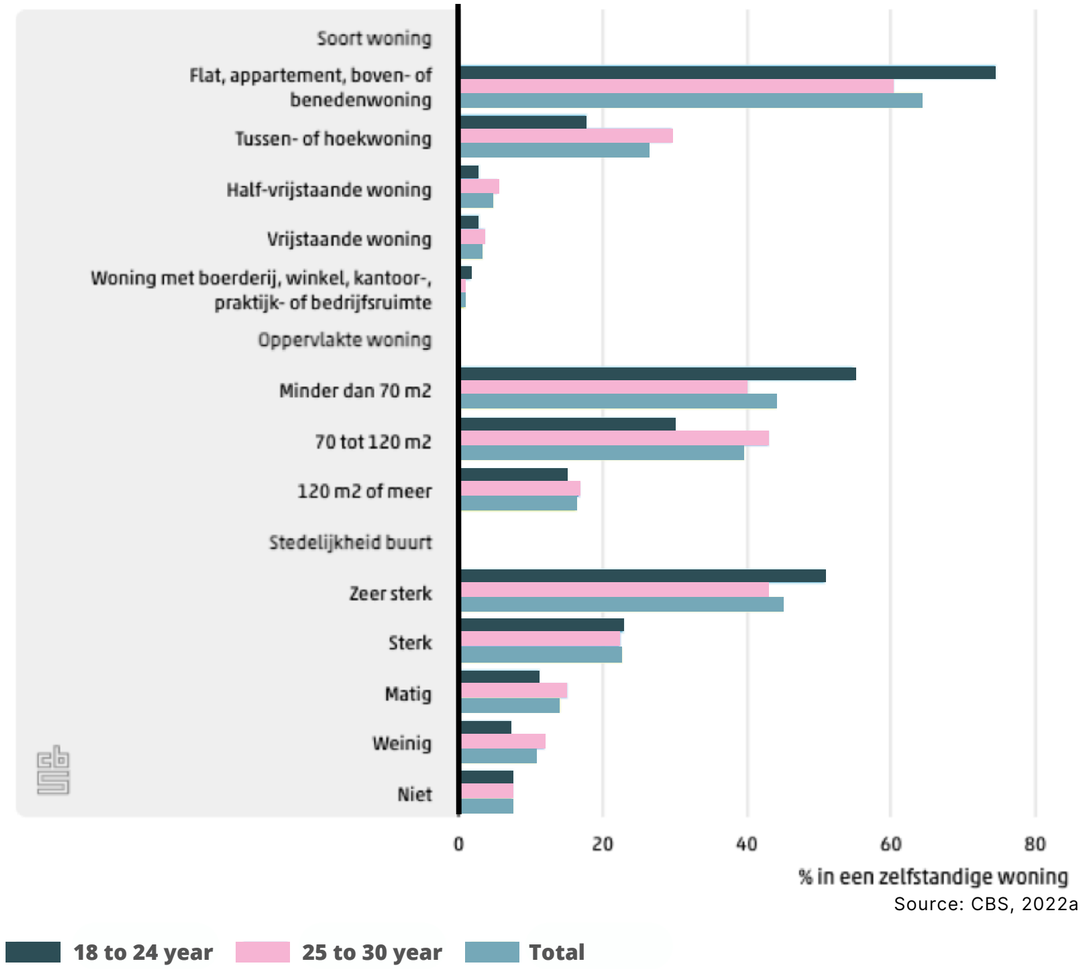
If a Quick Scan is used to determine if a vacant building is suitable for one or more specific target groups, the demand profile for the target group must be translated. Transformation of vacant office buildings into residences is only feasible if these residences fulfill a demand. According to the studies consulted regarding desires and preferences, the relative importance of the various factors on the demand side varies considerably. The type of home, the entrance, and the size (especially the size of the living room and the number of rooms) are determining factors for many people when deciding whether to rent or buy a home. Costs, the ratio of price to quality, renting versus purchasing, and the nature of the environment are also crucial factors.

Figure 7: Housing Demand in Amsterdam (categorized by age) in 2022



Source: Gemeente Amsterdam, 2022

Figure 8: Housing characteristics 18 to 34 years old households in 2021



Source: CBS, 2022a

Overall, the demand for transformed office buildings can be influenced by a combination of location, building characteristics, and costs, as well as the specific requirements and preferences of various target groups. By understanding the demand profile of these groups, developers and property owners can better tailor their offerings to satisfy the requirements of their target customers. Depending on market and local conditions, the demand profile of these target groups in relation to location, building features, and costs can vary.

In general, however, these target groups tend to prioritize access to natural light and flexible living spaces, as well as proximity to amenities, public transportation, and cultural attractions. Cost is also an important factor, many of these target groups may be attracted to converted office buildings that offer affordable housing.

The target groups that can be identified in connection with the transformation of vacant office buildings are students and newcomers (starters) with an age between 18 to 34 year.

As illustrated in the figure 8, the vast majority of the target population resides in a flat, apartment, upstairs or downstairs home of less than 70 square meters, in an urban area (CBS, 2022a). In 2019, the municipality of Amsterdam studied the living preferences of various groups; the target groups of this study have the following preferences:

Target group 1: Students
Students may be attracted to converted office buildings that offer affordable housing options close to their schools or universities. They may prioritize proximity to campus, public transportation, and amenities such as grocery stores and restaurants. Students prioritize locations that are close to their schools or universities, public transportation, and amenities such as grocery stores and restaurants. Building features that are important to students include affordability, flexibility, and shared spaces such as common areas and study rooms (Gemeente Amsterdam, 2022).

Target group 2: Starters
Young professionals tend to prioritize locations that are close to their workplaces, public transportation, and amenities such as restaurants, cafes, and entertainment venues. They may also value features such as natural light, open floor plans, and modern finishes. Cost is also a consideration, and affordable options may be especially attractive to this group.

SUMMARY

This chapter answers sub-question *1: What does the office and housing market look like in Amsterdam?*

In conclusion, Amsterdam's office market demonstrates a significant presence, while the housing market faces challenges stemming from a shortage of available properties. Regarding the office market, Amsterdam is home to a significant number of offices, totaling 1,037 and comprising approximately 5.6 million square meters of office space. The vast majority of these offices are located in the prestigious neighborhoods of "Centrum" and "Zuid." Despite the flourishing market, the vacancy rate in Amsterdam has increased slightly to 7.1% as a result of the completion of new construction projects. This increase in vacancy rates has been observed predominantly in "Nieuw-West" and "Zuid," whereas "Centrum" and "Westpoort" have experienced a decline in office space availability. On the housing front, the housing market in Amsterdam is strained, exacerbating the scarcity of residential properties. The average housing price of €400,000 underscores the difficulties prospective homebuyers and renters confront. The dynamics of the market indicate a substantial increase in private rental housing, which has surpassed privately-owned housing stock.

However, the supply of owner-occupied homes priced below €314,000 is constrained, as is the availability of social housing from housing associations, resulting in an extensive waiting list.

The demand for residential space in Amsterdam has been affected by a number of factors, including the expanding shortage, remote working patterns, and the desire for more spacious living environments. The type and size of the residence, affordability, and the desirable living environment play crucial roles in the decision-making process of prospective residents seeking suitable housing. Given the circumstances, converting vacant office buildings into residences presents an opportunity to address the housing shortage, especially for certain target populations. Students and newcomers between the ages of 18 and 34 are the primary target group for repurposing vacant office space. Transformed office buildings can serve the requirements of students by providing affordable housing options in close proximity to educational institutions, public transportation, and amenities such as grocery stores and restaurants.

3

THEORETICAL FRAMEWORK

3.1 NEW WORKING TRENDS
3.2 COMMERCIAL REAL ESTATE
3.3 VACANT PROPERTIES
3.4 TRANSFORMATION
3.5 TRANSFORMATION POTENTIAL
3.6 TRANSFORMATION MEASURING TOOL
3.7 MIXED-USE

The transformation of current business districts vacant offices into live-work mixed neighborhoods can be a promising opportunity that follows from the new working patterns to increase the quality of living, keep business districts attractive and address the city's housing shortage. To investigate this, it is vital to be aware of the theoretical concepts that will be used in this research. This chapter addresses the theoretical knowledge within the research topic. The theoretical framework starts with a clarification of the new working trends as a result of the shifting urban dynamics, followed by an explanation of how the commercial real estate market operates. Thirdly, vacant buildings and their intervention techniques will be examined to zoom into transformation as an opportunity for mixed use development.

3.1 NEW WORKING TRENDS

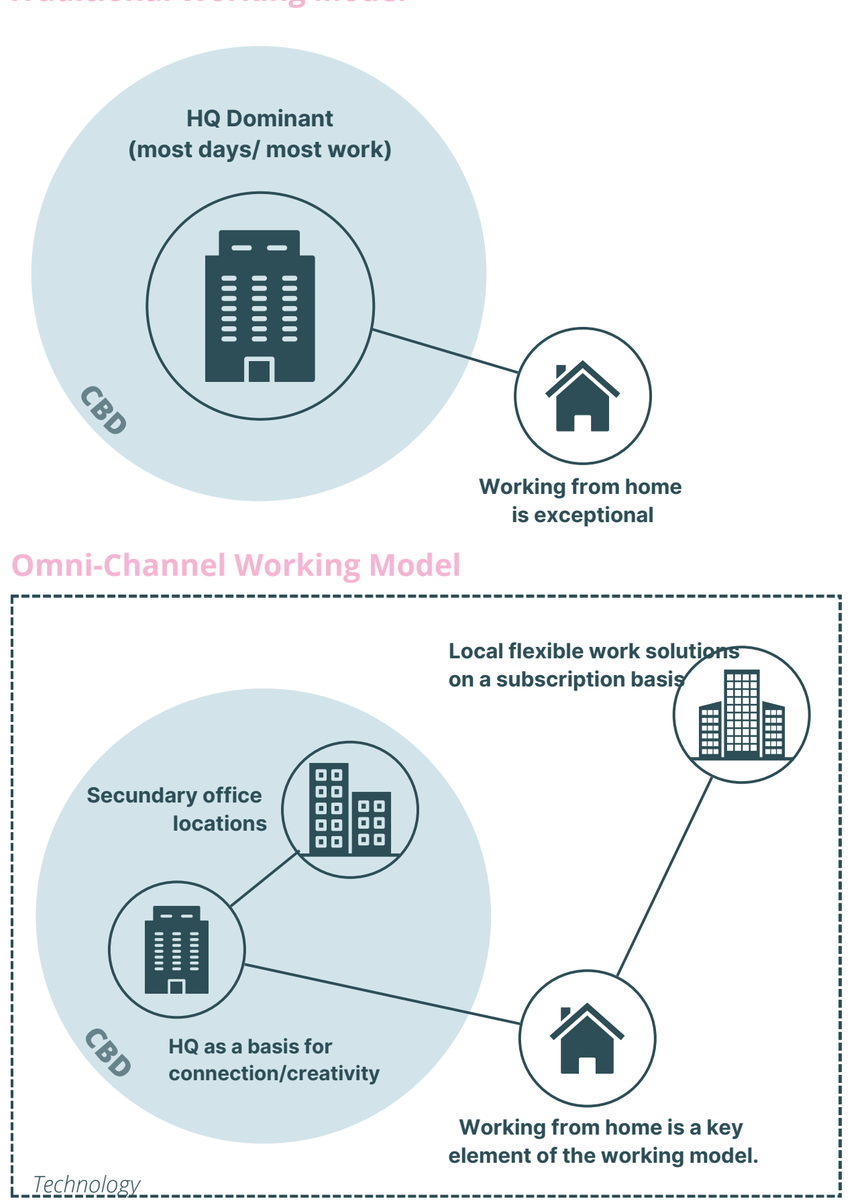
Remote-working arrangements, aging real estate across all property types, competition with emerging and non-traditional submarkets and long commutes continue to weigh on the short-term outlook for many office districts. Remote work, which was born out of need, now appears to be a permanent element of modern labor markets. Employees value this benefit, including flexible work hours, time saved from commuting, improved work-life balance, and cost savings on office equipment (Kylili et al., 2020). It is not an exaggeration to assert that the remote working pattern has the potential to alter our long-term expectations of life and cities.

What is Remote Working?

The term ‘remote work’ has been interpreted in numerous descriptions. One of the most popular definitions is: "any activity involving the processing of information and its delivery via a telecommunications link that is carried out primarily or partially away from the organization's main premises" (Felstead & Henseke, 2017).

Although widely perceived as an alternative method of preventing the spread of COVID-19, remote working is not a novel concept. Nilles (1972) introduced the terms "teleworking" and "telecommuting" already in 1972, to describe the substitution of telecommunications and information technology for travel in the workplace. Later, a variety of terms, such as remote work, flexible workplace, e-working, etc., were used to characterize the emerging work pattern. In 1995, Veldhoven introduced the concept of the "activity-based workplace", advocating flexible workplaces based on work-related activities instead of to a singular designated workplace (Veldhoven, 1995). By the end of the 20th century, several international corporations and organizations, including Steelcase, IBM, Johnson Controls, had adopted shared workspaces (Yu te al., 2019).

Figure 9: Traditional Working Model vs. New Ways of Working Model



Source: By author.

With the widespread adoption of personal computers and the internet as the 21st century began, the model of flexible working was presented with greater opportunities. Nonetheless, employee motivations, management issues, and workers' rights concerns were among the most significant doubts that impeded its further promotion (Felstead & Henseke, 2017). Prior to the COVID-19 pandemic, remote work was not widely utilized on a global scale. With the accumulation of studies on working experience during the pandemic, it has been demonstrated that remote work not only does not hinder efficiency, but also increases motivation, productivity, and job satisfaction (Kylili et al., 2020). Figure 10 shows the new ways of working compared to the traditional model.

Types of Remote Working

Patterns of remote work can be roughly divided into two categories: teleworking and co-working (Kylili et al., 2020; Yu et al., 2019). Depending on the space available for the activities, they can be further subdivided into:

- Home office working;
- Shared office working
- On-demand office working
- Café/shop working;
- Outdoor working;

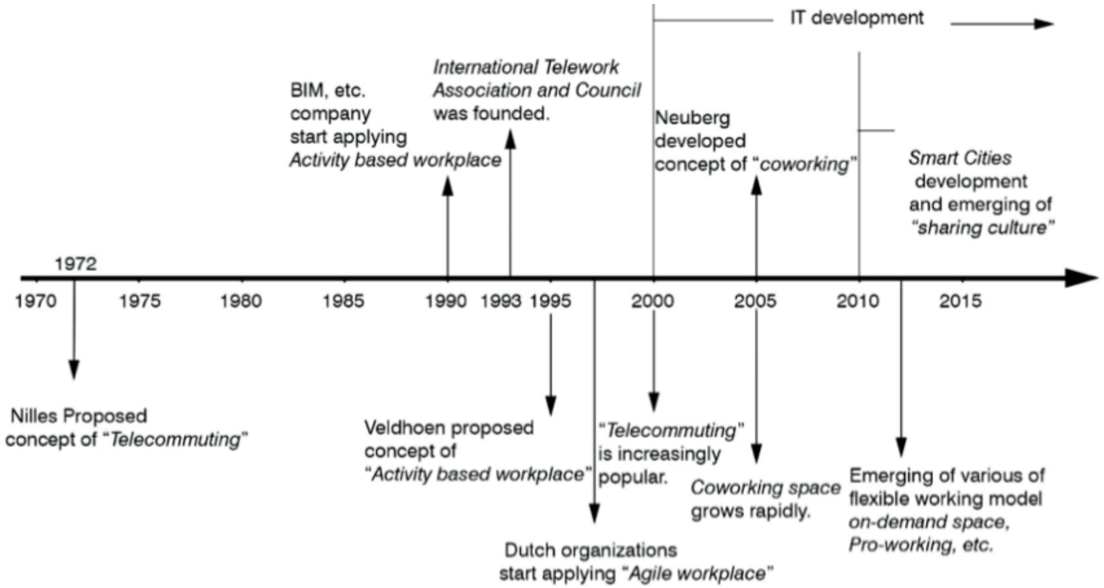
Teleworking refers to working away from the office with no personal contact with coworkers (Yu et al., 2019), which was the prevalent situation during the pandemic, whereas coworking refers to working in a shared office, either designated and shared by the company or booked by the employees.

Influence on office districts

The enduring trend of remote work will not only alter our conceptions of work and life, but also the (spatial) structure of infrastructure and cities (Rosenthal, Strange & Urrego, 2022; Gutpa et al., 2022; Nieuwerburgh, 2023). As a result of the blurring line between "work" and "home" and the opportunity to reevaluate their living choices, individuals are now more likely to place less value on the proximity to their workplace, and in many cases, business districts. In contrast, greater emphasis is placed on access to amenities and cultural, recreational, and green spaces, and residential rents in Europe's major cities like London and Berlin have increased (Lund et al., 2021). The changing requirements will place new demands on the housing market. With the current housing shortage, the preference for proximity to amenities and nature is likely to increase housing prices and aggravate the housing crisis.

On the other hand, remote working reduces the demand for office space and equipment, which impacts the business district and urban centers (CBDs) in particular. Twenty to twenty-five percent of employees in developed economies such as the Netherlands could work remotely three to five days per week. Although the percentage is relatively small, the occupations are primarily computer-based and higher-paying positions such as financial, executive, and technology-related positions (Lund et al., 2021), which tend to concentrate in (central business districts). Consequently, the reducing need for offices has a significant spatial and economic effect on the business districts and city centers.

Figure 10: Historical Development Remote Working



Source: Yu te al., 2019

Figure 11: Types of Remote working, based on workplace

Source: By author.

During the pandemic, office vacancy rates soared to 45% in Edinburgh, 32% in London, and 27% in Berlin. And yet, it continues to rise. A survey of 278 executives by McKinsey revealed a planned reduction of 30% in office space in Europe, even after the pandemic (Lund et al., 2021).

The main factor influenced by remote work appears to be commuting time. Dutch people collectively save 2 million hours per day by not commuting. Workers residing farther away are more likely to work remotely and have been slower to return to the office. Safety and reliability issues with public transit also contribute to this trend. The reduction in commuting needs would have a significant impact on transportation and consumer behaviors. According to Dutch Railways (NS), only 37% of commuters are willing to resume their pre-pandemic travel routines, with an estimated average of 2.2 days per week working from home. Around one of four individuals surveyed prefer working from home and driving (NS, 2021). The positive aspect is that reduced commuting can enhance sustainability and alleviate congestion. A case study conducted in Cyprus found that if 100 people choose to work remotely for an hour, it could save at least 4.0 liters of fuel and 7.4 kg of carbon dioxide (Kylili et al., 2020). However, the shift in commuting patterns can have adverse effects on service businesses catering to office workers, such as restaurants, bars, and shops.

Limitations of the new working trends

As discussed previously, although remote working has positive effects on both companies and individuals in terms of costs, spatial and temporal flexibility and, work-life balance. The emerging work pattern also has a significant impact on our lives, including housing demand, consumer behavior, economies, and urban development. Studies identified additional disadvantages of remote work, such as social isolation, distraction, and the blurring of the boundaries between work and family (Kylili et al., 2020).

Moreover, neither the benefits nor the viability of remote work is assured. The ability to work remotely is not available to everyone; rather, it is restricted to a group of highly educated, highly compensated individuals who primarily work in professional, executive, or technological fields (Sullivan, 2012; Lund et al., 2021). This restriction is even harming the employment opportunities of those who cannot work remotely. As McKinsey notes, job growth focuses more on high-wage, remote-work-friendly positions, while middle- and low-wage jobs decline (Lund et al., 2021). Workers in the service industries (food service, customer service, etc.) with a lower level of education are not only underpaid but also situated in more vulnerable conditions.

Nevertheless, it is undeniable that the emergence of remote working presents us with an enormous opportunity to reconsider and reorganize not only our lives, but also our cities and the fundamental structure upon which they are founded.

The spatial and infrastructure impacts of remote work necessitate the intervention of urban planning and spatial planning. To maximize and consolidate the positive effects of the work pattern, more supportive policies, management techniques, and planning strategies must be implemented. But to do this, it is important to firstly understand the commercial real estate market.

SUMMARY

This paragraph answers sub-question 2: *What are the new working trends and how do they affect office districts?*

Office districts are experiencing a profound impact from the changing urban dynamics, particularly remote work, which has the potential to alter the urban landscape. It affects commuting patterns, spatial needs, office space utilization, public space design, socioeconomic dynamics, and local economies.

Remote work is revolutionizing work, life, and urban areas. As work and home become more intertwined, proximity to work or business districts is valued less. People favor recreational, cultural and green spaces. This change in preference has led to an increase in residential rentals in major European cities, thereby aggravating housing shortages (Lund et al., 2021). Additionally, Work from home impacts office space in urban and central business districts.

These higher-paying, computer-based jobs are concentrated in urban cores. Thus, less office space has an economic and spatial impact on commercial areas and city centers. After the pandemic, McKinsey predicted European office capacity losses (Lund et al., 2021). In Edinburgh, London, and Berlin, there was an increase in office vacancies. Furthermore, hybrid working impacts the commute. Every day, working from home save 2 million hours of commuting time in the Netherlands. A shorter commute has an impact on transportation and consumption. Reduced commutes improve sustainability and traffic congestion, but they may be detrimental to restaurants, taverns, and stores that serve office workers.

Urban planners, policymakers, and businesses must adapt to these trends to ensure that office districts remain attractive and competitive.

3.2 COMMERCIAL REAL ESTATE

The office market is part of an umbrella term, called ‘Commercial Real Estate’. Commercial real estate are buildings intended for commercial purposes, such as shops, factories, hotels and offices (Van Gool et al., 2013). To understand the impact of a decrease in office demand as a result of new working patterns it is important to comprehend how the commercial real estate market operates.

Fluctuating demand

The office market is comprised of renting and buying. In the Netherlands, the rental market is larger than the buyer market. Office end-users typically want workspace flexibility, and leases eventually expire (Van Gool et al., 2013). The fluctuating need for space is a reason why businesses desire flexibility. Buitelaar et al. (2013) provide three reasons for the fluctuating need for space being the state of the economy, the demography of a country and the impact of societal changes on the demand of space. The state of the economy is the main reason for fluctuating demand. There will be more and larger businesses when the economy is in a boom phase (strong economic growth, high activity, and low unemployment). Consequently, office space demand will increase. When the economy is in a downturn, there is a fall in the number of businesses, economic contraction, and increased unemployment. The result is a decline in office space demand. A second explanation is a country's demography. When the prospective labor force increases, the demand for office space will increase automatically.

The final cause for the fluctuating need for space is the impact of societal changes on the demand for office space. For instance, the increasing popularity of remote work is influencing the need for office space. In short, the demand for office space is driven by a variety of societal shifts.

Real Estate Markets

To describe how real estate markets operate, the four-quadrant model of Wheaton and DiPasquale is utilized (1992). There are four quadrants in this model. Starting from the top right they are the Property Market, Stock Adjustment, Construction Market and Valuation Market, the quadrants above the x axis are viewed as short-term changes, whereas quadrants below the x axis are viewed as long-term developments.

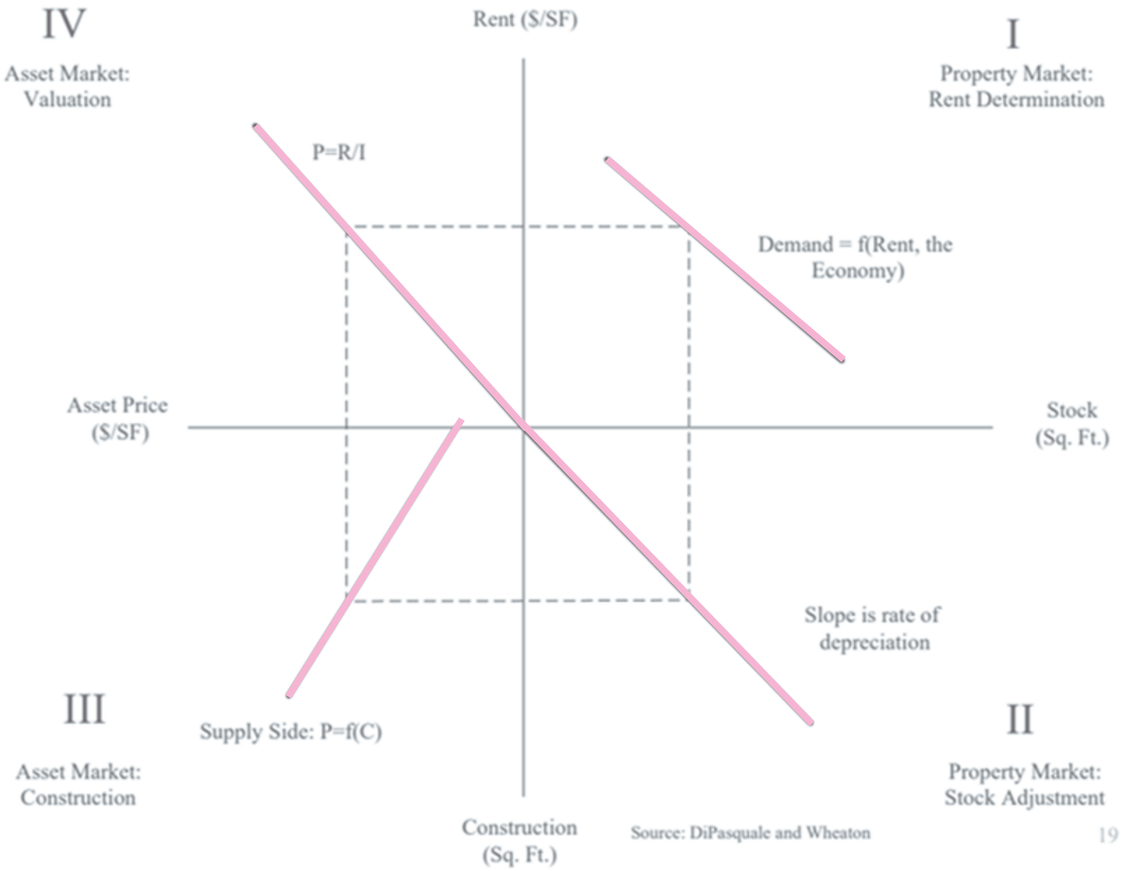
I.Property Market: Rent Determination

Real estate is fundamental to the Property Market. When the price of real estate is low, the downward demand line indicates that demand will be high. This implies that as the price is increased, demand will decrease. The manner in which this demand line operates is not predetermined, as demand is contingent on the state of the economy.

II.Property Market: Stock Adjustment

Construction and abstraction give rise to the second quadrant. As the line approaches the origin, many buildings are withdrawn from the stock. As the line moves away from the origin, it implies that more stock is being added than is being withdrawn.

Figure 12: Four-Quadrant Model



Source: Wheaton & DiPasquale, 1992

III.Asset Market: Construction
This line illustrates the construction cost per square meter. The curve never begins at the model's origin, since no construction will occur when the cost exceeds the eventual yield. Ultimately, this results in real estate development.

IV.Asset Market: Valuation
Rents from quadrant I influence the operation of the Valuation quadrant. It converts the level of rent into a price per square meter. This indicates that rent and property value are correlated. When the rent increases, the property's value rises. Additionally, the quantity of investments will increase.

The four-quadrant model is a systematized simplification of the real world. Actual situations are nearly hard to reproduce, but the four-quadrant model is a useful analytical tool. The real estate industry is characterized by cycles of boom and bust. Intermittent times of robust growth are followed by periods of contraction (Geltner, Miller, Clayton & Eichholtz, 2014). The sudden rise of for example the Covid epidemic, can be used to describe the operation of the model. The rise of remote work due to the requirements of distant labor has led to an increased adoption of new working patterns. Even after the epidemic, there has been a growing popularity of hybrid work, combining remote and in-person work. As Buitelaar et al. (2013) noted, this type of rapid change has a significant effect on the office market. According to the model, the property market is the first to feel the effects of this.

The demand line decreases vertically. As a result, a shortfall between supply and demand develops, causing rents to rise. This rise has the impact of increasing office space pricing per square meter. On the valuation market, this indicates a declining demand in offices. Falling demand affects office property values, making real estate investments less viable. Consequently, the construction of new office buildings is likewise falling. The fourth quadrant, representing stock mutation, is adjusting by not adding new stock. To summarize the process, changing demand caused by the new working patterns result in an office space oversupply, eventually resulting in vacancy. However, it is important to acknowledge that the model was published before the COVID-19 pandemic, and therefore its predictions may not always align with the actual outcomes observed during and after the pandemic.

SUMMARY

The paragraph answers sub-question 3: *How does the commercial real estate market function?*

The commercial real estate market, including the office market, is driven by fluctuating demand and diverse market dynamics. The four-quadrant model, proposed by Wheaton and DiPasquale, helps describe the operation of real estate markets. The model consists of the Property Market, Stock Adjustment, Construction Market, and Valuation Market.

It illustrates short-term changes (above the x-axis) and long-term developments (below the x-axis) in the real estate market:

- Property Market: This quadrant focuses on rent determination. Demand for real estate is influenced by its price, with higher prices leading to decreased demand. The specific demand line is dependent on the state of the economy.
- Stock Adjustment: Construction and abstraction of buildings impact the stock of available office space. When more buildings are withdrawn from the stock than added, the line moves closer to the origin, indicating a decrease in stock.
- Construction Market: This quadrant represents the construction cost per square meter. Construction occurs when the cost does not exceed the eventual yield.
- Valuation Market: Rents from the Property Market influence the valuation of properties. Rent increases lead to higher property values and increased investment quantities.

Furthermore, the commercial real estate market experiences cycles of boom and bust. Periods of robust growth are followed by contraction phases. These cycles are influenced by various factors, including economic conditions, market demand, and investor sentiment. New working patterns, such as the rise of remote and hybrid work, can significantly impact the office market.

Using the four-quadrant model, the effects can be observed. The property market experiences a vertical decrease in the demand line, leading to a supply-demand imbalance and rising rents per square meter. This, in turn, affects the valuation market, causing declining demand for offices and reducing property values. As a result, the construction market adjusts by reducing the construction of new office buildings. Ultimately, these changes contribute to an oversupply of office space and increased vacancy rates.

3.3 VACANT PROPERTIES

The strong polarization between demand and supply on the Amsterdam office market suggests that a significant portion of the current office (over)supply is unlikely to find a new tenant / user and will become vacant. This paragraph explains what vacancy is, how buildings become vacant, and intervention techniques for vacancy.

Vacancy

According to BAG (Basisregistratie Adressen en Gebouwen), A residential object belonging to the real estate stock is administratively vacant if no person is registered here according to the BRP (Basisregistratie Personen), and if there is no user according to the WOZ (Waardering Onroerende Zaken), and if there is no registration as a company in the 'Handelsregister. This is administrative vacancy: it has not been tested in practice whether individuals actually reside there and/or whether a company or institution is active (CBS, 2017).

Within the real estate literature, a distinction is made between initial and friction vacancy (vacancy less than one year), long-term vacancy (vacancy between one and three years) and structural vacancy (vacancy greater than three years). In contrast to total vacancies, the latter category has grown substantially in recent years (PBL, 2017). How a structure becomes obsolete is determined by its life cycles or lifespans. A building's life cycle can be divided into three categories (Remøy & Van der Voordt, 2014):

1.Technical life span;

The technical life span is the amount of time the structure remains in its current state after its construction. This depends on the materials and equipment utilized. In general, the technical lifespan of a building is lengthier than its functional and economic lives. The only time a structure requires technical adjustments is when its materials become deteriorated. Thus, sustainable materials increase a building's technical durability.

2. *Functional lifespan;*

The functional lifespan is the period during which a structure fulfills the requirements for the function for which it was designed. The functional lifespan is highly dependent on external changes that impact the needs of the building's occupants. Rapid development ensures a brief functional lifespan, necessitating new investment strategies. Building flexibility increases the likelihood of implementing functional changes; therefore, flexibility is essential for rapidly evolving functions.

3. *The economic lifespan:*

The period during which the net present value of future returns exceeds the net present value of future required expenditures. The economic lifespan ends when the net present value of the proceeds from the object's exploitation is less than the net present value of the proceeds from the land's demolition.

Why office vacancy

The Dutch office market is a replacement market in which vacancy will not be rapidly eliminated because demand will be concentrated at the top of the market, where structural vacancy is relatively low, leaving the bottom of the market vacant. Predictions indicate that demand will continue to diminish in the future due to economic, technological, and demographic changes such as hybrid working, resulting in a mismatch between demand and supply (Remøy & Van der Voordt, 2014). The oversupply of office space is caused by a disequilibrium on the office market. The supply has increased drastically over the previous decade while the demand grew gradually but slower. Normally the market mechanism stops this process when new developments are added to the supply. In Amsterdam during the last years however this was not the case due to a changing demand: new developments matched the demands better than the current offices and tenants often moved from older to new developed buildings (Geraedts, 2014).

As time passes, older buildings become aged and less appealing. Tenants leave their old buildings as their rental contracts expire and relocate to newer, higher-quality locations. Older office structures are becoming less desirable to occupy as time passes. Owners attempt to retain tenants by providing incentives. Eventually, the buildings will become completely vacant. This frictional vacancy transforms into a structural vacancy after three years.

According to projections, 60 to 70 percent of the total vacant stock will not be used again and will become structurally vacant (Zuidema & Van Erp, 2010). In Amsterdam, 17% of all vacant offices are structurally vacant (NVM, 2022). This type of vacancy will not be taken up by a rising economy (Remøy & van der Voordt, 2014). These objects should therefore be withdrawn from the stock either through demolition or transformation. In other words, these office buildings have reached the end of their life cycle.

Intervention techniques

When a building reaches the acceptable limits of its functional, economic, and/or technical lifespan, its proprietor will be required to choose between various accommodation strategies. This includes function renewal, function change, and function termination (Remøy & Van der Voordt, 2014; Geraedts, 2014). For a building owner to align his or her property with one of the three aforementioned strategies, table 1 shows the available intervention techniques.

This study examines long term transformation as an intervention strategy to address office vacancy and tackle the (social) problems. Vacancy is a problem on various levels. Economically, vacancy has a direct impact on the building proprietor. For society, vacancy poses problems of insecurity and social unpredictability, it can lead to criminal activity, including vandalism, graffiti, theft, unlawful occupancy, and fires.

Table 1: Vacancy Intervention Techniques

Intervention Technique*	Advantage	Disadvantage	Function change
Do nothing	• No extra expenses on short term • Minimizing running costs	• Vulnerable to vandalism • Depreciation • No revenue	No
Maintain in current state	• Preservation of real estate • Preservation of current use • Future possibilities are left open	• Maintenance costs rise • Current problems are not properly solved • Maintenance costs and obligations continue	No
Renovation	• Extend life span • Postpone impoverishment • Reduce building redundancy chance • Limited revenue	• Replacement of certain parts can be costly • Extended life span is shorter than building new	No
Transformation short term	• Generate revenue • Sociaal security direct area • Flexibility in use and management	• Building image can be damaged • Only temporary • High costs	Yes
Transformation long term	• Changes according to new function/user • Sustainability (reuse of current structure) • Preservation of building identity	• Time consuming intervention • Costly on short term	Yes
Demolition & New Build	• Changes according to new use • Building no limitation to perform new function	• Longer development period • Costly • High environmental impact • Loss of capital	Yes

* Additionally, it is possible to decide to sell the building, but the new owner will confront the same intervention strategy decision.

Source: Remøy & Van der Voordt (2014); Geraedts (2014), illustrated by author.

Vacancy also has indirect effects as a result of the negative impression it conveys to the surrounding area and buildings. This may result in an increase in technical deterioration, and the devaluation of the area's buildings (Geraedts & van der Voordt, 2007). Simultaneously, the Dutch housing market's restrictions create a prospective demand for vacant office buildings. Given the Netherlands' limited housing market, transformation into housing is an attractive intervention technique and opportunity. Housing has traditionally overlapped well with other aspects of the urban core, thereby fostering culture and recreation and create safer, healthier, and more vibrant neighborhoods.

SUMMARY

This paragraph answers sub-question 4: *What are intervention techniques to tackle vacancy*?

There are a number of techniques for intervention available to resolve vacancy in a building, including:

1.Do nothing: This technique consists of taking no immediate action to fill the vacancy. It may help reduce short-term costs, but it leaves the building vulnerable to vandalism and depreciation, and it generates no income.

2.Maintain in the current state: This strategy concentrates on preserving the building and its current use in its current state. It preserves future opportunities but comes with rising maintenance costs, unresolved issues, and ongoing responsibilities.

3. Renovation: By renovating the building, its useful life can be prolonged, delaying the need for new construction. It reduces the likelihood of redundancy, but its revenue potential may be limited and it can be expensive, particularly when certain parts need to be replaced.

4.Transformation (short term): This intervention involves making transient alterations to the building in order to generate revenue. It offers flexibility in use and administration and social security to the surrounding community. However, it can be detrimental to the building's image, and the alterations are temporary and expensive.

5.Transformation (long term): This technique concentrates on adapting the building to a new function or occupant. It promotes sustainability by preserving the building's identity and reusing the existing structure. However, the intervention is time-consuming and expensive, particularly in the short term.

6.Demolition and New Built: This strategy involves demolishing the existing structure and constructing a new one to satisfy the requirements of a new use. It allows for unrestricted design and eliminates the constraints of the existing structure. However, it requires a longer development period, high costs, a substantial impact on the environment, and the loss of capital invested in the original structure.

Each intervention technique has advantages and disadvantages, and the choice will hinge on financial feasibility, market demand, sustainability objectives, and long-term planning considerations. This research will focus on transformation.

3.4 TRANSFORMATION

As mentioned previously, transformation is an opportunity (intervention technique) presented by a surplus of vacant buildings. Through transformation, part of the vacancy problem can be solved in a sustainable manner. Adaptive reuse of buildings, a practice that has been in existence since the early days of construction (Remøy et al., 2011), involves transforming real estate into new functions, often converting offices, stores, or other commercial properties into residential spaces. The process of repurposing vacant office buildings or those with social functions, such as education or care facilities, into residential or other functional spaces leads to significant improvements. These improvements result in various social benefits, primarily addressing the issue of vacancy and creating new in-demand spaces (Remøy, 2014).

Benefits of transformation

Remøy et al., (2011) state that transformation has various benefits. By repurposing vacant offices to serve multiple functions, such as combining living, business, and catering establishments, the overall quality of life in the neighborhood can be greatly enhanced. This approach not only rejuvenates the area but also contributes to the development of a new supply of desirable amenities. One crucial advantage of adaptive reuse is its positive impact on sustainability. By opting for permanent transformation instead of new construction, both construction time and costs can be substantially reduced. Moreover, the existing building structure offers a foundation for sustainable practices, as it minimizes the need for additional resource-intensive materials and energy.

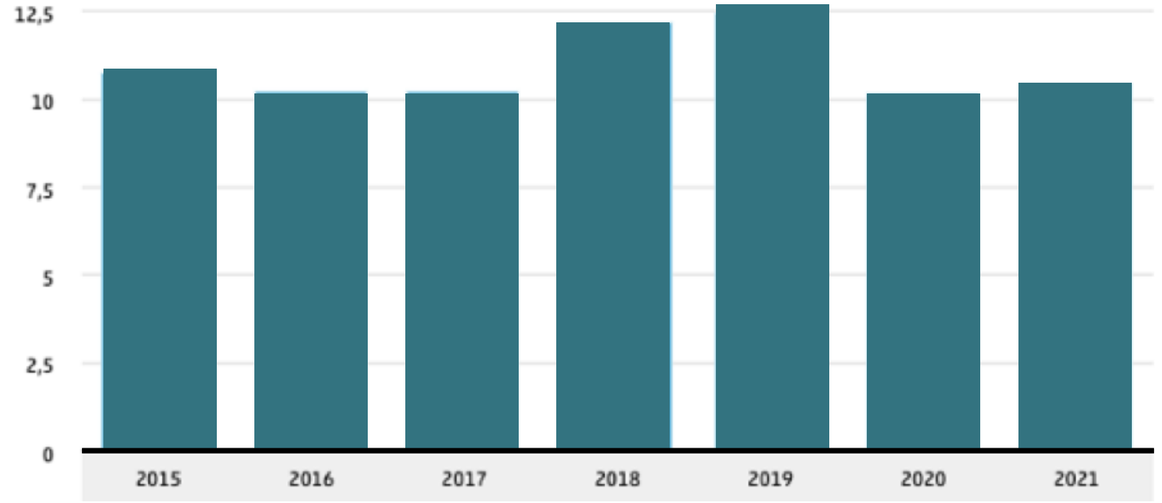
Additionally, when a building holds architectural or cultural-historical significance and is aesthetically appealing, this further adds value and attractiveness for potential inhabitants. The integration of historic elements into modern living spaces enhances the overall appeal of the neighborhood and fosters a sense of cultural continuity.

Transformation refers to the utilization of existing space in which the space's use is (partially) changed. If a structure is demolished and a new structure is constructed on the same site, this is not considered a transformation (Binnenlandse Zaken en Koninkrijksrelaties, 2022). This study focuses solely on transformation into residences. This entails converting existing buildings with residential objects (vbo's) that do not have a residential function into vbo's with a residential function. In the remainder of this report, the term housing transformation will be used for houses added to the housing stock in this way.

Housing transformation

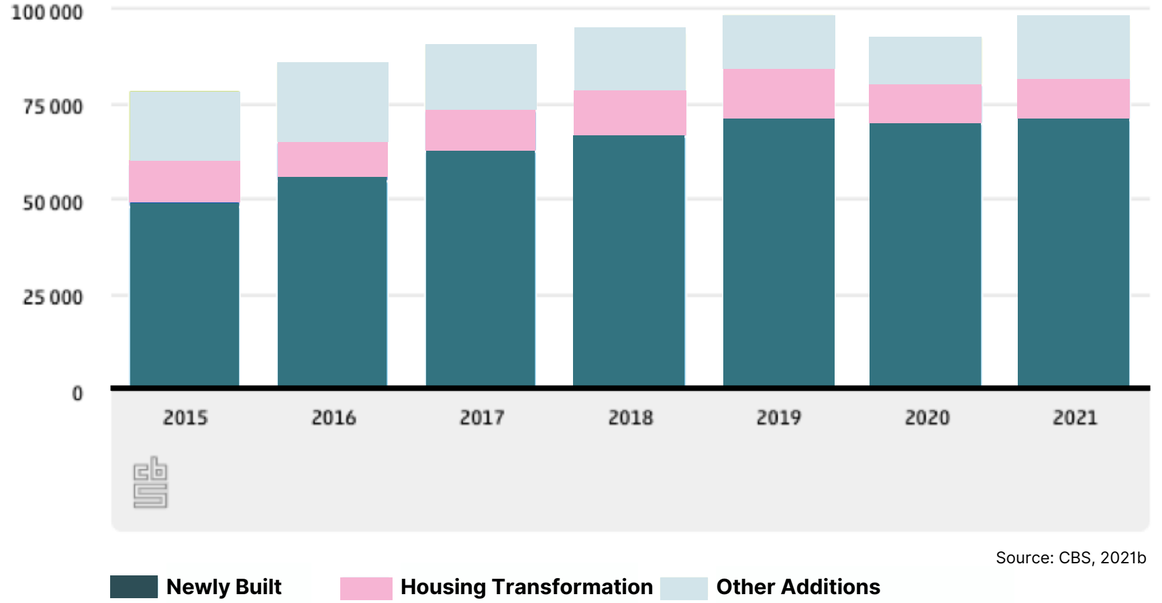
In the last 10 years, one hundred thousand homes have been developed by converting existing structures into homes through building transformation. CBS monitors these statistics annually. This monitor indicates that, since 2012, an average of 15% of the total housing production has been the result of building transformation (Figure 14; CBS, 2021b). According to CBS data, 10,500 new dwellings were created through building transformation in 2021. This is a modest increase from 2020, when 10,215 residential transformations were completed.

Figure 13: Number of homes created by transformation in the Netherlands (x 1000)



Source: CBS, 2021b

Figure 14: Additions to the housing stock



Source: CBS, 2021b

Since 2015, the number of transformations has exceeded 10,000, with 2018 and 2019 recording peaks of over 12,000 transformations (figure 13).

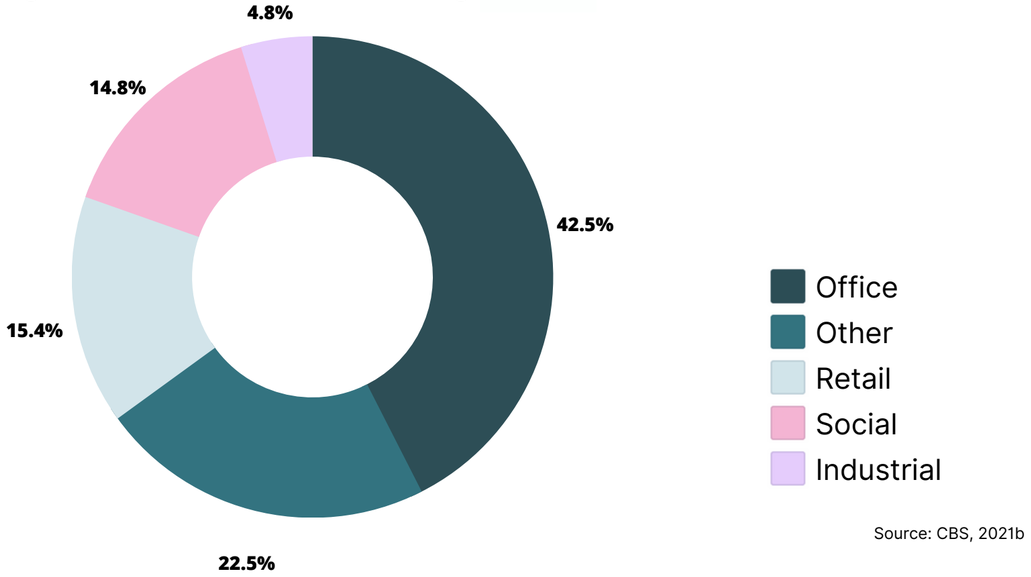
In 2021, nearly 4.500 residential units were created in former office buildings, 24 per cent more than in 2020. The share of housing transformations in former office buildings thus increased to 43%. Seven percent more office buildings were transformed into homes, and on average, more residences were added per office building than in 2020.

Transformed offices are the largest contributor to the number of housing transformations, followed by retail with 15% (Figure 15) . A combined one-fifth of residential transformations originated from industrial and social property. Office and retail property conversions increased in 2021, while industrial and social property conversions decreased compared to the previous year.

Figure 16 shows that more than half of the transformed buildings (55%) have a pre-1945 construction year (CBS, 2022d). However, there is a noticeable change in the construction years of transformation objects. Previously, offices built between 1960 and 1990 were deemed suitable for conversion. Currently, even structures constructed after the year 2000 are undergoing renovations (Dynamis, 2018).

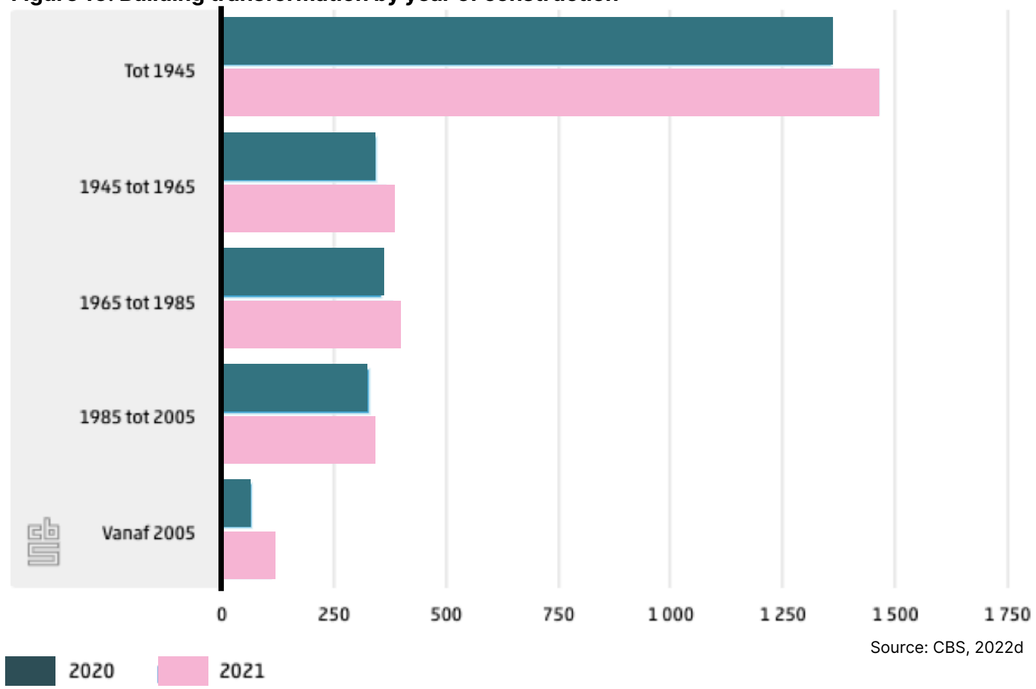
This is due to the depletion of elder buildings suitable for transformation. Therefore, more recently constructed structures are undergoing renovations. The median year of construction for transformed offices plainly reflects this pattern. In 2014, the median construction year was 1975; since then, it has risen to 1980. This trend is especially pronounced in the Randstad. The median year of construction has increased over the last four years, from 1972 to 1988, at this location. In 2021, 50% of Randstad transformation initiatives were less than 29 years old (CBS, 2022d). However, this trend is less noticeable outside of the Randstad. This may be explained by the subsequent rise of the transformation market.

Figure 15: Residential transformation to original use in 2021



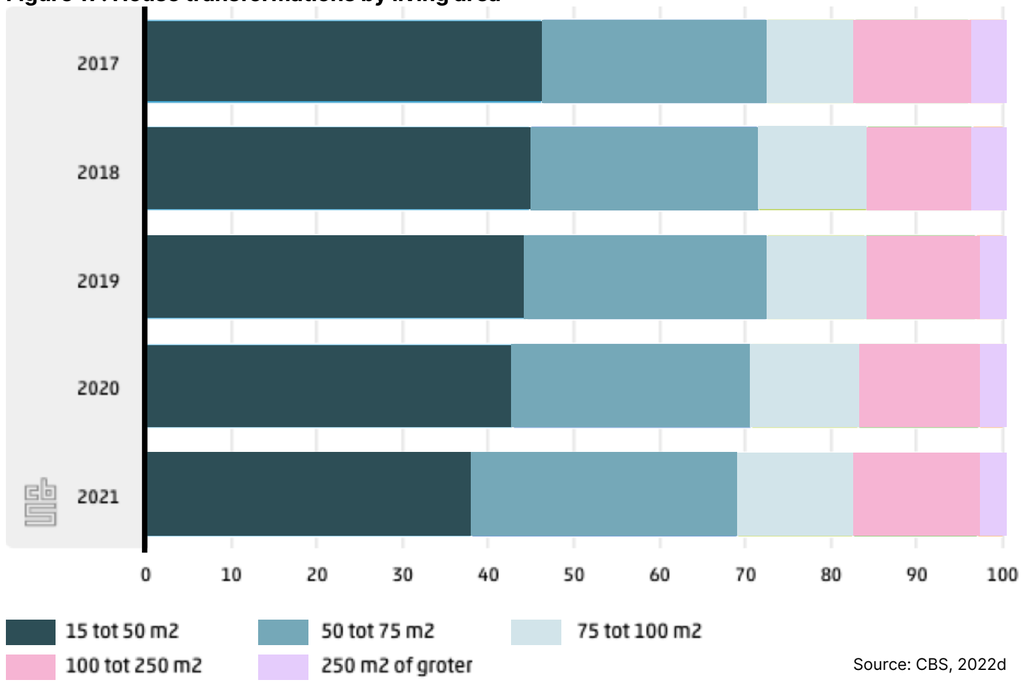
Source: CBS, 2021b

Figure 16: Building transformation by year of construction



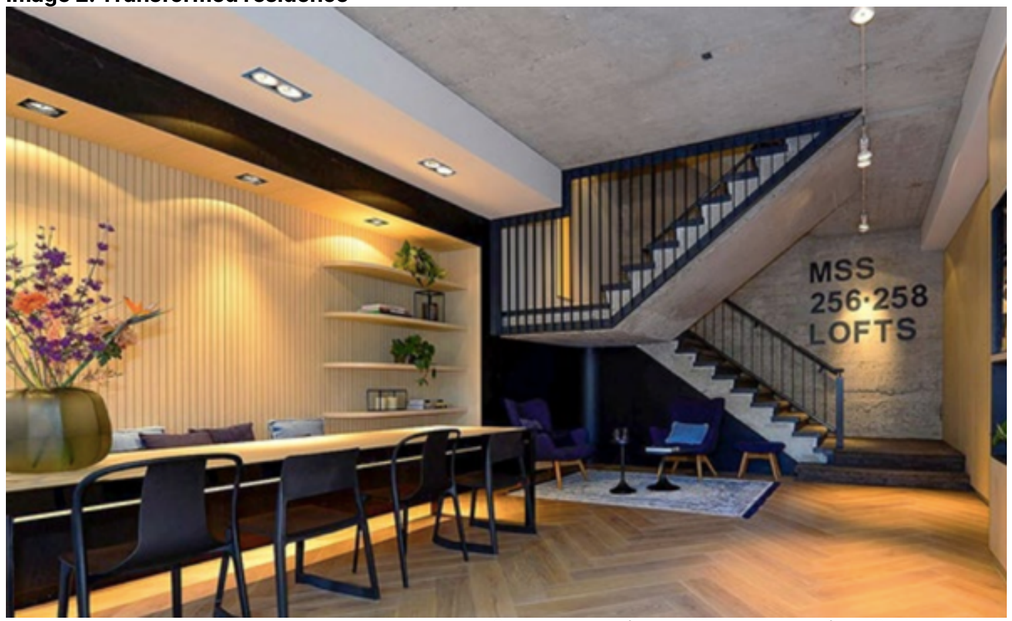
Source: CBS, 2022d

Figure 17: House transformations by living area



Source: CBS, 2022d

Image 2: Transformed residence



Source: Urban Lofts van BNLA Architecten, foto's Studio de Nooyer

Characteristics transformed houses

The houses created by transformation are not significantly different from newly-built homes. However, the delivery of smaller dwellings is relatively greater. This can be explained by the fact that many urban transformations targeted students and newcomers (Binnenlandse Zaken en Koninkrijksrelaties, 2022). We see this in the data as well: nearly half of all dwellings are less than 50 square meters in size and 69% of all transformations is smaller than 75 square meters.

Furthermore, housing transformations are relatively often rented homes. In 2021, 80% of the transformed residences included rented dwellings. Owner-occupied houses accounted for almost 12% of housing transformations. The other 8% has unknown ownership (CBS, 2022d).

Young adults occupy the majority of transformed dwellings. Almost half (46%) are younger than 28 years old, while about 6% are 67 or older. In recent years, the percentages appear comparable by age category.

The relatively compact residences created by transformation are primarily occupied by small households. Sixty-one percent of households living in housing transformations are single-person households, followed by childless couples with 29% (CBS, 2022d).

In practice, it can be observed that floor plans of transformed residences are more diverse than those of new constructions and frequently include unexpected features, such as voids and stairwell sections.

Often, the residences have characteristics that are no longer offered in newly-built homes. For example, high ceilings that allow for lofted beds in student rooms, mezzanine floors in urban apartments, and ample storage space (Binnenlandse Zaken en Koninkrijksrelaties, 2022).

Transformation in Amsterdam

The municipality of Amsterdam is very receptive to transformation because it recognizes that a significant portion of housing production must be realized through transformation initiatives (Gemeente Amsterdam, 2022). The municipality's goal is to encourage housing construction, which it accomplishes by issuing bids and facilitating transformation. The municipality entered a 'Transformation Impulse' on February 1, 2022, which is a temporary arrangement to accelerate transformation to housing. The Transformation Impulse was the result of consultations between the municipality and market stakeholders in response to the 3 February 2020 declaration of intent titled "More affordable housing with reliable partners." The plan includes a 10% land value allowance for the affordable (regulated) housing program of transformative developments. The objective of the Transformation Impulse is to encourage the rapid progress of housing transformation initiatives.

The Framebuilding is an example of an Amsterdam transformation project. The Framebuilding is a site-wide transformation of a vacant, obsolete office building into a sustainable residential building with 213 rental apartments. Together with the municipality of Amsterdam, this location has been meticulously interpreted over the past few years (Plegt-Vos, 2022). Both in terms of program, building capacity, and materialization, choices that align with the ArenAPoort's goals were made. The Framebuilding is partially constructed on the existing parking lot and roof garden of the former ING headquarters Het Zandkasteel, as well as against an existing apartment complex owned by housing organization Ymere. Due to the proximity of several buildings and shoppers in and around ArenaPoort, the location is a difficult construction site and a prime example of urban densification within the existing infrastructure of this area of the city. The residential tower will be delivered by Plegt-Vos with high-quality interior and exterior finishes. The Framebuilding will include 213 rental units, including 69 social rental units, 37 mid-rent units, and 107 free market rental units. The apartments differ in usable area from 28 to 90 square meters.

The Framebuilding therefore sets the tone for a high-quality transformation into a mixed-use neighborhood with a variety of residential categories, stores, and an attractive working area.

Image 3: Apartments in The Framebuilding

Source: Plegt-Vos, 2022

3.5 TRANSFORMATION POTENTIAL

Building conversions in office districts can offer valuable additions to the existing housing stock. Experts say that around 50% of all vacant office space is suitable for transformation (Remøy et al., 2011). However, exact data on how much potential transformation volume is left, is unknown (Ministerie van Binnenlandse Zaken, 2022). For transformation projects to be successful, three factors are crucial. These include a tight market of the future function, locational factors and building characteristics.

1.Market factor

The first crucial prerequisite for a successful building transformation is the presence of a robust and in-demand market for the intended future function. As previously stated in the introduction, the Dutch housing market has been under significant strain in recent decades, marked by a recurrence of the "one million homes" housing crisis (Zonneveld & Nadin, 2021). However, the housing shortage has escalated even further, reaching a critical point, particularly exacerbated by the impact of the pandemic. In 2022, the scarcity of available (new) real estate led to an alarming average housing price of €400,000 in Amsterdam (NVM, 2022). Additionally, the duration for which houses are listed for sale has been steadily decreasing over time, with last year's average being 79 days, and the current year's average being reduced further to just 54 days (NVM, 2022). This shortened period for house listings is predominantly driven by the exceptionally high demand for city living.

Demographics also affect the overheating of the market. The Dutch population has increased considerably in recent years, even more than the Central Bureau of Statistics had predicted. Although the birthrate is decreasing, the number of immigrants is increasing at such a rate that the total population is increasing. Particularly in the Randstad region, where all the nearby amenities contribute to its popularity, i.e. demand. As the market is slightly cooling down, the ABF Research, commissioned by the government, expected a population growth of 849,000 by 2035, which will lead to a need for approximately 1,160,000 dwellings (CBS, 2022b).

At the beginning of 2022, the Netherlands had a total of 8.1 million private households, out of which 3.2 million were one-person households. The average household size in the country is currently 2.13 persons, a notable decline from the average of 3.53 persons recorded in 1962 (CBS, 2022b). This trend of decreasing household size has led to an increase in the overall number of households, necessitating a greater demand for housing. Despite the continuous growth in the number of households, the construction of new homes has not been able to keep up with the rising demand. As a result, there is a projected housing deficit of 400,000 units by the year 2025, with 325,000 dwellings already required (Capital Value, 2023). Major metropolitan areas are particularly affected, with numerous municipalities experiencing a shortage of homes.

The most acute shortage is observed in Amsterdam, where the deficit reaches 45,000 homes (AT5, 2023). In order to alleviate the pressure on the housing market and create much-needed new supply, the transformation of obsolete buildings emerges as a significant solution (Boelhouwer, 2017).

2.Location factor

Location is likely the most significant factor in all real estate. This holds true for transformation initiatives. Transformation requires that the new location meet the needs of the local target population (Avidar et al., 2007; Smit, 2007; Koppels et al., 2011). The target groups of this study include students and newcomers, since there is a stressed housing market and transformed homes are tiny. If the location is inappropriate, the project is most likely unsuccessful. Important characteristics of a suitable location for transformation projects include easy access by car and public transportation, as well as the proximity of all amenities and facilities (Geraedts et al., 2017). If vacant buildings are in weakly connected areas, the entire area must be transformed (Smit, 2007; Koppels et al., 2011). All these studies state that that a transformation project with a favorable location but a ‘bad’ building has the potential to be successful, whereas a project with a ‘good’ building in a less desirable location is likely to yield unfavorable results. And will face greater difficulties in achieving success. This demonstrates the significance of location in transformation initiatives and real estate projects in general.

The Ministerie of Binnenlandse Zaken (2022) argues this and states; ‘Numerous studies examine the potential for transformation of vacant structures. The number of filters or selection criteria varies between the investigations. What the studies have in common is that they all exclude buildings in monofunctional working areas based on locational characteristics. Occasionally, they also consider obstructive factors (such as environmental characteristics or policy principles). The remaining structures on the sieve are referred to as the transformation potential. This disregards the distinction between buildings that can be transformed at the building level and those that necessitate an area-based strategy’ (Ministerie van Binnenlandse Zaken, p.12, 2022). They made a distinction between different transformation locations;

- *Low hanging fruit:* Immediately transformable office buildings;

The screening method identifies unused properties and sites that are likely to undergo accelerated transformation. It consists of so-called low-hanging fruit: vacant buildings in prime city locations where all traffic signals are green. However, an extensive amount of 'low-hanging fruit' has been gathered from accessible locations. The columns in table 1 plainly demonstrate this. Five years ago, the proportion of offices located in residential areas and the city center was roughly double what it is today. On the other hand, the surplus supply on industrial estates and in office districts has increased.

Table 1: Vacancy figures in the Netherlands

Location Type	Vacancy percentage 2021	Supply 2021	Oversupply 2021	Percentage oversupply vacancy 2021	2016
Bedrijventerrein	13,4%	1.201.000	751.500	25%	18%
Centrum	6,8%	873.500	234.500	8%	18%
Kantorenwijk	15,2%	2.510.500	1.683.000	55%	45%
Woonwijk	8,8%	709.500	307.500	10%	17%
Buitengebied	11,5%	10.900	6.000	2%	2%
Nederland totaal	11,5%	5.458.000	3.092.500	100%	100%

Source: NVM, 2022

- *Ripe Fruit:* Vacant buildings at office districts that are 'difficult to pick '

The preceding data demonstrates that the majority of the current surplus supply is located in office districts and industrial estates. Despite significant distinctions in office type, property quality, and environment, such offices are categorically excluded in earlier studies. There may be persistent office vacancies in these areas (especially in business parks), but this does not mean there are no suitable buildings. The Ministerie of Binnenlandse Zaken calls this ripe fruit that is difficult to pick. Unattractive environs are one of the factors limiting housing availability. Environmental zones may also impede the transformation of vacant property into housing, and planning competition may make the transformation undesirable.

To transform offices on business parks, however, does not always necessitate extensive demolition and redevelopment on a large scale. Sometimes it is sufficient to make public space desirable for habitation.

The Ministerie concludes that 30% of unused office space on business districts can be converted to residential use in the future. This means that in addition to the low-hanging fruit, an additional 16,000 residences have the potential to be transformed.

3.Building factor

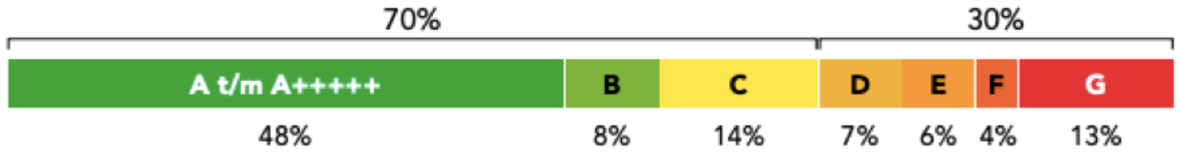
Moreover, the feasibility of a transformation project is significantly influenced by the characteristics of the building itself, albeit to a lesser extent than factors like a constrained housing market and suitable location. An overwhelming majority of transformed buildings have a construction year prior to 2000 (CBS, 2022d). This trend can be attributed to the favorable locations of many of these offices, situated near or within residential neighborhoods, making them attractive for conversion. Additionally, these older structures possess technical attributes that make them well-suited for transformation, including period-appropriate features like floor-to-ceiling height and the spacing between load-bearing columns and walls.

In recent years, the demand for such office spaces has declined substantially, mainly because their layouts often feature segmented cell structures, which do not align with the contemporary preference for open-plan floor layouts (Geraedts et al., 2017). Achieving an open-plan layout in these offices requires significant investments, which further diminishes their appeal in the competitive office market.

Another crucial aspect related to the building is the energy label obligation set forth by the Dutch government. As of January 1, 2023, all office stock in the Netherlands is required to have at least an energy label C, with the target of achieving label A by 2030 (Nieman Group, 2016). Nevertheless, some properties are exempted from this sustainability requirement, including monuments, structures using office space as a secondary function (with 50% or less user area for office purposes), and those slated for demolition, transformation, or expropriation within two years. Despite the obligation, a significant portion of Amsterdam's office stock (30% in 2022) still remains labeled D or worse in terms of energy performance (Figure 18).

According to estimates by the Economic Institute of the Built Environment (EIB), the cost of upgrading to label C ranges from €946 million to €1 billion. The expenses vary depending on the building's structural condition and the feasibility of implementing energy-saving measures. Estimated costs per square meter fall between €9.- per square meter for label D and €57.- per square meter for label G. This energy label obligation represents a crucial step towards meeting the objectives of the Paris Agreement and reducing energy consumption in office buildings. As the number of vacant office spaces grows, many of which have energy performance labels of D or worse, the impending milestones of Label C in 2023 and Label A in 2030 for office spaces can serve as incentives for building owners to consider transformation as an intervention technique.

Figure 18: Energy labels offices Amsterdam (2022)



Bron: Gemeente Amsterdam, 2022

Interrelated boundaries
The three aforementioned factors are bound by three interrelated influencing boundaries that determines a transformation projects' success or failure. These are technical, legal, and financial boundaries (Remøy et al., 2011).

Technical
Technical factors play a pivotal role and can be classified into two main categories: technical properties and functional properties. Technical properties encompass various aspects, such as the building's materials, construction year, and energy label, among others. On the other hand, functional properties focus on space utilization, including floorplan layout, the positioning of columns and load-bearing walls, floor-to-ceiling height, the number of levels, and overall floor area. The functional adaptability of vacant buildings is crucial to the feasibility of conversion Geraedts & Van der Voordt, 2007). For instance, post-war office buildings were designed to cater specifically to the functions they were intended to accommodate. This level of customization often results in a close fit between the building's original design and its designated purpose, which, in turn, can pose challenges when considering transformation into housing or alternative uses.

Legal
The legal boundaries are subdivided into the construction and spatial planning. The construction section includes the Building Decree, the municipal building regulation, and the municipal welfare policy, while the spatial planning section includes the current zoning plans.

Zoning Plan: In the municipal zoning plan, the city or area is subdivided into numerous land use types. The zoning plan specifies, at a minimum, the permitted functions and building heights in a given area. A permit is required for altering the function of a piece of land. Therefore, a permit must be obtained before altering the primary function of a building (Gemeente Amsterdam, 2019).

In some cases, the zoning plan allows for the office to be converted to residential. In the case of a 'Mixed-1' zoning, for instance. In accordance with the zoning plan, housing is then permitted alongside offices and stores. If the residential function is not permitted by the zoning plan, such as in the case of a 'Single zoning office' or 'Single zoning business,' a request for a deviation from the zoning plan must be made to the municipality (Gemeente Amsterdam, 2019). The municipality then examines each case to determine whether a deviation can be accommodated. The municipality evaluates its willingness to cooperate with the conversion of commercial space into independent living quarters in a number of different methods. The Amsterdam Ondernemers Programme (AOP) has a guideline for determining whether or not to cooperate with a zoning plan deviation. The guidelines state that residential conversion is not permitted unless the following conditions are met:

- The business space is at least 100 meters from a shopping street
- The business space has been rented for two years at a market rate
- The owner has made demonstrable efforts to let the premises at a market rate
- No parties are known to be interested in renting the space
- There is no demand for this space from social properties
- No other non-residential uses are permitted under the zoning plan

Environmental Permit: This permit is required prior to the commencement of any large-scale construction. Environmental permits are required for all types of construction projects, from tree removal to the installation of dormer windows. This permit is tested against the Zoning Plan and Building Decree. A further component of the Environmental permit is the building's aesthetic and architectural value. Each municipality has its own committee that evaluates the architectural merit of each design. The presence of a monument designation and a high architectural or cultural-historical value will prevent demolition and encourage adaptive reuse (Benraad & Remøy, 2007). The majority of office buildings, however, are not on the list, as many of them are relatively new and have unremarkable architecture (Remøy & Van der Voordt 2014). In these instances, the primary motivation for conversion is not to preserve the existing structure, but to reuse it in order to improve the character of the environment and the future value of the location and the structure itself. Requirements to maintain and preserve a national or municipal monument can impede adaptive reuse, such as prohibiting the addition of terraces to the facade.

Building Decree: The Building Decree's 63 Departments address safety, health (air quality and nuisance), usability, energy efficiency, and environmental protection (de Jong, 2003).

In 1992, the Building Decree took effect for the first time. This meant that the technical building regulations are outlined in the Building Decree and related documents, such as the Ministerial Building Planning Act and designated NEN standards (so-called first line norms). In 2006, the energy efficiency coefficient was increased from 0.80 to 1. This last change only applies to newly constructed structures (VROM, 2006).

Financial
There are a number of factors that influence the cost and, consequently, revenue of transformation initiatives. The financial factors that can significantly influence the success or failure of a transformation project can be broken down into three interrelated categories: market demand, building costs, and building value.

Market Demand: In order to generate revenue, there must be a significant market demand for another function, such as housing. Without this demand, there would be no buyers (Geraedts et al., 2017).

B*uilding Costs:* Include all construction-related expenses as well as the purchase price of the vacant office building. For the entire transformation project to be feasible, it is crucial to keep costs as low as possible. These costs are dependent on the characteristics of the structure. Typically, building characteristics do not render conversion impossible, but they can significantly impact financial viability. When conversion costs exceed anticipated benefits, conversion may no longer be financially viable.

Building Value: Whereas in the past property owners believed that office space demand would rebound, they are now confronted with declining occupancy rates of the worst office property in their portfolio, resulting in a decrease in value. Since 2012, a growing number of proprietors are considering alternative uses for their vacant office properties (Geraedts, 2014). It is possible to add value by redeveloping or demolishing the vacant office property. To convert or demolish vacant office property, financial viability is required, with residual value playing a significant role in determining the property's value.

SUMMARY

The likelihood of a successful building transformation is impacted by three primary factors that answer sub-question 5: *Which factors influence the transformation potential of an office building?*

1.Market factor: Important is the existence of a tight market for the future function of the transformed building. In the housing market, a lack of available housing and high demand establish favorable conditions for building conversion. For example, as a result of increasing population growth and shrinking average household size, the Netherlands has experienced a housing shortage. The demand for housing is substantial, particularly in popular areas such as the Randstad. Transformation projects can assist in meeting this demand and alleviating the housing shortage.

2.Location factor: The transformational potential of a building is significantly influenced by its location. A suitable location should satisfy the needs of the target group, such as students or newcomers. Access to transportation, amenities, and facilities is important for the success of transformation projects. Buildings located in well-connected areas with proximity to amenities have better prospects for successful transformation. In contrast, buildings in weakly connected or unattractive areas may face more difficulties in achieving success.

3.Building factor: The characteristics of the building themselves have an impact on its feasibility for transformation. Due to their advantageous locations and period-appropriate characteristics, older buildings, particularly those constructed before 2000, are often more suitable for conversion. Height from floor to ceiling and the layout of load-bearing columns and walls may affect the ease of transformation. Additionally, the importance of the building's energy efficiency is growing. Buildings are required by government regulations, such as mandatory energy labels, to meet certain sustainability standards. Modernizing buildings to meet energy label requirements can be expensive, but is essential for achieving environmental goals and reducing energy consumption.

Considering these factors, building owners need to assess the market demand, location suitability, and building characteristics before deciding on a transformation intervention. The combination of a tight market, a suitable location, and a building with favorable characteristics increases the potential for successful building transformation.

3.6 TRANSFORMATION MEASURING TOOL

As demonstrated in the preceding paragraphs, transformation initiatives present difficulties on the market, location, functional, technical, cultural, financial, fiscal, legal, and organizational levels. Numerous theories and instruments have been devised to shed light on the potential and limitations of these influencing factors. In addition to mapping the problem aspects of a project, these instruments provide insight into the transformation project's potential (Geraedts & Van der Voort 2003; Fikse, 2008). Three of the most comprehensive, widely used, and studied instruments are examined. The ABT Quickscan (ABT, 2018), the Herbestemmingswijzer (Hek & Kamstra, 2004), and the Transformation Meter (Geraedts et al., 2017). These scans or tools seek to incorporate all transformation project prerequisites, or characteristics. This paragraph will elaborate on these three theoretical instruments, their applications, and their advantages and disadvantages. It gives a comparison of the three tools with in the end a selection of the most appropriate tool for measuring Amsterdam's transformation potential. It concludes with an explanation of why this theoretical approach is used in this research and fits better than the competing alternatives.

ABT Quick Scan

This instrument, created by ABT Consult, provides a more technical approach to transformation initiatives.

This analysis focuses on the technical viability of a function in a building, rather than its market viability The financial ramifications of implementing a certain function are calculated based on these technical factors. The rapid assessment examines six facets of the existing situation (ABT, 2018). These include: location, entrances, supporting structure, exterior of the building, installations, and interior. Each of these aspects is assessed based on their current state, quality, and applicable laws, i.e. regulations. How long the elements can continue to function is determined by their current state. The quality encompasses the potential for transformation, the architectural/cultural-historical quality, and the emotional quality. These are the flexible values. When analyzing the regulations, the potential new use of functions is compared to the regulations of the building decree. Consideration is given to the possibility that this new function may have been previously added to the building. This scan distinguishes ten user functions, including residential function, meeting function, cell function, health function, industry function, office function, accommodation function, education function, sports function, and retail function. These functions are derived from the function classification established by the Dutch building code. These are rated on a scale ranging from 1 (excellent) to 5 (poor). The future use of the vacant building becomes apparent based on this evaluation.

Table 2: ABT Quickscan function analysis example

Function	1.Excellent	2.Good	3.Reasonable	4.Mediocre	5.Bad
Residential	1				
Meeting			3		
Cell					5
Health		2			
Industry			3		
Office				4	
Accommodation		2			
Education	1				
Shop					5
Sports				4	

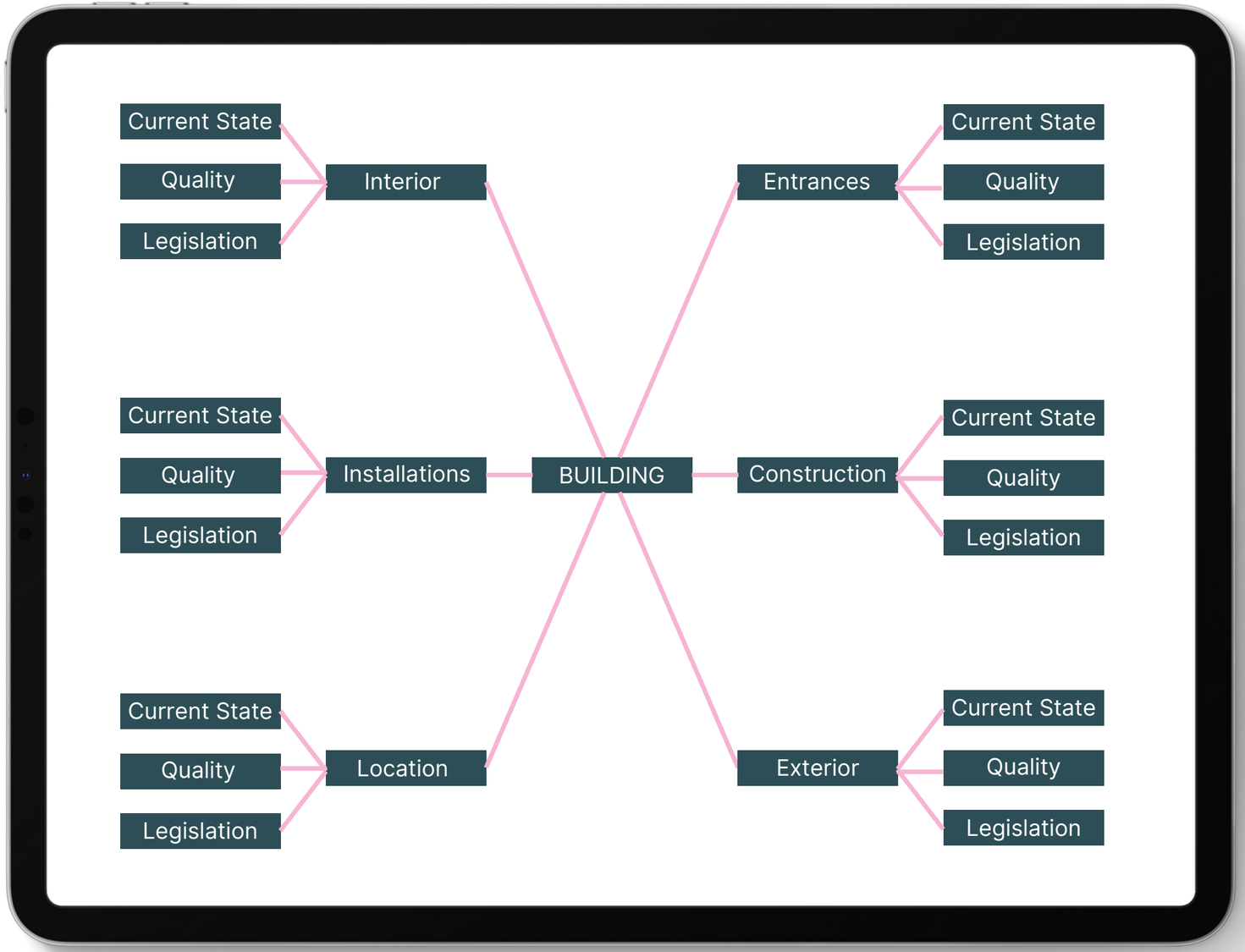
Source: ABT (2018), illustrated by author.

After the function analysis, the costs of reuse can be calculated. According to the function analysis, this only pertains to functions that are good or excellent. The cost estimate is based on the constructional interventions required for the elimination of deferred maintenance and defects, the preservation of architectural qualities, and the interventions required to bring the building into compliance with the applicable regulations. Additionally, the client's objectives are considered. The client's quality requirements in the fields of architecture, environment, sustainability, comfort, and energy efficiency are combined with the required structural interventions.

Based on NEN 2631, an investment estimate is generated. In the building analysis, the nature and extent of the building's materialization serve as a measurable starting point for determining the financial effects of proposed interventions. The cost estimate is constructed on an element-by-element basis and plainly identifies the most essential cost units.

The ABT quick scan is intended for anybody engaged in redevelopment. This pertains to both the design and management sides, as well as the development side.

Figure 19: ABT Quickscan current situation scan



Source: ABT (2018), illustrated by author.

It focuses primarily on the redevelopment from the supply perspective. In doing so, it focuses mainly on the transformation's technical aspects. The scan is applicable during the initiation phase and has a policy level that is tactical and almost operational. In addition to the technical aspects, the examination also includes the financial aspect. This is not, however, incorporated into the model itself. The functional side consists of only 10 function categories. At the time of assessing the suitability of the various function groups, a five-point scale is utilized, implying a gradual evaluation from poor to excellent. The results of reallocating resources to a specific function will be easier to implement if they are based on a function analysis that is more financially oriented. To finish the scan, professional assistance is required. When the user does not have a background in architectural engineering and has no experience with construction costs, the correct fulfillment of this model will be extremely difficult. Because the information is extracted from the building's condition in accordance with the building code's standards. The cost of this scan may be higher than that of other scans due to the fact that expert consultation is essentially required. However, with this expert's assistance, a thorough technical analysis with an excellent overview of anticipated construction costs will be produced.

Herbestemmingswijzer

The 'Herbestemmingswijzer' (*redevelopment guide*) is an instrument with a scientific basis developed by Hek and Kamstra in 2004. With the assistance of the Herbestemmingswijzer and a comprehensive understanding of the building and its location, a new and viable use can be identified at the earliest possible stage. When it comes to transformation initiatives, such as student housing, it is more common than not to consider monofunctional solutions. The Redevelopment Guide examines the possibility of combining functions as well. The possibility of a solution with a single function cannot be ruled out, but the range of possibilities that can be explored with this instrument is broader. The new layout of the building is refined from broad to specific by methodically progressing through the various phases. The Herbestemminsgwijzer has four phases (figure 20).

Phase 1: Function selection. In the initial phase, the most appropriate functions are determined systematically from an overview of all potential destinations (a list containing nearly 900 functions). The evaluation is conducted in stages based on location, social, technical, financial, and procedural feasibility. By selecting from broad to specific, functions that are incompatible with the building are protected from exhaustive testing for feasibility. Broad refers to the selection of function groups at the location level (such as retail and commercial structures), whereas detailed refers to the specific layout of a building (such as a supermarket or clothing store).

Phase 2: Function combination. The second phase entails integrating, tuning, and positioning building functions. Within the framework of the existing structure, the optimal combinations of phase 1's most suitable functions will be pursued. The functions will be evaluated based on their combined use.

Phase 3: Spot plan. In the third phase, classification variants are derived from the function combinations and square-meter distribution. The building's mutual relations and positioning are determined.

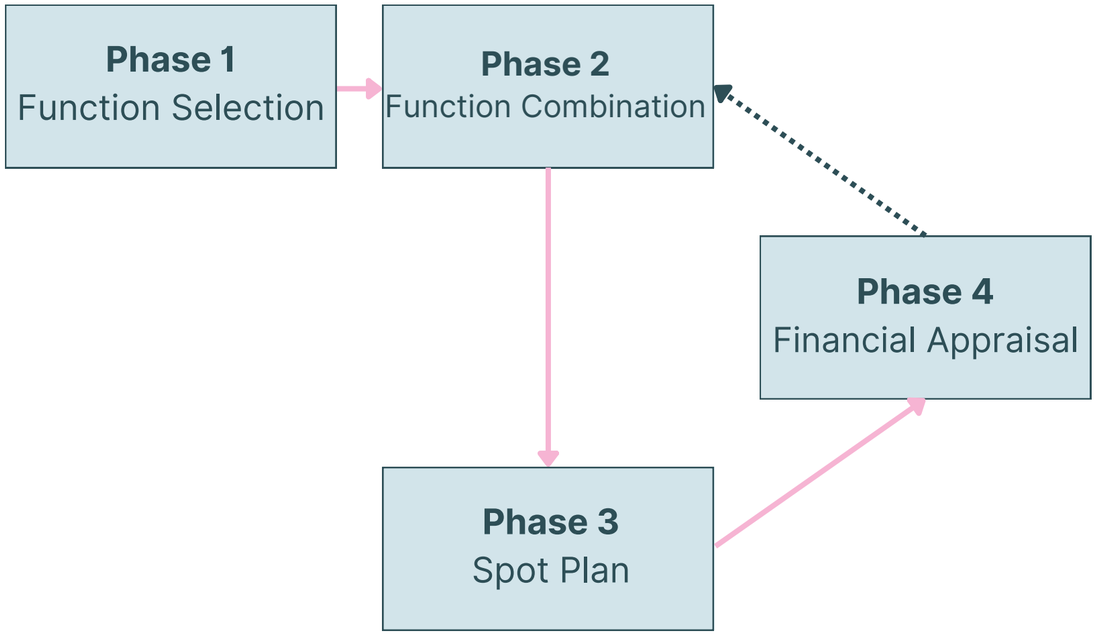
Phase 4: Financial Appraisal: Utilizing an integral cost approach, the feasibility of reuse is determined in the fourth phase. A financial exploitation is conducted for the remainder of the building's useful existence. In addition to determining the investment level, the rent level and/or sales value of the various (combinations of) functions are also determined.

After completing each phase, the result is a function or combination of functions that can be accommodated at the specific location and within the existing structure. Individual building functions will not be directly impacted by the future conclusion of the structure. A building concept for the entire structure reflects the interdependencies. Based on this concept, the placement of building functions is determined. Both the functional classification and the maximization of financial results determine the magnitude of the functions. For the purpose of determining the project's effectiveness, the complete building concept is calculated financially. Finally, the results of the Redevelopment Guide and the actions taken are described and displayed openly.

The Redevelopment Guide was designed for architects, investors, governments, developers, municipalities, tenants, and other consulting firms. Before reading the entire guide, architectural knowledge at both the design and financial levels is required. The guide investigates both the demand and supply of the transforming structure. Both the location as well as the future function. The guide begins with the initiation phase of the building process and proceeds through the sketch design phase. It has a tactical level of policy. In addition, the approach is primarily functional and financial. In the beginning of the guide, the level of expertise is not particularly high, but architectural knowledge is required to use this instrument.

The value judgment scores do not come with the model by default. However, they are necessary for the proper completion of the model. As a consequence, the general application by users is severely constrained, as calculating these scores manually is a difficult process. PRC (the company that created the guide) will therefore continue to be the most qualified to complete the assessment. Consequently, professional assistance is required for the remaining stages. In the initial stages, an incremental measurement is taken based on the function's suitability. Financially, later is accounted for with rigid values. The results of this guide's completion can be used to create a preliminary design.

Figure 20: Herbestemmingswijzer phase overview



Source: Hek & Kamstra (2004), illustrated by author

Transformation Meter

Geraedts and Van der Voordt designed the 'Conversion Meter' in 2003, so that office buildings could be evaluated based on their potential for conversion into residences. The Conversion Meter has been revised in 2017, it predominantly consists of a yes/no checklist combined with an initial cost-benefit analysis. This is a concise checklist with veto criteria and gradual criteria for determining whether the location and building characteristics are favorable or adverse for a successful transformation.

The meter consists of a fast and global quick scan and an in-depth and comprehensive feasibility scan. The meter is based on scientific research and has been utilized by numerous market participants. This tool evaluates the feasibility of transforming an empty office building in five steps.

Step 0: Inventory of supply at area level. Before beginning to use the Transformation Potential Meter, it is necessary to conduct an inventory of vacant offices in a given area.

Step 1: Quick scan, a preliminary investigation and assessment with veto criteria. The instrument enables the user to conduct an initial, fast, and minimally labor- and data-intensive scan based on eight veto criteria, categorized by the three factors that influence the transformation potential of a building: market, location and building characteristics. When one of the pertinent veto criteria is not met, the relevant office building's transformation to residential use is immediately canceled. No further detailed investigation is then required. When evaluating the prospective market in an urban area, a quick selection of interesting buildings can be made in this manner.

Table 3: Overview Transformation Meter 2017

Step	Action	Level	Outcome
Step 0	Inventory market of unoccupied offices	Stock	Location of unoccupied offices
Step 1	Quickscan: Initial appraisal of vacant offices using veto criteria	Location Building	Selection or rejection offices for further study; GO/NO GO decision
Step 2	Feasability scan: Further appraisal using gradual criteria	Location Building	Judgement about transformation potential of office building
Step 3	Determination of transformation class	Location Building	Indicates transformation potential on 5-point scale from excellent to not
Further analysis (optional, and may be performed in reverse order if so desired)			
Step 4	Financial feasibility scan using design	Building	Indicates financial/economic feasibility sketch and cost-benefit analysis; GO/NO GO decision
Step 5	Risk assessment checklist	Location Building	Highlight areas of concern in transformation plan; GO/NO GO decision

Source: Geraedts et al., (2017) illustrated by author.

Step 2: Feasibility scan wit gradual criteria. If the results of the veto-scan from step 1 indicate a possibility of transformation, then a more comprehensive scan using so-called gradual criteria can provide a more accurate picture of the actual transformation possibilities. By gradual criteria, it is meant that the assessment of a single criterion does not result in the approval or rejection of a building, but that the total criteria provide a nuanced picture of a building's transformation potential. In this step, the location and building factors will be examined in greater detail.

Step 3: Determination of transformation class. After assessing both the location and the building for gradual transformation, a score can be assigned to determine the transformation class of the building in question. The total score is determined by the total number of 'yes' assessments of the gradual location and building factors criteria. In the Transformation Potential Meter, building and location are evaluated concurrently, but location has a greater influence on the final score.

Step 4: Financial feasibility scan. Step 4 and 5 are optional additional analysis steps. If the transformation project is not financially feasible, it makes no sense to continue developing the plan. This financial feasibility depends, among other things, on the purchase price, the condition of the building, the extent to which it must be converted or modified, the size and capacity of the building for new homes, and the revenues after the renovation in the form of rental income and/or selling prices.

These queries about costs and benefits must be answered in order to determine the project's financial viability. The Transformation Potential Meter employs key metrics to assess the viability of transformation initiatives that have reached step 4.

Step 5: Checklist risks planning. If it is determined that the office building in question has the locational and technical potential to be transformed into residential units, and a preliminary financial feasibility analysis is also positive, a risk analysis can be conducted. In the Meter, a risk check-list has been compiled with a summary of potential risks or issues and corresponding solutions. This summary is intended to serve as the foundation for a project-specific risk analysis.

It appears, based on applications of the Transformation Potential Meter, that the meter's underlying principle is sufficient to map, from a general to a specific level, the potential for housing transformation of certain office buildings. Nevertheless, a number of the original criteria in 2003 proved to be too stringent. Some buildings that did not satisfy the veto criteria on paper were successfully converted into residences in practice. Criteria such as a minimum size 2000 square meters for 20 dwellings and a partial vacancy, or a property age of less than three years appear to be disqualifying. In addition, it turned out to be highly desirable to determine early on whether a municipality is willing to cooperate with the approval of a zoning plan. In light of this, a number of such criteria have been introduced to the most recent version of the instrument in 2017.

Comparing instruments
In this paragraph, the tools are compared in order to select the most appropriate tool for the forthcoming task of determining the potential for transformation of vacant office buildings in Amsterdam.

As previously stated, the ABT Quick Scan focuses primarily on the technical capabilities of the building within the parameters of the building code and the cost of the required interventions to transform the structure. The Herbestemmingswijzer is a complex instrument. Experts from PRC are required to complete the form. The ability to incorporate multiple purposes into the building is a strength. Whereas the other two tools can only perform one function, in this instance housing, the Herbestemmingswijzer can perform multiple functions. This implementation of the numerous functions is the tool's primary focus. However, the future function has already been determined for this study. Consequently, the significance of this multifunctional implementation is diminished. Similar to the ABT Quick Scan, the guide also lacks location-specific aspects. Due to the complexity of this instrument, grading a structure requires a substantial amount of time. The Transformation Meter is a versatile instrument that can be used by both professionals and amateurs up to step 3. The ability to add or modify veto and incremental criteria to better suit a particular situation or portfolio is what makes the tool flexible. In addition to technical building-related aspects, this instrument also considers market and locational variables.

In addition, the time required to grade a building with this last instrument is significantly less than with the other two. By setting a timer for one hour, the utility of each instrument was evaluated. Neither the ABT Quick Scan nor the Herbestemmingswijzer were able to grade a complete building within this hour. Using the Transformation Potential Meter, two buildings were thoroughly graded in the same amount of time. Additionally, the data required for this latter instrument can be obtained from publicly accessible sources, which enhances its usability.

After comparing the tools, it is evident that the Transformation Meter tool is the most appropriate out of the three and will therefore be chosen to test the office vacancy in Amsterdam for its potential transformation into housing.

3.7 MIXED-USE

When advantage of opportunities such as the transformation of vacant office buildings are being taken, it will be possible to create mixed-use developments in monofunctional office districts. This paragraph defines mixed-use and describes the advantages of mixed-use developments.

Historical development
Since World War II, the principles of functionalism espoused by the international movement CIAM (Congre's Internationaux d'Architecture Moderne) have exerted a significant influence on urban planning in numerous European and North American cities. (Hoppenbrouwer & Louw, 2005). The international movement CIAM advocated for the implementation of the 'Functional City,' characterized by the clear separation of the city's main functions, namely housing, employment, recreation, and transportation (Stead & Hoppenbrouwer, 2004; Breheny, 1992). This approach aimed to enhance efficiency and safety by segregating incompatible activities within urban landscapes (Stead & Hoppenbrouwer, 2004). The prevalence of poor urban conditions and environmental pollution further contributed to the adoption of land use segregation as a planning strategy (Hoppenbrouwer & Louw, 2005). However, there has been a notable paradigm shift in urban planning over the past few decades, with a growing emphasis on mixed land use (Stead & Hoppenbrouwer, 2004). Mixed-use development has gained recognition as a significant planning approach in various European and North American cities.

In Europe, mixed-use is often considered a vital aspect of urban renaissance and a component of the compact city concept (Stead & Hoppenbrouwer, 2004; Breheny, 1992). In the United States, it is closely associated with the New Urbanism strategy (Furuseth, 1997; Bernick & Cervero, 1997; Gyourko & Rybczynski, 2000). Mixed-use development is now recognized as a significant tool for creating and maintaining attractive, livable, and sustainable urban environments.

Despite the extensive literature on the practical aspects of mixed-use development, there has been a noticeable dearth of theoretical discourse on the subject. In 1961, Jane Jacobs addressed this gap in her influential work, *The Death and Life of Great American Cities*. Jacobs posited that the creation of vibrant and prosperous neighborhoods necessitates a nuanced blend of diverse land uses. According to her theory, a well-balanced combination of working, service, and residential activities fosters a lively, stimulating, and secure public realm. Jacobs introduced the concept of primary and secondary uses to elucidate the dynamics of mixed-use environments. In Jacobs' framework, primary uses encompass residential and primary employment or service functions—land uses that attract a significant number of people to a particular area. These primary uses generate a demand for secondary uses, including retail stores, restaurants, and small-scale establishments.

The resulting movements between these primary and secondary uses occur at different times, creating a rhythmic pattern akin to the ebb and flow of tides. Jacobs argues that this temporal distribution of activity generates a more balanced and diverse demand throughout the day, as opposed to a public realm dominated by a single land use that is only active during specific periods. Jacobs' theoretical perspective offers valuable insights into the complexities and benefits of mixed-use environments. Her emphasis on the interplay between primary and secondary uses highlights the importance of a diverse array of activities and their temporal patterns in creating vibrant and socially engaging neighborhoods. Moreover, her theory challenges the conventional planning approaches that favor mono-functional land uses by illustrating the potential of mixed-use development to foster liveliness, diversity, and vitality in urban settings.

Definition Mixed-Use

Since the publication of Jane Jacobs' influential work, *The Death and Life of Great American Cities*, the concept of mixed-use development has garnered significant attention in urban planning literature. However, it is notable that the term ‘mixed-use’ lacks a precise and universally accepted definition. The Urban Land Institute (1987) provides a definition that characterizes a mixed-use project as a cohesive design incorporating two or more revenue-generating functions that are functionally and physically integrated. By contrasting the principles of CIAM-town planning, which advocate for the strict separation of housing, employment, recreation, and transportation, mixed-use development can be understood as the combination of two or more of these functions, thus constituting a form of mixed land use.

In addition to the combination of functions, the geographical scale of mixed-use development must also be considered. Jacobs refers to mixed-use at the neighborhood scale, whereas Coupland (1997) and Grant refer to the building-complex scale. Consequently, urban functions can be mixed at multiple spatial levels. Functions ca also be mixed in time. When a space is used for two or more distinct functions, it is a sequential use of space. For instance, a school can serve as a community center in the evening, and a theatre can be used for conferences during the day and as a cinema in the evening (Hoppebrouwer & Louw, 2005). Therefore, the dimension of time refers to the fulfillment of multiple functions within a given time period, such as an hour, 24 hours, week, month, season, etc. Clearly, the lengthier the time horizon, the greater the variety of functions. In this research, an area with two or more functions such as housing and employment, will be considered as mixed-use areas.

When examining the functions of housing and employment, it is evident that these functions can be mixed in a variety of ways at different spatial scales and at different times. For example, a house where someone lives and works can be characterized as a mix of housing and employment at the lowest spatial level (De Wilde, 2002). On a building complex scale, these activities can also be mixed, with, for instance, offices on the ground floor and residences on the upper floors. On the scope of an inner city, housing and employment are also mixed, complemented by a vast array of other functions. Even at the scale of a city, distinct mixed-use environments can be distinguished, each with its own unique combination of uses.

Benefits mixed-use development

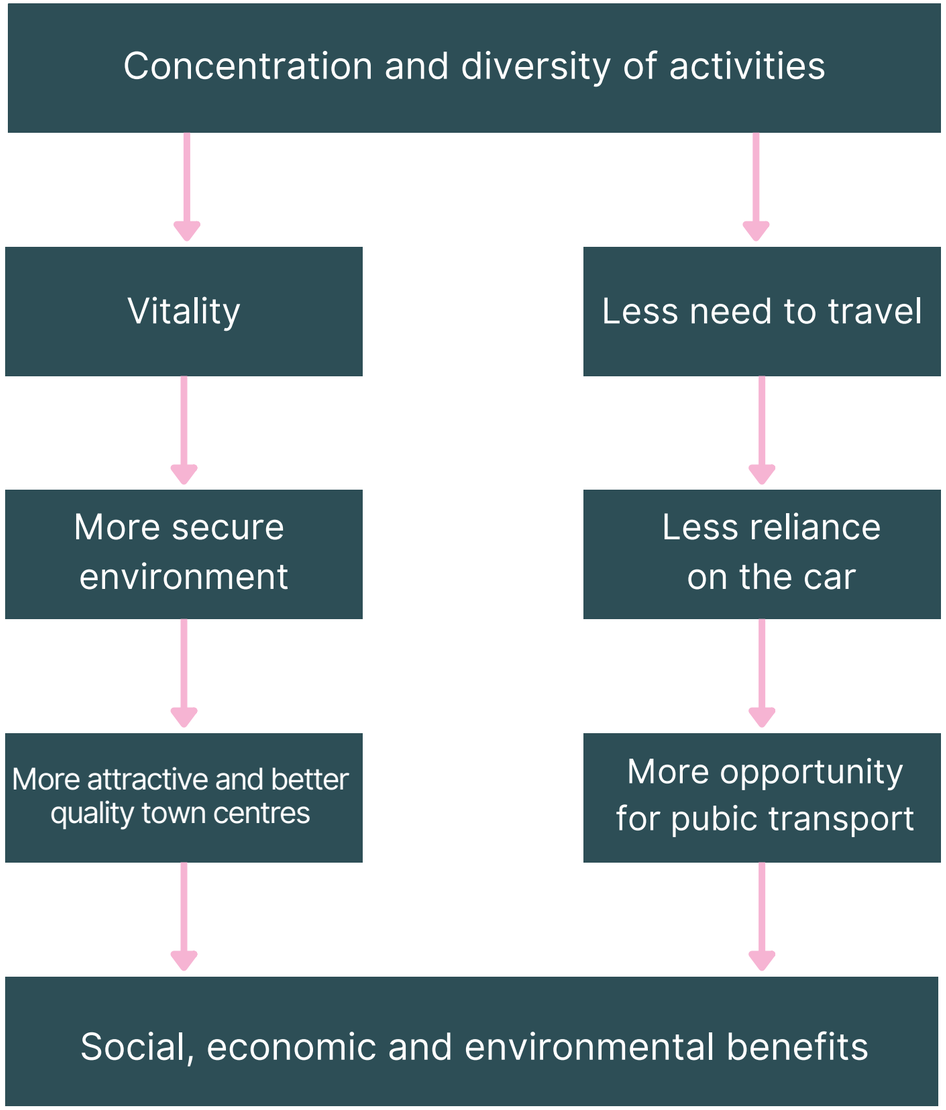
In planning practice, many documents adopt the view that mixed-use has a number of benefits. The first general reason for encouraging mixed-use development is to reduce the need for travel by serving a variety of needs in close proximity. A concentration of activities allows for the integration of activities while simultaneously allowing for the combination of potential traffic movements between these concentrations through the use of efficient traffic systems (Priemus et al., 2000). Nonetheless, the concentration of various urban functions does not only effect mobility patterns, but also the urban territory itself. The second reason for promoting mixed-use development is its contribution to the diversity and vitality of urban areas. Mixed-use development provides opportunities to enhance the quality and desirability of urban areas, for example by increasing usage, activity, and vitality during the day, evening, and weekends. There may also be benefits regarding crime prevention and security enhancement.

However, mixed land use is not a panacea. Grant (2002) asserts that mixed-use promises economic vitality, social equity, and environmental quality, but it can not easily deliver these benefits in a context where cultural and economic forces encourage the separation of land uses. One such economic force is the real estate sector (Hoppenbrouwer & Louw, 2005).

According to Coupland (1997), developers are hesitant to proceed with mixed-use development because they favor safe, dependable investments that generate solid returns over a long period of time over risky investments in mixed-use development. In addition, certain activities still require separation from other uses, particularly residential. For instance, heavy industry is generally incompatible with residential areas (Angotti & Hanhardt, 2001), despite the fact that modern industries are becoming cleaner and calmer than older industrial facilities. Consequently, diverse land use and diversity do not necessarily result in vitality. For instance, Lynch (2000, p. 192) asserts that excessive diversity results in an overabundance of offerings, resulting in urban stress.

Nevertheless, despite these constraints, mixed land use is widely regarded as an important instrument in urban planning for creating attractive, vital cities, and its benefits are taken for granted. Rowley (1996, p. 95) urges us to "treasure mixed-use diversity and seize all opportunities to create mixed-use development exemplars, to test and educate." Coupland (1997) concludes that mixed-use development is not a panacea, but that its contribution to the ongoing improvement of cities and municipalities should not be undervalued.

Figure 21: Benefits of mixed-use development



Source: Coupland (1997), illustrated by author.

Mixed-use in Amsterdam

For the past two decades, Dutch planning policies have been guided by the compact city concept and a restrictive building policy, driven by the goals of curbing uncontrolled urban sprawl and fostering urban revitalization (Dieleman et al., 1999). In the 1980s, the municipality of Amsterdam embraced the compact city concept, culminating in the publication of the proposed structure plan "De stad centraal" (Focus on the City) in 1984, which officially introduced compactness and mixed-use as policy objectives (Gemeente Amsterdam, 1984). The central aim was to counteract population decline by enhancing the quality and quantity of housing stock and increasing employment opportunities. Within this context, mixed-use development in Amsterdam targeted the service sector and small businesses, with a notable shift in focus occurring in the 1990s. The scale of mixed-use development evolved from the district level to the block level and eventually to the building level (Hoppenbrouwer & Louw, 2005). This transition in scale has fostered a greater integration of working and residential functions, leading to an intensified interweaving of these land uses within the urban fabric.

SUMMARY

Mixed-use development refers to the integration of multiple land uses within a single neighborhood or development. It departs from the conventional separation of functions such as housing, work and recreation. To answers sub-question 6: *'What are the benefits of mixed-use development?'* It can be concluded that multiple benefits are associated with mixed-use development:

- Reduced travel demand: By supplying a variety of functions in close proximity, mixed-use development decreases the demand for travel. Residents can access employment, services, and amenities on foot or via short commutes, resulting in fewer vehicle journeys and less traffic congestion. This can contribute to a more efficient and environmentally friendly transportation system.
- Increase diversity and vitality: Increased diversity and vitality Mixed-use development enhances urban areas' diversity and vitality. Mixed-use neighborhoods become more vibrant and active by integrating residential, commercial, and recreational uses during the day and evening. This increased activity can contribute to the creation of a sense of place, the attraction of tourists, and the support of local businesses. Additionally, it promotes social interactions and community involvement.
- Improved urban quality and desirability: Urban quality and desirability can be enhanced through mixed-use development. Promoting a variety of purposes and activities generates a more attractive and dynamic urban environment. This can result in increased property values, increased investment, and a heightened sense of place. Mixed-use neighborhoods typically have a higher perceived quality of life due to the availability of amenities and social interaction opportunities.
- Crime prevention and security enhancement: In mixed-use neighborhoods, the presence of diverse individuals and activities throughout the day and evening can contribute to crime prevention and security. Active streetscapes and public spaces with an increase in pedestrian traffic can provide natural surveillance and deter criminal behavior. This can increase the community's overall safety and security.

4

METHODOLOGY

The methodology chapter outlines the choices that were made in conducting the research, including the literature review and empirical study. Although the decisions appear to be adequately justified, a critical evaluation is required to assess the robustness of the employed methods.

4.1 LITERATURE REVIEW

The first section of the research is a review of the relevant literature. The purpose of this literature review is to establish a theoretical framework. This framework serves as the basis for the measurement tool for transformation potential. In a literature review, as much pertinent information about the topic as possible is compiled from existing literature, articles, and other relevant publications.Background information and in-depth analyses of office vacancy and the constrained housing market are provided, zoomed in from the Dutch national market to the Amsterdam local market. The transformation intervention technique is then investigated. From this data, influential transformation project factors were extracted and classified by market, location, and structure. The findings of this literature review serve as the basis for the empirical study.

4.2 EMPIRICAL STUDY

The empirical research will be conducted via a building-level case study based on the findings of the literature review. To answer sub question 7, the Conversion Meter 2017 from the theoretical framework is used to assess the transformation potential of Amsterdam's vacant office space.

This theory and method allow the user to consider all necessary factors when initiating a transformation project by guiding him or her through the tool's steps. Its strength is derived from the tool's simplicity, which consists of a step-by-step progression from broad to specific and minimal input requirements.

The choice to conduct a building-level case study is advantageous for analyzing the transformation potential of office buildings in Amsterdam because a building-level case study allows for an in-depth exploration of specific office buildings in Amsterdam, thereby providing a rich contextual understanding of the unique characteristics, challenges, and opportunities associated with each building. By analyzing individual cases, it is possible to gain a detailed understanding of the potential for transformation in various contexts and assess the viability of specific transformation interventions (Harrison et al., 2017). In addition, building-level case studies enable a genuine evaluation of the physical characteristics, infrastructure, and condition of vacant office buildings in Amsterdam. This thorough examination allows for the assessment of each building's suitability for transformation, considering factors such as building design, available space, and adaptability to various uses. This evaluation assists in identifying the potential constraints and opportunities associated with particular buildings, thereby informing decision-making processes and future transformation strategies. Lastly, the case study approach permits a comprehensive evaluation of transformation potential by simultaneously considering multiple factors.

The Transformation Meter can examine not only the building's physical characteristics, but also the adjacent urban environment, market demand, regulatory constraints, and community aspirations. This exhaustive analysis allows for a more accurate evaluation of the overall transformation potential by taking into consideration the intricate interplay of numerous factors.

4.3 METHODOLOGICAL APPROACH

While the selected methods have been discussed, it is also essential to evaluate critically alternative methods that could have been used in the study. It is essential to critically evaluate the benefits and limitations of each method in relation to the research objectives, available resources, and constraints so that the selection of used methods is supported and motivated (Moses & Knutsen, 2012). Some alternative methods for considerations are:

1. *Qualitative Interviews:* Conducting qualitative interviews with key stakeholders, such as real estate developers, urban planners, and policymakers, could provide valuable insights into the potential for transformation of vacant office spaces in Amsterdam. These interviews would permit a thorough examination of the factors influencing transformation, the obstacles encountered, and potential strategies for maximizing the use of vacant office buildings. This method was not chosen for this study because qualitative interviews may be subjective and the results may not be readily generalizable to a larger population.

In addition, because the empirical part of this study focuses on location, market, and building factors, which can be found much more easily in data sets, conducting interviews would be time-consuming and difficult.

2. *Surveys and Questionnaires:* Implementing surveys and questionnaires could help collect data from a wider range of stakeholders, such as building proprietors, potential investors, and residents. This quantitative strategy would enable the accumulation of data on preferences, perceptions, and attitudes regarding transformation potential, as well as the identification of barriers and incentives for repurposing office spaces. By selecting a diverse sample of respondents, a more complete understanding of the factors influencing transformation potential could be obtained. This method is not employed, however, because the primary objective of this research is not the comprehension of preferences, but rather the quantity of potential space. Also, time, budget, and available sample size constraints may restrict the survey's scope and representativeness.

3. *Comparative Case Studies:* Comparative case studies of cities or regions that have successfully transformed their vacant office buildings could yield valuable insights and lessons learned. This strategy would entail selecting comparable locations facing comparable challenges and analyzing the strategies and interventions they employed to encourage transformation. By analyzing successful transformation initiatives from other locations, researchers could identify best practices, potential pitfalls, and transferable strategies that could be implemented in Amsterdam.

Comparative case studies necessitate the selection of suitable comparison locations, which may have distinct contextual factors and challenges. Therefore, this method is not utilized. It can be difficult to identify perfect matches, which may reduce the generalizability of the findings. Moreover, this research concentrates on the potential on building level, thus, case analysis on a building-by-building basis with the Transformation Meter is conducted rather than a comparative case study of regions.

So, building-level case studies are the best method to conduct this research. Input from the literature review, will serve as the basis to develop a modified variant of the Transformation Meter instrument. To evaluate this modified version and measure Amsterdam's potential for transformation, the tool is applied to all vacant office buildings. Before testing could begin, two steps needed to be taken. The initial step is to modify the original Conversion Meter 2017 so that it is better suited for testing the Amsterdam portfolio. The following step is to select the population that will be evaluated for their transformative potential. This second stage is essentially step 0 of both the original Conversion Meter and the modified version. The population, i.e. the input for testing the tool, consists of physical artifacts, which are in turn vacant office buildings located in Amsterdam's monofunctional office districts. Information on these office buildings is gathered through desk research utilizing various data sources (Funda, BAK), spanning from market information provided by local real estate agents to location and building characteristics obtained from Google Maps. From these sources, each office building's address, size, age, and duration of vacancy are extracted.

The selected population (all vacant office buildings in Amsterdam's monofunctional office districts) proceed to the first step of the modified Transformation Meter. These case studies are run through the instrument. The outcome of this case study analysis is the identification of Amsterdam's actual transformational potential. This will be represented via a GIS-map. The results are then evaluated by a panel of experts.

4.4 MODIFY TRANSFORMATION METER

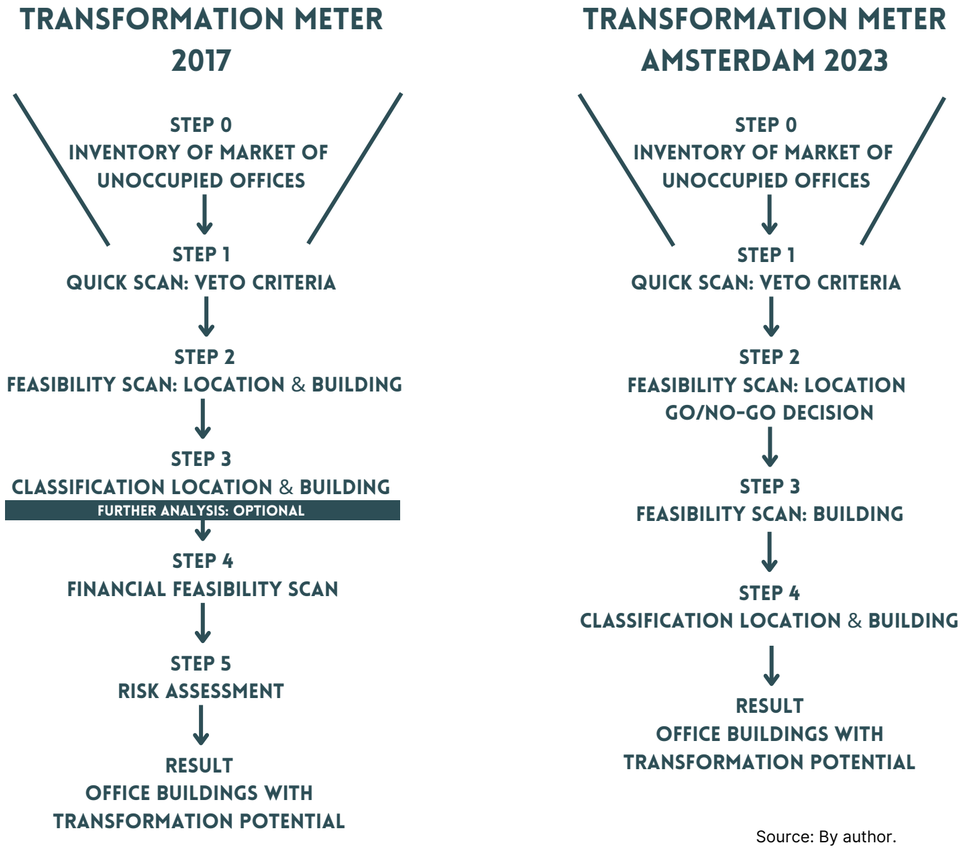
Because the Transformation Meter provides a structured approach, there is little debate regarding the tool's reliability and validity. Nonetheless, it is essential to evaluate the Conversion Meter's efficacy and applicability within the context of Amsterdam. In the absence of this substantiation, potential limitations or biases in the instrument could compromise the precision of the transformation potential assessment. Consequently, the instrument is modified so that it conforms to the specific characteristics and requirements of the target group as well as Amsterdam's regulations. The modified tool will be labeled as the Transformation Meter Amsterdam 2023.

The initial conversion meter consists of five steps. Actually, there are six when counting step 0's inventory of the market's unoccupied office supply. This stage 0 does not change. In the empirical part of this study, when the population, i.e., all vacant office buildings in Amsterdam's monofunctional office districts, is selected, this phase will be elaborated upon. In the revised version, the location feasibility scan and the building feasibility scan have been segregated.

Literature demonstrates that in transformation initiatives the location is more important than the building itself. Consequently, an additional Go/No Go evaluation has been added to the modified instrument. This additional Go/No-Go moment necessitates a minimum score of 15x5 = 75 in step 2 for a vacant office building to proceed to the building assessment using gradual criteria. Furthermore, the optional analyses Financial feasibility and Risk Assessment (steps 4 and 5) are discarded in this study.

This research will focus on qualitative potential like rather than finances (quantitative potential). In addition, the risk list in the original meter was a generic list of potential risks and solutions. Not specific to the building and not optional. Discarding step 4 and 5 has no effect on the vacant office building's potential for transformation. Figure 22 provides an overview of the original instrument and the modified instrument.

Figure 22: Transformation Meter 2017 and modified Transformation Meter Amsterdam 2023



Source: By author.

Table 4 & 5: Step 1 Transformation Meter 2017 & 2023

STEP 1: ORIGINAL QUICK SCAN

Answer Yes (score =1) is positive for transformation into homes.
Answer No (score=0) is negative for transformation into homes. Score

Aspect	Veto Criterion	Assessment	
	Market Factor	**Yes**	**No**
1. Housing Demand	1.There is a demand for housing of local target groups		
2. Vacancy	2. The building is vacant (6 months or longer)		
	Location Factor		
3. Urban Location	3. Not located in designated office area		
	4. Zoning plan permits modification		
	5. No serious public health risk (pollution, noise)		
	Building factor		
4. Support structure	6.Free ceiling height > 2.60 meter		
	Result Quick Scan		

STEP 1: MODIFIED QUICK SCAN

Answer Yes (score =1) is positive for transformation into homes. Answer No (score=0) is negative for transformation into homes. Score of less then 5 results in a NO GO for further transformation potential appraisal

Aspect	Veto Criterion	Data Source	Assessment	
	Market Factor		**Yes**	**No**
1. Housing Demand	1.There is a demand for housing of local target groups	Estate Agent Municipality Market trends		
2. Vacancy	2. The building is vacant (6 months or longer)	Funda Business Estate Agent		
	Location Factor			
3. Urban Location	3. Zoning plan (permits modification)	Zoning Plan Municipal Policy		
	4. No serious public health risk (pollution, noise)	Municipality Map		
	Building Factor			
4. Support structure	5.Free ceiling height > 2.60 meter	Estate Agent		
	Result Quick Scan			

Source: Geraedts et al., (2017), illustrated by author

Step 1: Quick Scan

The first step of the adapted version differs from that of the original (table 5). In the 2017 version of the Conversion Meter, there are four aspects and a total of six veto criteria. In the 2023 version, the four aspects are categorized into the three influential factors that followed from the theoretical framework. Furthermore, the veto criterion 'not located in designated office area' has been removed from the new version. This is because the focus of this study is on 'ripe fruit' since the majority of the oversupply is in office districts. Despite significant differences in typology, property quality, and environment, these offices are categorically disregarded by numerous studies, such as the one conducted by Deloitte in 2015. These studies all roughly filter by location characteristics, immediately eliminating buildings in monofunctional work locations. While it is essential to focus on these regions because opportunities exist there. Binnenlandse Zaken en Koninkrijksrelaties (2022) reports that office vacancy in business parks can be persistent, but this does not imply that there are no adaptable buildings. The unattractive ambiance of office districts can be one of the limiting factors for housing, according to their argument. Transformation of offices on office districts does not always necessitate extensive deconstruction and reconstruction. Sometimes it is sufficient to make the area more attractive and desirable for housing. But most important, the adjacent office area is not always as undesirable as people believe. Consequently, it is crucial to investigate these buildings and the surrounding area, as this is where untapped opportunities exist.

Step 2: Feasibility Scan: Location

Step 2 consists of the gradual location criteria. The 2017 version of the Conversion Meter is comprised of six aspects and 23 gradual criteria. According to the theoretical framework, it is only possible to transform vacant office buildings into residences if there is a need for such residences. The location has to meet the preferences as well as requirements of the local target group (students/newcomers). The majority of the location criteria align with the needs of the target group, but some do not. Three criteria concern car accessibility, but students do not view this as an essential location characteristic. Accessibility via public transportation is deemed significantly more essential. Therefore, 'distance to parking site less than 250 meters' is removed from the list. The criterion of '> 1 parking space per 100 square meters' is maintained because it is essential to have some parking for visitors, students, and newcomers that do have cars. The modified transformation meter also includes a new criterion based on the profiles of the target audience and their needs, due to the fact that students value proximity to their schools and universities. So, this criterion is introduced to the modified meter, and the kindergarten criterion is removed (table 6).

Other than the aforementioned modifications, all other criteria remain unchanged in the modified Conversion Meter Amsterdam. The office building's location is graded based on these 19 criteria. A yes results in a score of 1, while a no yields a score of 0.

Table 6: Step 2 Transformation Meter 2017 & modified Transformation Meter Amsterdam 2023

STEP 2: ORIGINAL SCAN LOCATION

Answer Yes (score =1) is positive for transformation into homes. Answer No (score=0) is negative for transformation into homes. A score of at least 14 out of 21 must be obtained in order to proceed to step 3.

Aspect	Gradual Criterion	Assessment	
	Functional	**Yes**	**No**
1. Urban Location	1.Building in suitable area (not peripheral)		
	2. Good natural light possibilities		
	3. Good view from building > 75% floor space		
2. Distance and Quality of amenities	4. Shop for daily necessities < 500m		
	5. Neighborhood meeting places (square, park) < 500m		
	6. Food service industry (bar, café, restaurant) < 500 m		
	7. Basic medical facilities (health center, doctor, pharmacy) < 2000m		
	8. Sport facilities (fitness, swimming pool, sports park) < 2000m		
	9. Educational facilities (kindergarten to high school) < 2000m		
3. Accessibility by public transport	10. Distance to railway station < 2000m		
	11. Distance to bus-, tram-, metro stop < 1000m		
4. Accessibility by car	12. Good flow, normal street quality		
	13. Distance to parking sites < 250m		
	14. > 1 parking lot per 100 sqm office space		
	Cultural		
5. Representative Impression	15. Situated centrally (not near highway locations)		
	16. Other buildings present in direct neighborhood < 250m		
	17. Lively neighborhood		
	18. Direct availability of green environment		
	19. Area has good reputation (no vadalism/low crime)		
	20. Area has good air quality		
	Legal		
6. Noise	21. Noise load on facade < 50dB (e.g. max for office building is 60 dB)		
	Result Further Appraisal		

STEP 2: MODIFIED SCAN LOCATION

Answer Yes (score =1) is positive for transformation into homes. Answer No (score=0) is negative for transformation into homes. A score of at least 12 out of 18 must be obtained in order to proceed to step 3.

Aspect	Gradual Criterion	Assessment	
	Functional	**Yes**	**No**
1. Urban Location	1.Building in suitable area (not peripheral)		
	2. Good natural light possibilities		
	3. Good view from building > 75% floor space		
2. Distance and Quality of amenities	4. Shop for daily necessities < 500m		
	5. Neighborhood meeting places (square, park) < 500m		
	6. Food service industry (bar, café, restaurant) < 500 m		
	7. Basic medical facilities (health center, doctor, pharmacy) < 2000m		
	8. Sport facilities (fitness, swimming pool, sports park) < 2000m		
	9. High educational facilities (high school or university) < 2000m		
3. Accessibility by public transport	10. Distance to railway station < 2000m		
	11. Distance to bus-, tram-, metro stop < 500m		
4. Accessibility by car	12. Good flow, normal street quality		
	13. > 1 parking lot per 100 sqm office space		
	Cultural		
5. Representative Impression	14. Other buildings present in direct neighborhood < 250m		
	15. Direct availability of green environment. Trees <100m		
	16. Area has good reputation (no vadalism/low crime)		
	17. Area has good air quality		
	Legal		
6. Noise	18. Noise load on facade < 50dB (e.g. max for office building is 60 dB)		
	Result Further Appraisal		

Source: Geraedts et al., (2017), illustrated by author

Because theory shows that the location is more crucial to the success or failure of a transformation project, a minimum score of 13 points must be achieved to advance to step 3. Thus, an additional Go/No-Go decision is added. This additional Go/NoGo decision heightens the significance of location in transformation initiatives. Google Maps is used to assign amenities and measuring distance to the vacant office building. This pertains to criteria 4 through 14. For assessing criteria 1 through 3 and 15 through 19, Google Street View, field visits, and, when available, floor plans were used. The municipal website was consulted for criteria 17. This website contains information regarding the area's reputation. To evaluate the final two criteria, noise and air pollution maps were consulted for criteria 18 and 19. Each of these criteria for gradual location has equal weight. There is no difference in weight between these factors. As mentioned before the adjustment that has been made to amplify the importance of the location is to separate its grading of that of the building. Unlike the original meter, where these two steps were combined into one. The comprehensive list of gradual criteria relative to the original list is presented in the table 6.

Step 3: Feasibility Scan: Building

The buildings that satisfy the requirements of step 2 will move on to step 3, where they will be evaluated further using gradual criteria on their building characteristics. The initial scan consisted of 14 factors and 28 criteria.

Criterion 4 is changed from 75 to 50 square meters because, according to the theoretical framework, nearly half of all transformed dwellings are smaller than 50 square meters and 69% are smaller than 75 square meters. We changed this criterion to a smaller size because our target group is comprised of students and newcomers who seek a small, affordable home. All other criteria remain unchanged.

These 28 criteria will be used to evaluate the transformation potential of vacant office buildings in Amsterdam's business districts. Again, for each criterion, a yes results in a 1 and a no in a 0. The scores from steps 2 and 3 are added together in the subsequent step. Each gradual criterion in step 3 is evaluated using distinct methods and sources. In paragraph 4.5, a bibliography of all sources is provided. For the building's further evaluation, floor plans, Google Street View, on-site inspections, the Kadaster, and real estate agent information were utilized primarily. The results of the feasibility scan of the building are presented in the following chapter. Later on, the criteria from all the steps will be evaluated individually by specialists. How this expert evaluation is conducted is elucidated in section 4.6. After this expert evaluation, the entire portfolio of vacant office buildings is reassessed using the updated lists of criteria. And a comparison is made between the outcomes.

Table 7: Step 3 Transformation Meter Amsterdam 2023

STEP 3: MODIFIED BUILDING SCAN

Answer Yes (score =1) is positive for transformation into homes.
Answer No (score=0) is negative for transformation into homes.

Aspect	Gradual Criterion	Assessment	
	Functional	**Yes**	**No**
1.Year of construction	1.Building > 3 years		
	2. Building renovated > 3 years		
2. Vacancy	3. Complete building is vacant		
3. New housing	4. Capacity building > 10 units of 50 sqm		
	5. Lay-out adaptable for local target groups		
4. Extendibility	6. Horizontal extension building possible (neighboring buildings)		
	7. Vertical extension building possible (no inclined roof/ light support structure)		
	8. Possibilities for constructing basement		
	Cultural		
5. Representative Impression	9. Identifiable compared to surrounding buildings		
	10. Own identify realizable		
6. Cultural image	11. Being not a cultural heritage		
7. Access	12. Clear and safe entrance (elevator/stair)		
	Technical		
8. Maintenance	13. Well, maintained; maintenance up to date		
9. Dimensions of support structure	14. Depth of building < 10,00m		
	15. Grid support structure > 3,60m		
	16. Height dimension between floor < 6,00m		
10. Support structure (walls, columns, floors)	17. Condition support structure is good / not hazardous		
	18. Possible connection inner walls on grid < 5,40 m		
11. Facade	19. Facade well adaptable		
	20. Facade windows can be reused/opened		
12. Installations	21. Sufficient service ducts can be constructed		
	Legal		
13. Environment	22. Absence of large amount hazardous materials in building		
	23. Acoustic insulation of floors > 5dB		
	24. Good thermal insulation of facades / roof		
	25. Sufficient daylight factor > 90% floor surface new units		
14. National building decree	26. Elevators available / easy realizable in building with > 4 floors		
	27. (Emergency) stairways available/realizable		
	28. Distance of units to stair/elevator < 50m		
	Result Further Appraisal		

Source: Geraedts et al., (2017), illustrated by author

Step 4 Determination of transformation class.
In this fourth stage, further evaluation scores are determined using progressive criteria. The combined scores from steps 2 and 3 constitute the final score. This score indicates the office building's potential for transformation. As stated previously in the literature review, the location is superior to the building in terms of the feasibility of a transformation project. Prior to combining the scores from steps 2 and 3, each score is multiplied by a weighting number. The score for location is multiplied by 5. The scoring of the building is multiplied by 3. This incorporates the greater importance mathematically. This will result in a maximum total of 179 points. Five transformation classes are distinguished. Essentially, each class is separated by 36 points. This is shown in table 8.

Example: Location score (16) and building score (18) gives a transformation score of (16 x 5) + (18 x 3) = 134. This means that the building has transformation class 4: high transformation potential.

4.5 POPULATION SELECTION

To conduct the case study assessment, the Transformation Meter, it is necessary to select cases. This section describes the case selection method and the selected cases (office buildings). As previously indicated, the tool will be tested on Amsterdam's office market. This area was chosen because it has the highest office vacancy rate in the Netherlands, it has an overheated and tight housing market, has a cooperative municipality, and the vacant offices are located in monofunctional office districts, a previously unstudied area.

Research Area
Amsterdam has 22 office districts (map 1) which offer a range of office spaces and amenities to suit the needs of different businesses, from large corporations to startups and creative businesses (Gemeente Amsterdam, 2022).

To see which districts are monofunctional, the 'Function Mix' map from the municipality of Amsterdam was used (map 2). The municipality of Amsterdam has developed this map to illustrate the intended use of each area. The Function Map classifies the functions as 'Residential' 'Amenities,' or 'Working.' If more than 70% of an area's use is Residential, the Residential-color is shown on the map. The same holds true for 70% of Amenities and 70% of Working. For a combination of two functions, less than 15% of the third function is present in an area. For example: 'Residential-Amenities' applies if there is no more than 70% of one function and less than 15% of the other function. The remaining portion consists of a combination of the three functions, 'Residential-Amenities-Working': none of these has a percentage greater than 70% nor less than 15%.

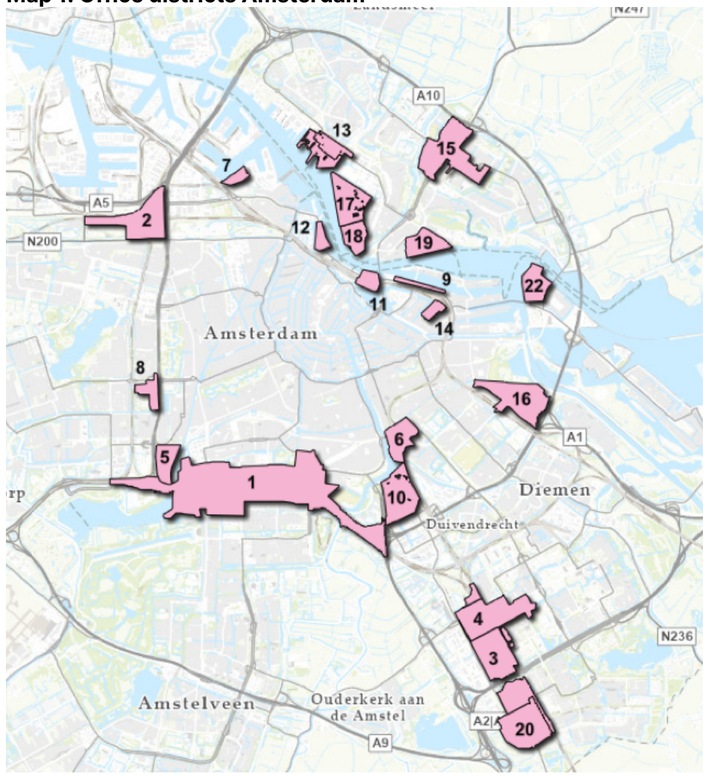
As this study examines how monofunctional work areas can be converted into mixed-use areas, the map was filtered to areas with the function 'Working' only (green). When copying this layer with areas containing more than 70% of works on top of the office districts map, it becomes visible in map 2 that nine office districts are monofunctional; Zuidas, Sloterdijk, Amstel III, Schinkelkwarier, Amstelstation, Minervahaven, Hamerkwartier and Sluisbuurt. These nine office monofunctional districts will therefore be the research area of this study.

Table 8: Transformation Class

Transformation Score	Transformation Class
Score location + building = 0 - 35	Class 1: No transformation potential
Score location + building = 36 - 70	Class 2: Hardly a transformation potential
Score location + building = 71 - 105	Class 3: Limited transformation potential
Score location + building = 106 - 140	Class 4: High transformation potential
Score location + building = 141 - 175	Class 5: Excellent transformation potential
Maximum score: 90 + 84	174
Total score feasibility scan: (location x 5) + (building x 3):	Score Transformation Potential

Source: Geraedts et al., (2017), illustrated by author

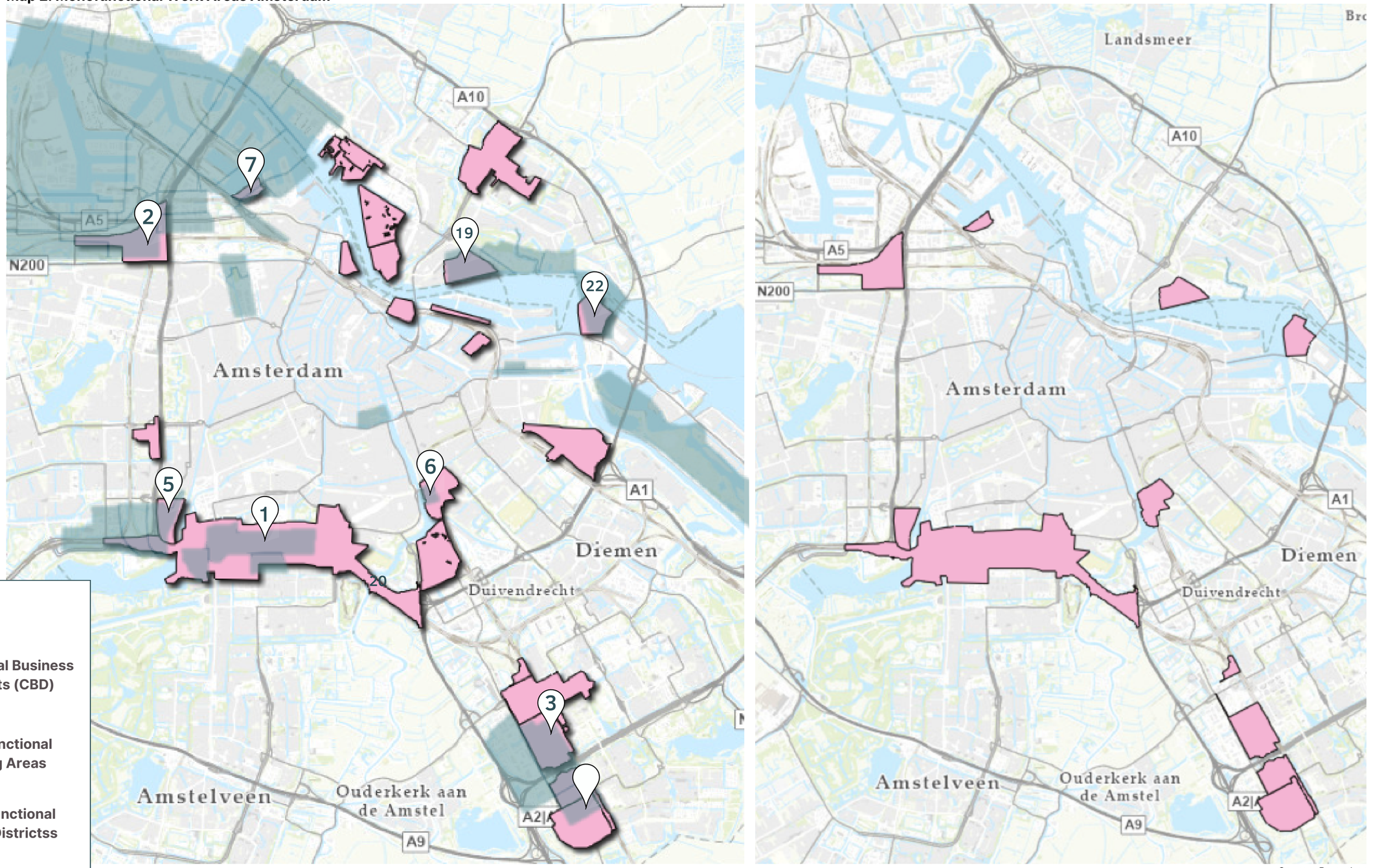
Map 1: Office districts Amsterdam



1. Zuidas
2. Sloterdijk
3. Amstel III
4. ArenAPoort
5. Schinkelkwartier
6. Amstelstation
7. Minervahaven
8. Lelylaan
9. Oostelijke Handelskade
10. Overamstel en Weespertrekvaart
11. Oosterdokseiland
12. Westerdokseiland
13. NDSM
14. Oostenburg
15. Centrum Amsterdam Noord
16. Amsterdam Science Park
17. Buiksloterham en Klaprozenbuurt
18.Overhoeks en Sixhaven
19. Hamerkwartier
20. AMC
21. Marineterrein
22. Sluisbuurt

Source: By author

Map 2: Monofunctional Work Areas Amsterdam



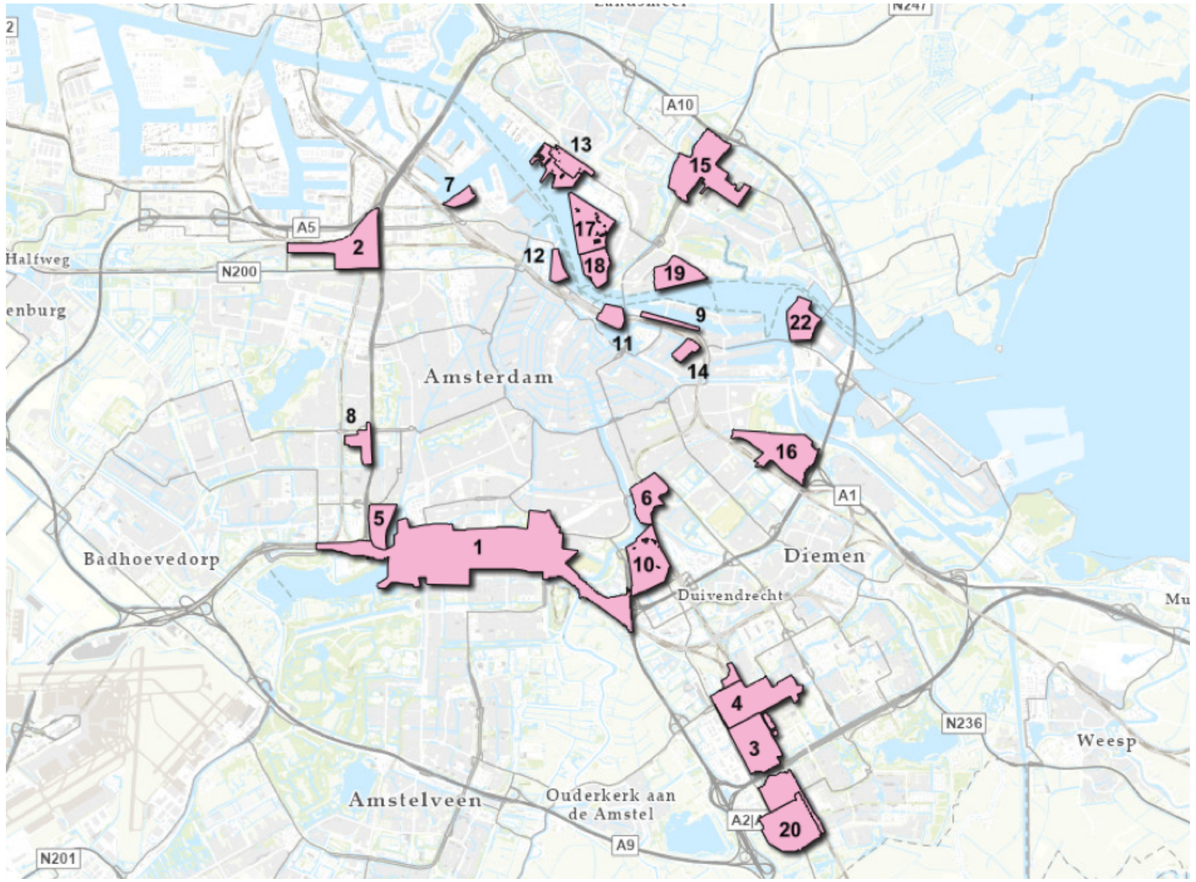
LEGEND

= Central Business Districts (CBD)

= Monofunctional Working Areas

= Monofunctional Office Districtss

Source: By author



1. Zuidas
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6. Amstelstation
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8. Lelylaan
9. Oostelijke Handelskade
10. Overamstel en Weespertrekvaart
11. Oosterdokseiland
12. Westerdokseiland
13. NDSM
14. Oostenburg
15. Centrum Amsterdam Noord
16. Amsterdam Science Park
17. Buiksloterham en Klaprozenbuurt
18. Overhoeks en Sixhaven
19. Hamerkwartier
20. AMC
21. Marineterrein
22. Sluisbuurt

ZUIDAS

Source: Cic, 2022

Located in the south of Amsterdam, Zuidas is one of the most prestigious commercial districts in the city. It is well-known for its high-end office buildings, luxury apartments, and upscale retail and dining opportunities. Public transportation provides convenient access to Schiphol Airport and the city center from the neighborhood. A distinguishing feature of Zuidas is its emphasis on sustainability and verdant spaces. The neighborhood contains a number of parks and gardens, including the popular Beatrixpark, which serves as a tranquil retreat for area employees and residents. With numerous cycle lanes and pedestrian-friendly streets, the neighborhood is also intended to encourage walking and cycling. Numerous multinational corporations, law firms, and financial institutions call Zuidas their home, making it a center of business and commerce.

MONOFUNCTIONAL OFFICE DISTRICTS

SLOTERDIJK

Source: thebeach, 2022

In western Amsterdam, Sloterdijk is a bustling business district. The area is well-known for its modern architecture, with numerous skyscrapers dominating the skyline. Several main highways, Amsterdam Airport Schiphol, and the city center can be reached via public transportation with relative ease.

The Sloterdijk neighborhood is distinguished by its flourishing business community. The area is home to numerous companies, ranging from minor startups to multinational corporations, and innovation and entrepreneurship are emphasized heavily. This has resulted in an environment that is vibrant and dynamic, with opportunities for networking and collaboration.

AMSTEL III

Source: Omniplan, 2019

lAmstel III is a developing business district in the southeast of Amsterdam, the Netherlands. The area was formerly an industrial zone, but it is currently being transformed into a contemporary and environmentally-friendly business district. There is a focus on mobility, with cycle lanes and charging stations for electric vehicles incorporated into the infrastructure. Additionally, Amstel III is distinguished by its vibrant and diverse community.

The district is home to numerous startups, small enterprises, and established businesses. With many co-working spaces and incubators in the area, there is a strong emphasis on collaboration and entrepreneurship. The cultural diversity of Amstel III is also noteworthy. There is a strong emphasis on facilitating cultural exchange and integration in a district with a large immigrant population. This is reflected in the numerous cultural events and activities, like the Amsterdam Street Art (ASA) festival, held in the region.

SCHINKELKWARTIER

Source: Gemeente Amsterdam, 2020

Schinkelkwartier is unique by its focus on innovation and creativity. Several design studios, creative agencies, and other businesses that stretch the boundaries of innovation and creativity are located in this district. There is a robust entrepreneurial culture in the region, with numerous opportunities for collaboration and networking.

Schinkelkwartier is an innovative and dynamic business district with an emphasis on sustainability, creativity, and community. With a supportive and vibrant environment, a commitment to sustainability, and a mix of residential and commercial properties, it offers an ideal location for businesses seeking to establish themselves in Amsterdam.

AMSTELSTATION

Source: ArchDaily, 2021

Amstelstation is a business district in the east of Amsterdam, Netherlands, concentrated on the Amstel train and metro station. The area has undergone significant redevelopment in recent years, and it is now a modern and bustling commercial centre. Excellent connectivity is one of Amstelstation's distinguishing features. With quick access to the A10 highway, Amsterdam Schiphol Airport, and other key transportation hubs, the area is well-connected to the rest of Amsterdam and beyond. This makes it an ideal location for enterprises with international ties or frequent travel requirements.

Amstelstation is also distinguished by its innovative and diverse business community. The neighborhood is home to a variety of businesses, ranging from small startups to multinational corporations, like Philips and KPMG, with an emphasis on technology, creative industries, and sustainability. With numerous co-working spaces and startup incubators available to assist new businesses, the area has a strong entrepreneurial spirit.

MONOFUNCTIONAL OFFICE DISTRICTS

MINERVAHAVEN

Source: De Zwarte Hond, 2020

Minervahaven is a business district in western Amsterdam, Netherlands, close to the port. This region is known for its industrial pastb and proximity to water.

The industrial history of Minervahaven is one of its unique characteristics. The area once supported a flourishing shipyard and other industrial activities, and many of the original buildings and structures remain. These structures have been repurposed for commercial and residential use, creating a unique fusion of the old and the new. Additionally, Minervahaven is distinguished by its proximity to the water. Several marinas and boatyards are located within the district, which is situated along the IJ river. This creates a distinctive and lively environment, with opportunities for water-based activities and a strong connection to the city's maritime heritage. Minervahaven is an ideal location for businesses seeking a unique and dynamic environment, with a blend of old and modern, green spaces, and water-based activities.

HAMERKWARTIER

Source: Gemeente Amsterdam, 2020

Hamerkwartier is located in the northern part of Amsterdam, Netherlands, near the banks of the IJ river. One of the unique characteristics of Hamerkwartier is its innovative urban design.

The district is designed to be highly walkable, with a network of pedestrian and bike paths connecting the various businesses. There is also a strong focus on green space, with parks and public spaces integrated into the urban fabric of the area. It offers an ideal location for businesses looking to establish themselves in Amsterdam, with a supportive and vibrant environment.

AMC

Source: Aerostockphoto.com, 2018

The Amsterdam Medical Centre (AMC) is an Amsterdam, Netherlands business district located in the city's southeast. It is a prominent academic hospital and medical research center that attracts patients, students, and scientists from around the globe.

One of the distinguishing features of the AMC is its world-class medical facilities and professionals. The center provides a comprehensive array of medical services, including specialized care for uncommon and complex conditions. The AMC also houses a number of research institutes with a strong emphasis on translational research, which applies scientific discoveries to clinical settings. This creates an environment that is unique and dynamic, with opportunities for collaboration and sharing of knowledge.

SLUISBUURT

Source: Gemeente Amsterdam, 2020

Hamerkwartier is located in the northern part of Amsterdam, Netherlands, near the banks of the IJ river.

One of the unique characteristics of Hamerkwartier is its innovative urban design. The district is designed to be highly walkable, with a network of pedestrian and bike paths connecting the various businesses. There is also a strong focus on green space, with parks and public spaces integrated into the urban fabric of the area. It offers an ideal location for businesses looking to establish themselves in Amsterdam, with a supportive and vibrant environment.

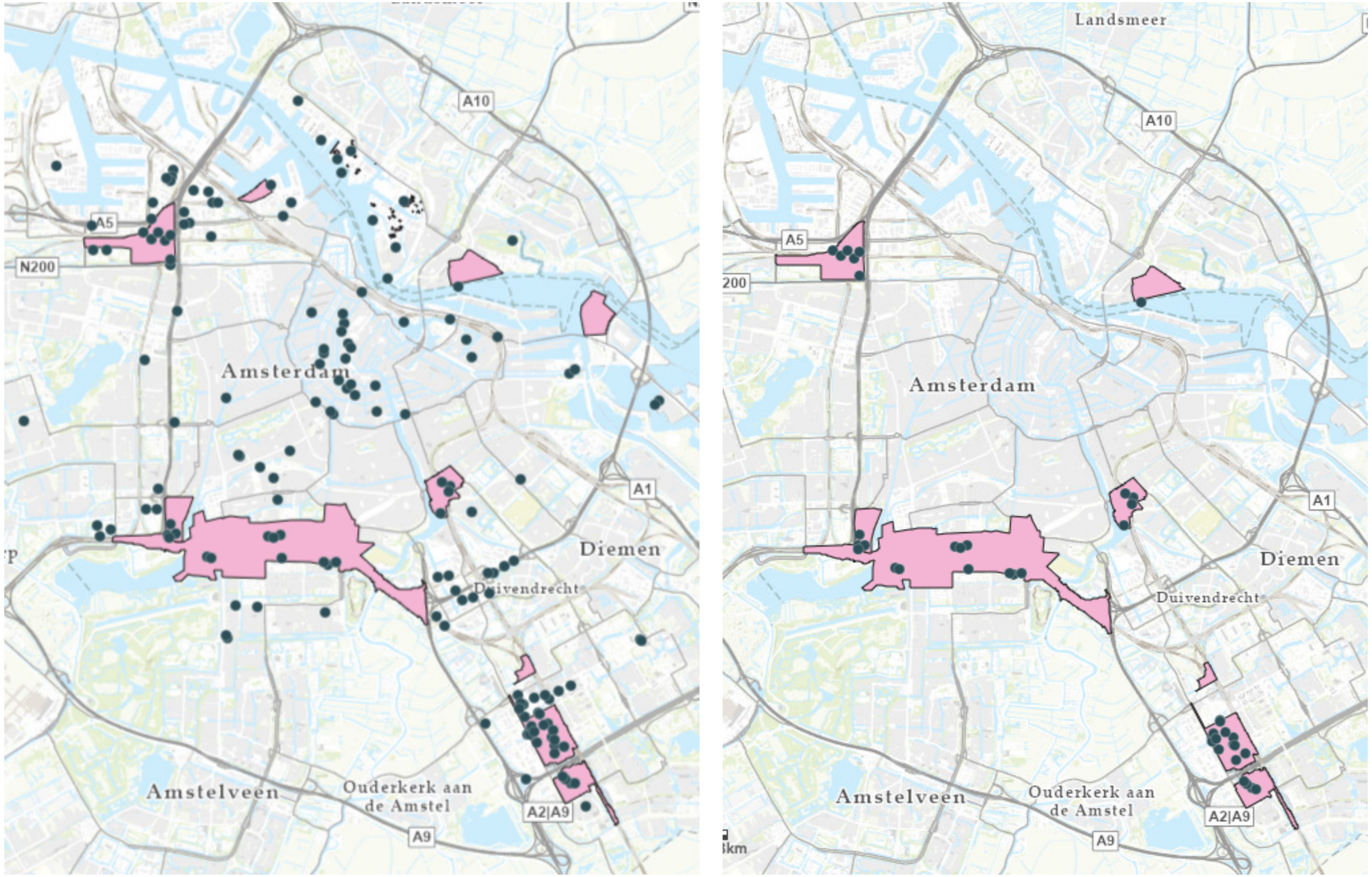
The nine monofunctional office districts in Amsterdam are the research area of this study. In order to determine whether vacant buildings in these districts are suitable for transformation into mixed-use areas, it is crucial to further elaborate their individual locational characteristics, features and planning regulations in step 2 and 3 of the measuring tool.

Case selection

For selecting the cases (buildings) in the research area, multiple publicly available data sources are consulted (Funda in Business, Real estate agencies websites, BAG Viewer, Google Maps, Kadaster, Onsite inspections etc.). In this study, office space is defined as 'vacant office' if the building is at least 500 square meters in size, is available for occupancy, and is on the market. This excludes office space that is undergoing conversion, office space that is (sublet) offered but is still occupied, and vacant office space that is not or is no longer offered (because the space is already pre-leased, in preparation for transformation or redevelopment, or because the owner is not seeking a new tenant). The criteria gave a selection of 161 vacant office buildings in Amsterdam (see appendix 1) For this study, all vacant office buildings located within the selected nine office districts are selected.

Of the 161 vacant office buildings in Amsterdam, 41 are located in the research area with a combined LFA of 161.055 square meters. These 41 buildings in monofunctional office districts are the selected population for this research (appendix 2).

Map 3: Case selection of office buildings



Source: by author.

4.6 DATA COLLECTION

This study focuses on gathering information on vacant office buildings in the selected 9 office districts of Amsterdam for the Transformation Meter Amsterdam 2023. The information on the office buildings and their surroundings was obtained through comprehensive desk research utilizing various datasets. To ensure comprehensive data collection, multiple publicly available sources were consulted, including Funda in Business, BAG Viewer, Interactive Supply Map, Google Maps, Current height file map (Actueel hoogte bestand), Cadaster, PropertyNL, and fifteen real estate agent websites. Additionally, on-site inspections were conducted to gather the necessary data.

The collected data on vacant office buildings includes various key details, such as district, neighborhood, postcode, address, square meters for rent, total LFA (Leasable Floor Area), vacancy percentage, vacancy duration in months, office rental price per square meter per year in Euro, year of construction, energy label, number of floors, building height in meters, floor-to-ceiling height in meters, and whether the building is located in a designated office zone and/or transformation zone.

Apart from information on the office buildings themselves, locational data is also essential for running all steps of the adapted tool. For this purpose, six additional sources were consulted, including CBS, Cadaster, Google Maps, Conversion Meter 2017, Huizenzoeker.nl, and Weetmeer.nl.

Furthermore, the study also collected data on various amenities surrounding the office buildings, including distances to supermarkets, highway on-ramps, train stations, hospitals, general practitioners, cinemas, restaurants and higher education institutions.

The selected cases were systematically analyzed using the Transformation Meter Amsterdam 2023 to derive valuable insights for the study.

4.7 EXPERT EVALUATION

After assessing the potential for transformation of vacant offices in Amsterdam's monofunctional office districts, the tool and results are evaluated. The evaluation is performed by experts from Jones Lang LaSalle, a real estate company. Professional real estate developers with expertise in transformation projects will evaluate the methodology and content of the tool. Are the used veto and gradual criteria consistent with what these experts use to evaluate the transformative potential of a building in practice? In addition, the output will be assessed.

4.8 RELIABILITY

This research's Reliability and Validity are debatable. Writing on a topic as current as this has certain difficulties; the majority of questions are unanswered, and new measurements are being taken in real time. Each month, the relevant literature grows by leaps and bounds, making it impossible to include all pertinent studies in my bibliography. Nevertheless, it demonstrates that research on this topic is extremely vital and can contribute to the scientific discourse.

5

RESULTS

5.1 THEORETICAL OUTCOME
5.2 TESTING AMSTERDAM'S PORFOLIO
5.3 THEORETICAL RESULTS

This chapter constitutes the empirical aspect of the thesis. In the previous chapter, the measuring tool was made operational and the procedures for selecting vacant office buildings were outlined. In this chapter, the collected data, also known as case studies, are processed using the modified measuring tool: Transformation Meter 2023. The results may be used to align demand and supply in the office and housing markets of Amsterdam. Ultimately, demonstrating the extent to which office vacancy and housing shortages can be reduced and mixed-use development stimulated.

5.1 THEORETICAL OUTCOME

Before beginning the empirical testing, a theoretical prediction is made based on the findings of the literature review. This can then be compared to this study's empirical findings. The majority of theoretical studies indicate that less desirable locations like office districts are not suitable for transformation due to their facilities. If we consider location factors to be more important than building characteristics, the theory suggests that if the site is improper, the project will likely fail. If vacant buildings are located in areas with poor connectivity, such as commercial districts, the entire area must be redeveloped (Smit, 2007; Koppels et al., 2011). However, the Ministerie van Binnenlandse Zaken (2022) asserts that the *low-hanging fruit* has already been collected and that the opportunities lie in vacant office buildings in unstudied areas like office districts.

They report that at least 30% of vacant office buildings are suitable for residential conversion in the near future. So, the hypothesis that will be tested is:

'Thirty percent of unused office space in monofunctional business districts can be transformed to residential use.'

5.2 TESTING AMSTERDAM'S PORTFOLIO

Step 1: Quick Scan

The first step of the modified transformation meter is the evaluation of Amsterdam's office vacancy using the veto criterion. If any one of the five criteria is not met, the case will not advance. This table summarizes the veto criteria and their respective scores.

Step 1 begins with the market, identifying housing demand. As identified in Chapter 2, the Amsterdam housing market is overheating. Consequently, there is a high demand for housing. This accounts for all of Amsterdam's areas when focusing on local markets. Therefore, the evaluation of the first veto criterion is 'yes' for all 41 vacant buildings. In addition, the high vacancy rate in Amsterdam has already been established. As stated in previous chapters, Amsterdam's vacancy rate on March 1, 2023 was 7.1%. The second veto criterion requires a period of vacancy to be specified. Via Funda business could conclude that 33 of the 41 buildings have been vacant for six months or longer. The remaining eight structures have been vacant for a lesser duration and are therefore not (yet) suitable for transformation because they may be rented.

The remaining 33 buildings that have been on the market for six months or more contain a total of 128.585 square meters of empty office space.

The third criterion is a location factor. The first locational veto assessment is whether the vacant office building is located in an area with a zoning plan that allows 'dwelling' or that allows the zoning plan to be modified from 'office' to 'dwelling'.

As seen in the theoretical framework, buildings with a 'Mixed-1' zoning, are allowed to be transformed into residences (map 4). According data from ruimtelijkeplannen.nl, 22 of the case studies have a 'Mixed-1' zoning and 11 of the case studies have a 'Single zoning office' or 'Single zoning business' function. The municipality must review these 11 cases to determine whether a deviation can be accommodated.

Table 8: Results step 1

STEP 1: MODIFIED QUICK SCAN

Answer Yes (score =1) is positive for transformation into homes. Answer No (score=0) is negative for transformation into homes. Score of less then 5 results in a NO GO for further transformation potential appraisal

Aspect	Veto Criterion	Data Source	Assessment	
	Market Factor		**Yes**	**No**
1. Housing Demand	1.There is a demand for housing of local target groups	Estate Agent Municipality Market trends	41	0
2. Vacancy	2. The building is vacant (6 months or longer)	Funda Business Estate Agent	33	8
	Location Factor			
3. Urban Location	3. Zoning plan (permits modification)	Zoning Plan Municipal Policy	22	11
	4. No serious public health risk (pollution, noise)	Municipality Map	22	0
	Building Factor			
4. Support structure	5.Free ceiling height > 2.60 meter	Estate Agent	22	0
	Result Quick Scan		22	

Source: by author.

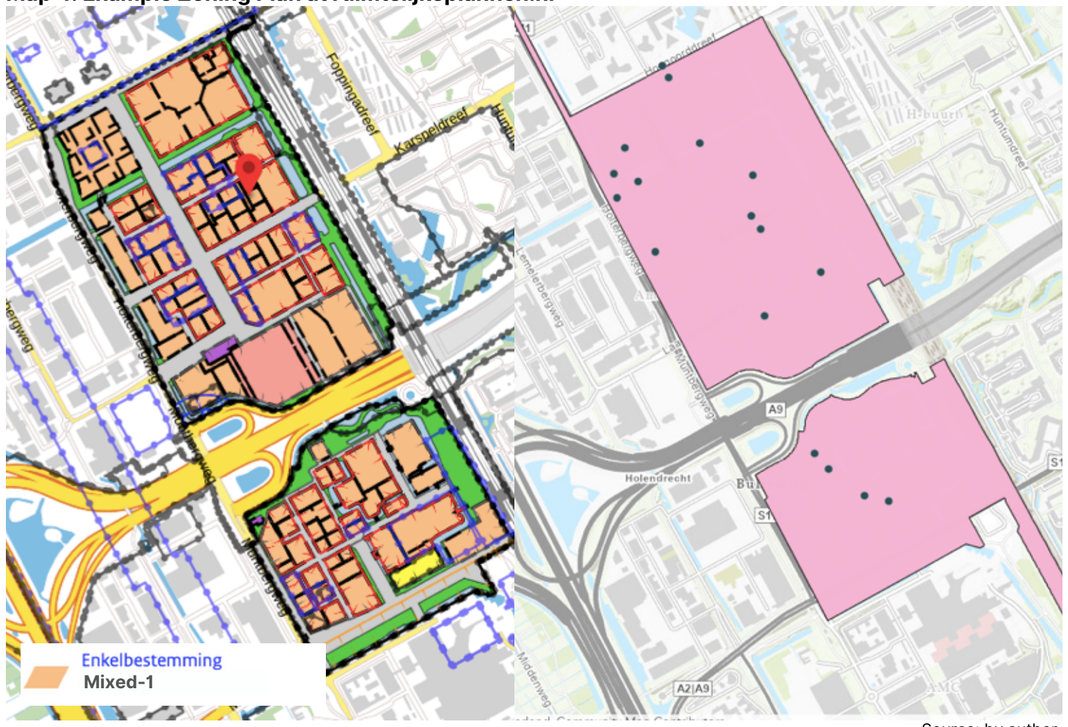
One of the requirements of the AOP guideline is that the building must be vacant for at least two years. Since this information is unavailable and we do not know if the municipality will cooperate with the transformation into residential space, the assessment for these 11 buildings is a 'no'. Now 33 – 11 = 22 vacant office buildings will proceed to the next veto criterion.

The following criterion addresses air quality and noise pollution. First, a residential building is permitted in an area where noise levels exceed 50 decibels, but additional noise reduction measures are required within the building.

Map 5 displays Amsterdam's noise pollution.

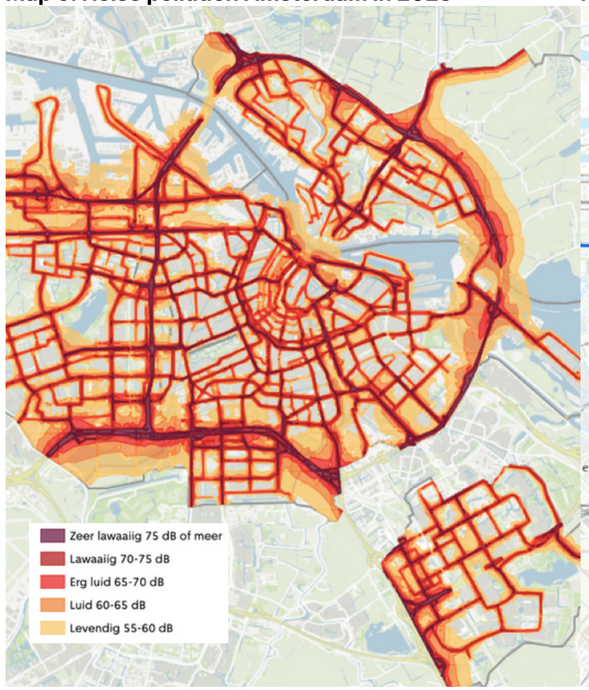
In and around Amsterdam, the principal sources of annoyance are vehicular and rail traffic. Empty office structures located in a highlighted area can still be transformed successfully. However, the costs will increase due to the need for additional measures. Nevertheless, as shown in map 6, noise barriers (red and blue lines) have already been installed around numerous office buildings, significantly reducing noise in the surrounding areas. As a result, none of the remaining 22 office buildings are given an assessment of 'no'.

Map 4: Example Zoning Plan at ruimtelijkeplannen.nl

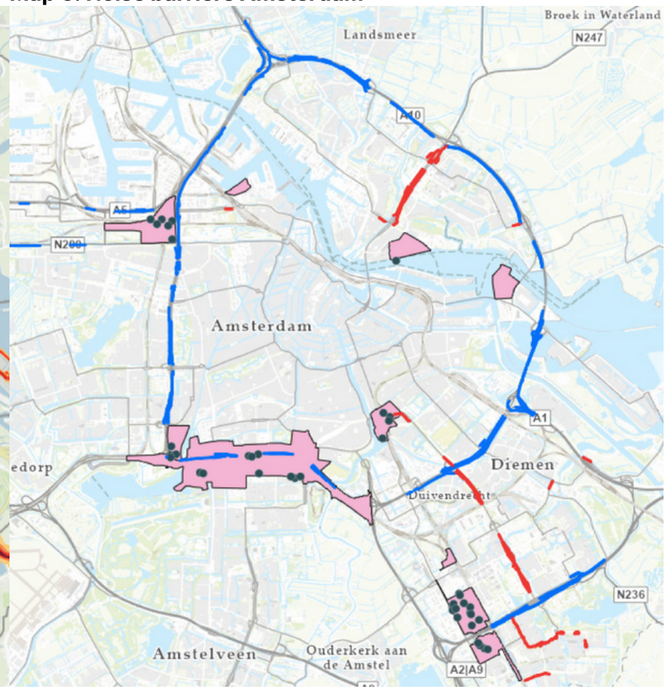


Source: by author.

Map 5: Noise pollution Amsterdam in 2023



Map 6: Noise barriers Amsterdam

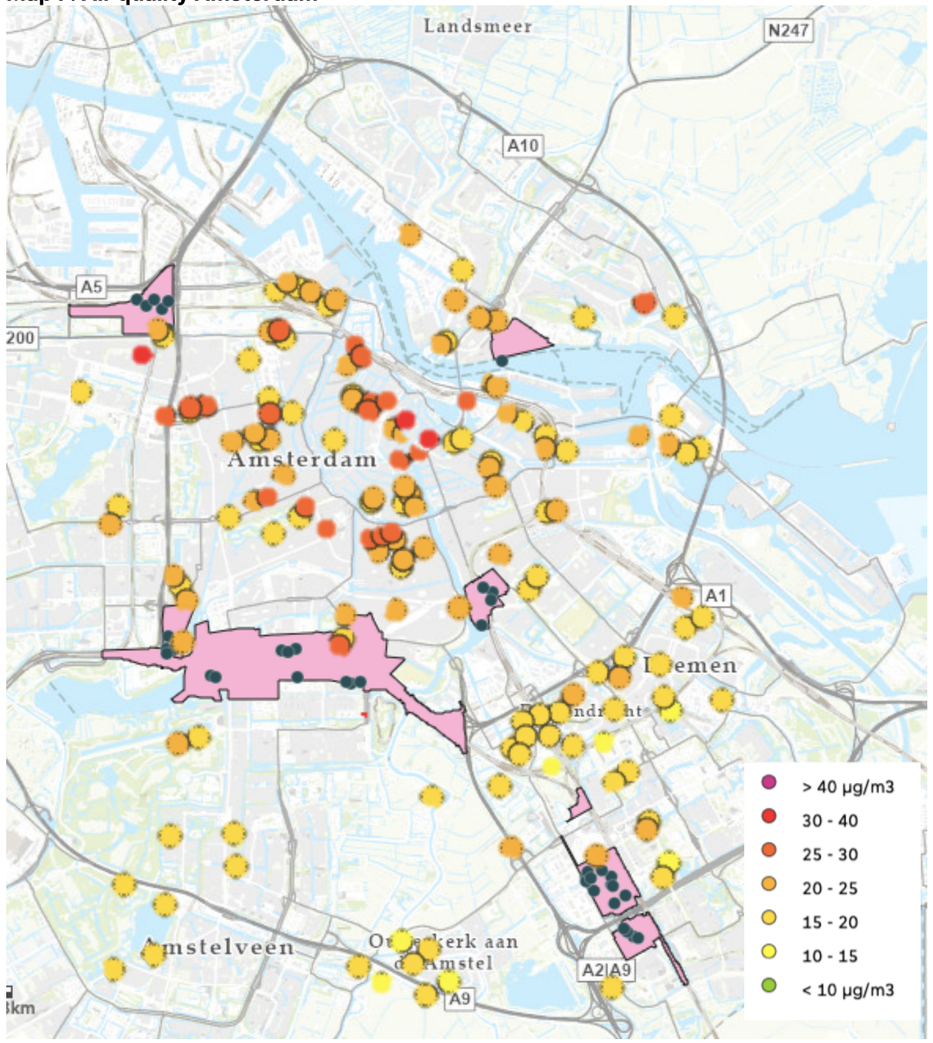


Source: by author.

Furthermore, the air quality a residential building is located at cannot be a serious health hazard. Luchtmeetnet measures the amount of nitrogen dioxide, sulfur dioxide, ozone, and particulate matter in the air at various locations in the Netherlands. Map 7 visualizes the current air quality in Amsterdam (Luchtmeetnet, 2023). There are no buildings located near a red dot. Therefore, the air quality permitted the development of residential space. Consequently, the remaining 22 vacant office buildings will be evaluated against the subsequent veto criterion.

The following veto criterion is floor-to-ceiling height. From a legislative standpoint, this criterion is required. The Dutch building decree stipulates that floor-to-ceiling height must be at least 2,6 meters. The procedure for determining this is as follows. Initially, all of the aforementioned sources were consulted. In the majority of instances, Funda businesses mentioned the building's ceiling height. In certain instances, this had to be calculated using a different source. To calculate this, two variables, building height and number of floors, had to be determined.

Map 7: Air quality Amsterdam



Source: Luchtmeetnet (2023), illustrated by author.

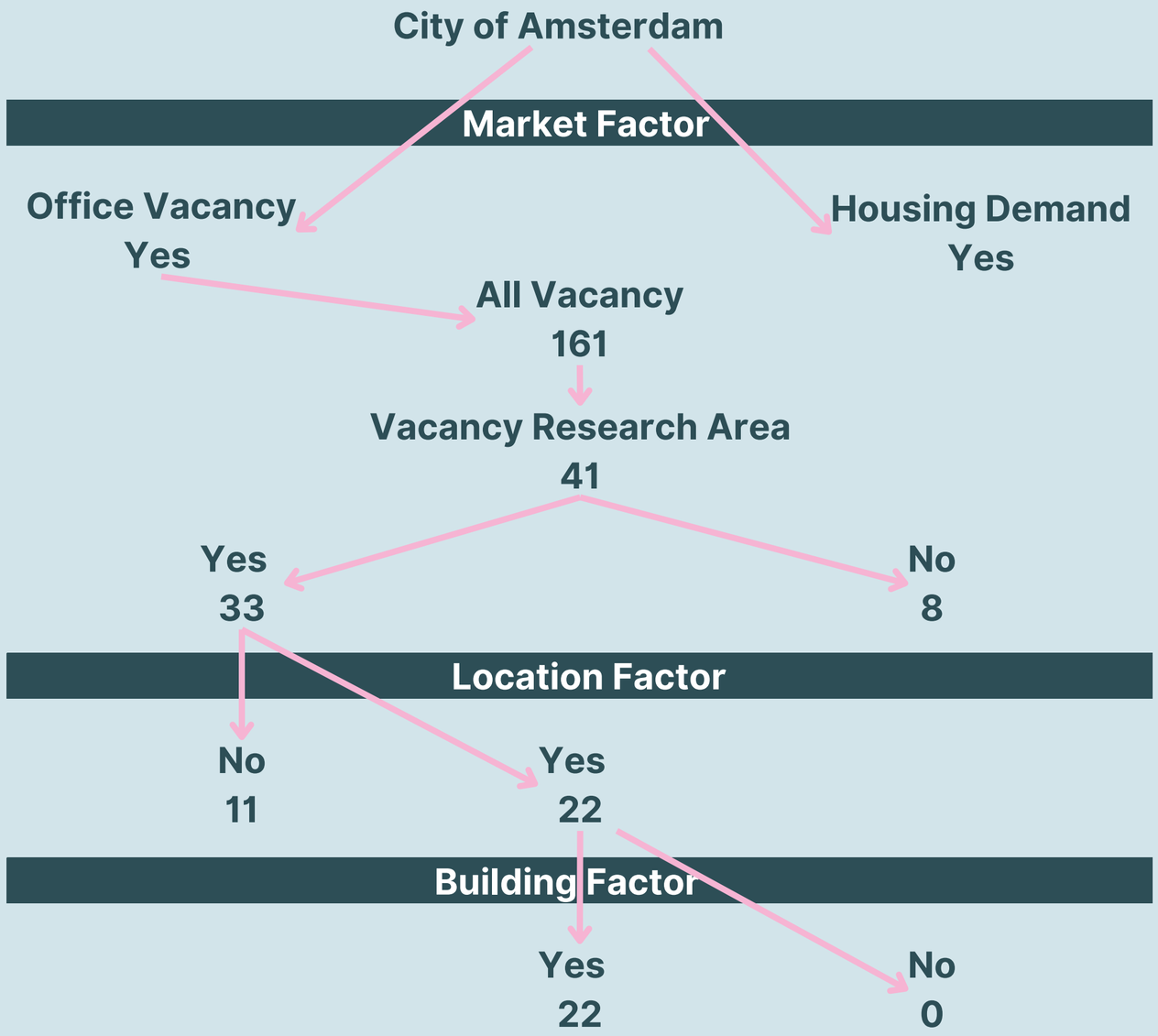
Map 8: Current Height Amsterdam

High

Low

Source: Actueel Hoogtebestand Nederland (2023), illustrated by author.

Figure 23: Visualization of step 1assessment using veto criteria Conversion Meter Amsterdam 2023



Source: By author

Current Height File Netherlands (Actueel Hoogtebestand Nederland) is a source for obtaining building height information. This website displays the precise height of each surface in the Netherlands, as shown on the map below. The quantity of floors must then be determined. This was accomplished by merely counting them using Google Maps Streetview or by conducting inspections on-site. All 22 structurally vacant office buildings met the floor-to-ceiling height veto criterion of 2,6 meters.

Step 1 of the Amsterdam 2023 Transformation Meter is depicted in figure 23. The procedure illustrated below is carried out on every building according to each criterion, beginning with the veto criteria and progressing to the gradual criteria in step 2. These 22 office buildings that proceed to step 2 have a combined LFA of 84.056 square meters.

Step 2: Location Scan

Only 22 of the 41 vacant office buildings in Amsterdam's monofunctional office areas met all of the step 1 veto criteria. Step 2 is the further assessment of the location utilizing graduated grading criteria for these 22 vacant offices. An additional Go/No Go decision has been added to the original transformation Meter 2017 to emphasize the location's significance. Table 9 illustrates the 6 features and 18 locational gradual criteria. At least 13 of those 18 criteria, or two thirds, must be answered "yes," earning a score of 1. With this minimal requirement, the location factor is given more importance. The additional weighing is on top of the original meter's built-in weight. In this case, the locational score is multiplied by 5 as opposed to a factor 3 for the building criteria. The reason the location is more crucial is that a nice building in a terrible area will almost always result in a failed project. However, a project might be successful even with a poor building in a good location. This is because the building can be altered, or in this case transformed, while the location cannot or can only be altered to a limited degree. So, location, location, location is everything in real estate.

The 22 unoccupied office buildings are evaluated based on the 18 location-gradual criteria. This grading procedure is summarized in the table below. The full summary is contained in appendix 4.

For the gradual location characteristics, 12 or more ‘yes’ assessments were made for 17 of the 22 buildings. The five vacant office buildings that did not pass the locational grade are as follows:

- Paasheuvelweg 3
- Paasheuvelweg 1
- Hogehilweg 24
- Herikerbergweg 145
- Herikerbergweg 35

These five vacant buildings will be excluded from further measuring their transformation potential.

The fact that all the buildings are situated in peripheral locations is immediately apparent. Peripheral locations include office / industrial areas. Since this study focuses only on vacancy in monofunctional office districts, all buildings are given a 'No’, because theoretically office districts are not the best places for transformation. This study investigates whether this is actually the case.

When looking at the distance and quality of amenities, it is evident that only a small percentage of the buildings satisfy requirements 4 and 5, which is consistent with theory. Due to the buildings' office locations, some amenities, such as shops for basic necessities or a neighborhood meeting spot, are not always reachable within 500 meters. The positive aspect of an office district is that almost all 22 of the buildings are easily accessible by car and public transportation. All objects are located within 2000 meters of a train station. The connectivity and distance to amenities was measured with Google Maps. In the cultural section, criterion 16 is apparent. The criterion ‘area has a good reputation/image (no vandalism/low crime)’ has a relatively low yes-assessment rate.

Table 9: Results Step 2 Amsterdam Transformation Meter 2023

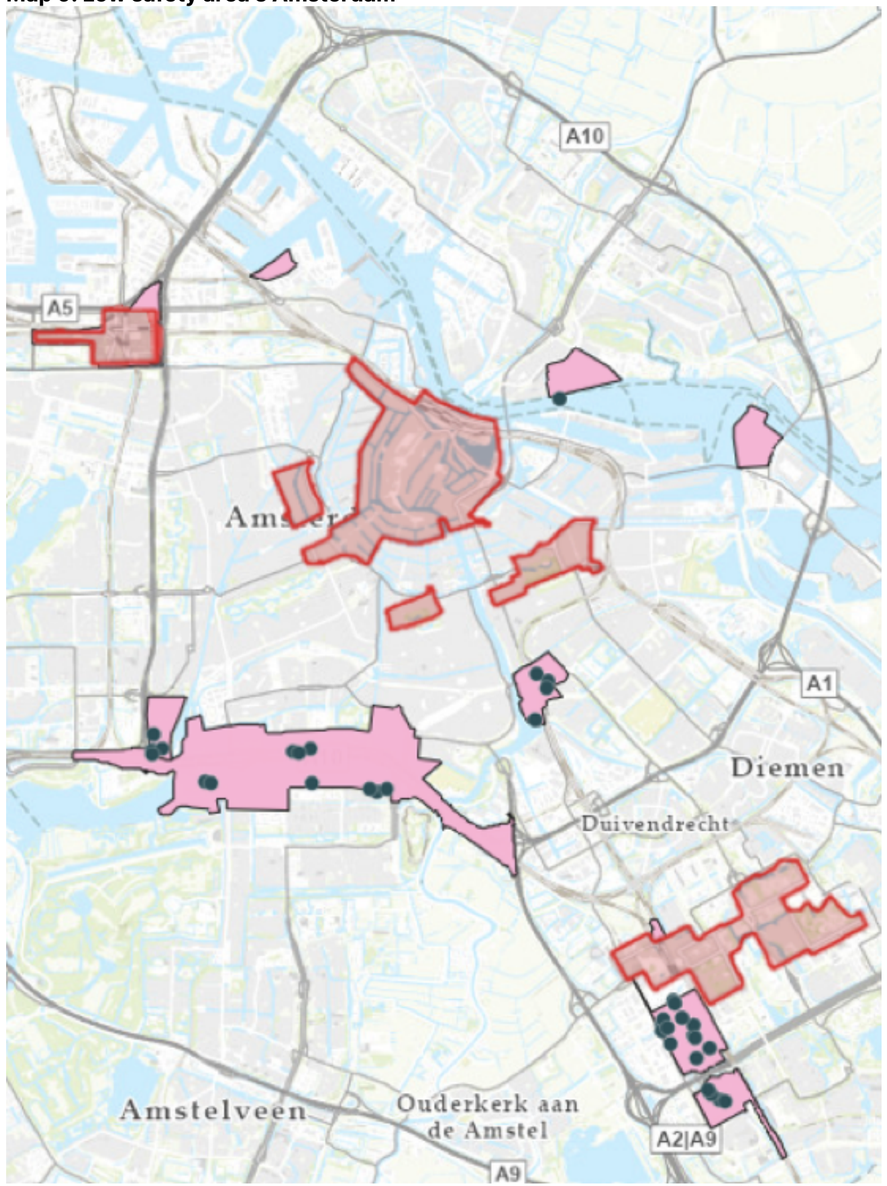
STEP 2: MODIFIED SCAN LOCATION

Answer Yes (score =1) is positive for transformation into homes. Answer No (score=0) is negative for transformation into homes. A score of at least 12 out of 18 must be obtained in order to proceed to step 3.

Aspect	Gradual Criterion	Assessment	
	Functional	**Yes**	**No**
1. Urban Location	1.Building in suitable area (not peripheral)	0	22
	2. Good natural light possibilities	17	5
	3. Good view from building > 75% floor space	16	6
2. Distance and Quality of amenities	4. Shop for daily necessities < 500m	5	17
	5. Neighborhood meeting places (square, park) < 500m	6	16
	6. Food service industry (bar, café, restaurant) < 500 m	20	2
	7. Basic medical facilities (health center, doctor, pharmacy) < 2000m	22	0
	8. Sport facilities (fitness, swimming pool, sports park) < 2000m	22	0
	9. High educational facilities (high school or university) < 2000m	22	0
3. Accessibility by public transport	10. Distance to railway station < 2000m	22	0
	11. Distance to bus-, tram-, metro stop < 500m	20	2
4. Accessibility by car	12. Good flow, normal street quality	22	0
	13. > 1 parking lot per 100 sqm office space	20	2
	Cultural		
5. Representative Impression	14. Other buildings present in direct neighborhood < 250m	22	0
	15. Direct availability of green environment. Trees <100m	22	0
	16. Area has good reputation (no vadalism/low crime)	17	5
	17. Area has good air quality	22	0
	Legal		
6. Noise	18. Noise load on facade < 50dB (e.g. max for office building is 60 dB)	0	22
	Result Further Appraisal	**17**	

Source: By author

Map 9: Low safety area's Amsterdam



Source: By author.

Map 10: Noise pollution Amsterdam in 2023

Source: By author.

The municipality of Amsterdam has made a physical-, safety- and social scan for each district and neighborhood. From these scans it showed that some districts performed poorly on the safety index (see map 9). This resulted in a lower score, since some of the vacant buildings are located here.

Last but not least, it is noteworthy that no building fulfills the noise load barrier of 50dB in criterion 18. In many districts of Amsterdam, noise pollution from trains and automobiles is a problem. Unfortunately, all of the buildings are close to areas with noise pollution (map 10), however as was already shown in step 1, many office buildings have already had noise barriers erected around them, greatly decreasing noise in the neighborhood.

Step 3: Building Scan

In step 3, there are 17 vacant office buildings left to test, with a total LFA of 53.095 square meters. These remaining buildings will be valued using gradually building criteria. There are 14 distinct aspects and 28 gradual requirements, as was already explained in chapter 3. The results from step 3 are summarized in table 10.

What stands out is that only one building was entirely vacant. All of the remaining 16 vacant offices were just partially empty and have still one or more tenants in place. These remaining tenants occupy 31.230 LFA. The remaining vacant office space is 53.095 – 31.230 = 21.865 square meters of floor space. Furthermore, the structures are all more than three years old. The "youngest" building was constructed in 2012.

The majority of the data is gathered through phone calls to the estate agent and site visits. Upon on-site investigation, none of the structures appeared to have undergone significant renovations recently. According to the Cadastre, only seven structures may be horizontally extended due to additional space on its plot. The zoning plan and on-site inspections were used to score criterion seven. 8 of the 17 may not be vertically expanded due to a slanted roof, a light material (read: wooden), or the zoning plan's prohibition on an additional floor or greater height. Most technical criteria can be answered affirmatively with a 'yes'. However, only 15 of the 17 façades are adaptable. The facade is a structural component of these buildings, thus the explanation. These facades are therefore difficult to alter.

The use of asbestos, a dangerous insulating substance, has been prohibited since 1998. Since nine of the unoccupied office buildings date back to before 1998, it is assumed that asbestos is present in these structures. Thermal insulation is governed by the energy labels. A 'no' rating was given to all structures with a designation lower than C. Most of the other legal requirements were evaluated through on-site inspections.

Step 4

Each physically vacant building that successfully completes the first three steps of the Transformation Meter Amsterdam 2023 will obtain a transformation score, demonstrated in step four as previously mentioned and displayed in the table below. As can be seen in the table below, this score corresponds to a classification of transformation potential. The locational score is multiplied by five, and the building score by a factor three.

Only 17 of the 41 vacant office buildings in the research area fulfilled all three steps. All of the remaining structures achieved ratings of at least 127, indicating that they all have a high or exceptional potential for transformation. 5 buildings are class 5, while 12 are class 4. The total unoccupied square meters of these 17 buildings is 21.865. Wibautstraat 137 has the highest location score, which is the case due to its location near the city center. The remaining 24 empty structures received a score of 0, classifying them as having no potential for transformation. The site grade and/or veto criteria were insufficient, despite the fact that the latter group may have had a high building grade. An overview of the grouping of all empty office buildings is provided in appendix 5.

Table 10: Results step 3 Transformation Meter Amsterdam 2023

STEP 3: MODIFIED BUILDING SCAN

Answer Yes (score =1) is positive for transformation into homes.
Answer No (score=0) is negative for transformation into homes.

Aspect	Gradual Criterion	Assessment	
	Functional	**Yes**	**No**
1.Year of construction	1.Building > 3 years	17	0
	2. Building renovated > 3 years	4	13
2. Vacancy	3. Complete building is vacant	1	16
3. New housing	4. Capacity building > 10 units of 50 sqm	16	1
	5. Lay-out adaptable for local target groups	17	0
4. Extendibility	6. Horizontal extension building possible (neighboring buildings)	7	10
	7. Vertical extension building possible (no inclined roof/ light support structure)	9	8
	8. Possibilities for constructing basement	0	17
	Cultural		
5. Representative Impression	9. Identifiable compared to surrounding buildings	17	0
	10. Own identify realizable	17	0
6. Cultural image	11. Being not a cultural heritage	16	1
7. Access	12. Clear and safe entrance (elevator/stair)	17	0
	Technical		
8. Maintenance	13. Well, maintained; maintenance up to date	13	4
9. Dimensions of support structure	14. Depth of building < 10,00m	17	0
	15. Grid support structure > 3,60m	17	0
	16. Height dimension between floor < 6,00m	16	1
10. Support structure (walls, columns, floors)	17. Condition support structure is good / not hazardous	17	0
	18. Possible connection inner walls on grid < 5,40 m	17	0
11. Facade	19. Facade well adaptable	15	2
	20. Facade windows can be reused/opened	17	0
12. Installations	21. Sufficient service ducts can be constructed	17	0
	Legal		
13. Environment	22. Absence of large amount hazardous materials in building	8	9
	23. Acoustic insulation of floors > 5dB	11	6
	24. Good thermal insulation of facades / roof	10	7
	25. Sufficient daylight factor > 90% floor surface new units	17	0
14. National building decree	26. Elevators available / easy realizable in building with > 4 floors	15	2
	27. (Emergency) stairways available/realizable	17	0
	28. Distance of units to stair/elevator < 50m	17	0
	Result Further Appraisal		

Source: By author.

Table 11: Outcome Transformation Meter Amsterdam 2023

Address	Total Step 2 Location	Total Step 3 Building	Transformation Score	Transformation Class
Hoogoorddreef 60	14	20	130	4
Radarweg 60	15	22	141	4
Pietersbergweg 273	15	24	147	5
Hullenbergweg 278	13	22	131	4
Hullenbergweg 81- 135	14	24	142	4
Hoogoorddreef 62	15	20	135	4
Hogehilweg 21	14	21	133	4
Hogehilweg 18	14	24	142	4
Hogehilweg 8	14	21	133	4
Hatostraat 28	14	19	127	4
Wibautstraat 137	18	20	150	5
La Guardiaweg 36	14	25	145	5
Kingsfordweg 43	13	25	140	4
Hoogoorddreef 7	14	20	130	4
Herikerbergweg 181	14	26	148	5
Herikerbergweg 74	14	25	145	5
Gatwickstraat 9	13	22	131	4

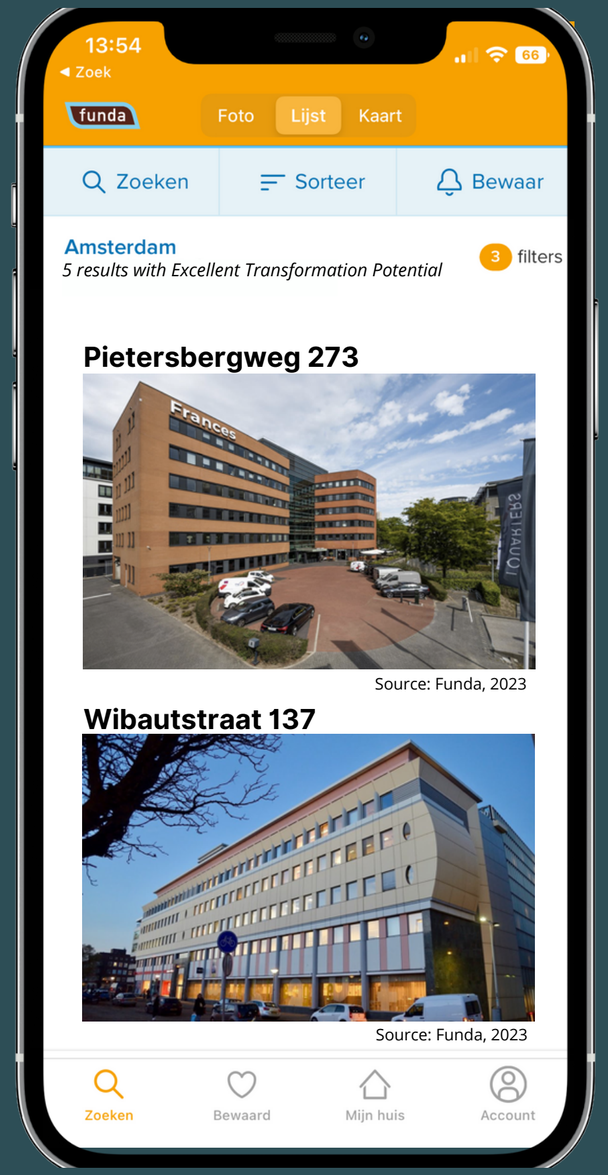
Source: By author

Table 12: Transformation Class

Transformation Score	Transformation Class
Score location + building = 0 - 35	Class 1: No transformation potential
Score location + building = 36 - 70	Class 2: Hardly a transformation potential
Score location + building = 71 - 105	Class 3: Limited transformation potential
Score location + building = 106 - 140	Class 4: High transformation potential
Score location + building = 141 - 175	Class 5: Excellent transformation potential
Maximum score: 90 + 84	174
Total score feasibility scan: (location x 5) + (building x 3):	Score Transformation Potential

Source: Geraedts et al., (2017), illustrated by author

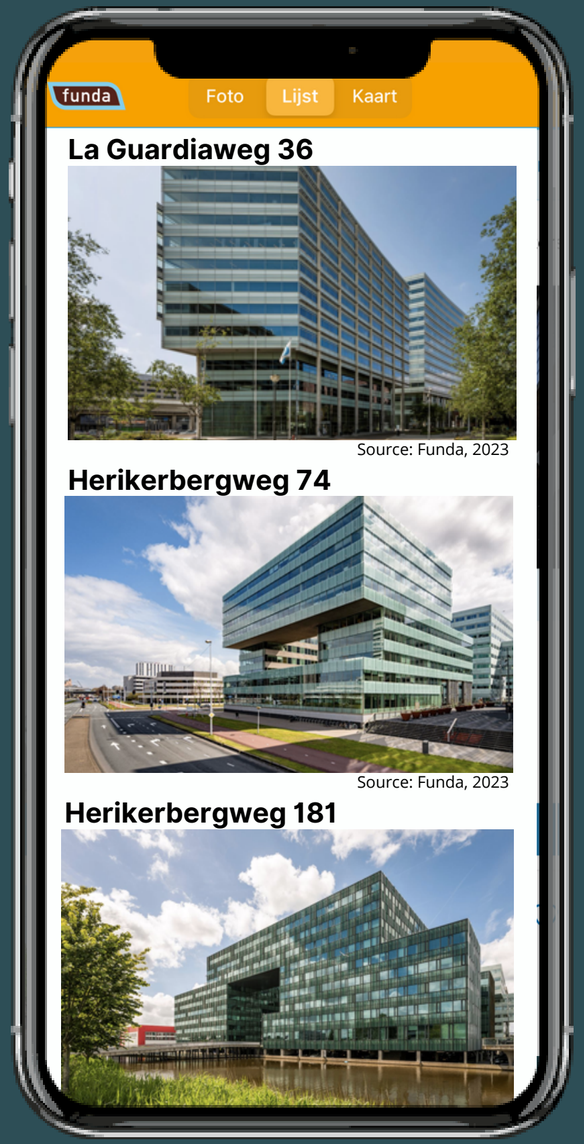
Office buildings with Excellent transformation potential:



Source: Funda, 2023

Source: Funda, 2023

Office buildings with Excellent transformation potential:



5.3 THEORETICAL RESULTS

There were 41 office buildings coping with vacancy in the nine monofunctional office districts of Amsterdam. Only 33 of these 41 buildings were reordered as having been vacant for more than six months. The potential for transformation in this latter group was chosen for further examination. Because the office function is not entirely redundant here, as it is in office buildings that are vacant for a longer period of time, the other buildings are disregarded.

11 additional buildings were eliminated for further testing after the first quick scan using the veto criteria. Without modifying the zoning plan, these 11 buildings are situated in areas where residences are not currently permitted. In step 2, the location was graded once more using 18 gradual criteria. At least 13 of these 18 criteria must be answered "yes" in order to move on to the next step. After step 1, 5 of the 22 vacant office buildings did not meet this minimum standard. Considering that these structures only received a score of 12 or lower. Step 3 was only attained by 17 of the 41 vacant office buildings. In this step, 28 gradual criteria were used to grade the building characteristics. Because after step 3 there is no GO / NO GO decision built in. But step 4 does include a decision of this kind. Five buildings were eliminated when the transformation class was determined. The reason for this was a poor locational score. This score was high enough to pass step 1 and move on to step 2, but it was too low to move on to step 3 and 4. These structures are all situated in the Amstell III business park.

According to the Transformation Meter Amsterdam 2023, 5 buildings were classified as having excellent transformation potential, 12 as having high potential, and the remaining 24 as having no potential after the qualitative measuring was done using veto and gradual criteria.

At the beginning of this chapter, a hypothesis was presented. Now that the assessment of all vacant offices has been completed, empirical evidence can be provided in support of the hypothesis that 30% of unused office space in monofunctional business districts can be converted to residential use.

17 of the 41 buildings have high to excellent transformation potential. So, the total percentage of vacant office space that has potential for successful transformation is 41%. Twelve percent of all the 41 buildings have an excellent transformation potential and 29% are having a high potential. So, after assessing the Transformation Meter Amsterdam it can be concluded that the hypothesis is true. The percentage of 41 forms also the answer to sub-question 7: *What percentage of vacant office space in monofunctional office districts in Amsterdam has the potential to be effectively transformed into houses?*

Considering the total square meters of these 17 buildings, which amounts to 21.865 square meters, it can be estimated that by utilizing the theoretical assumption of 50 sqm as the size of a transformed residence, it is possible to develop approximately 437 homes in the nine monofunctional working districts. This transformative effort will contribute to the creation of vibrant mixed work-life neighborhoods.

6

EXPERTS

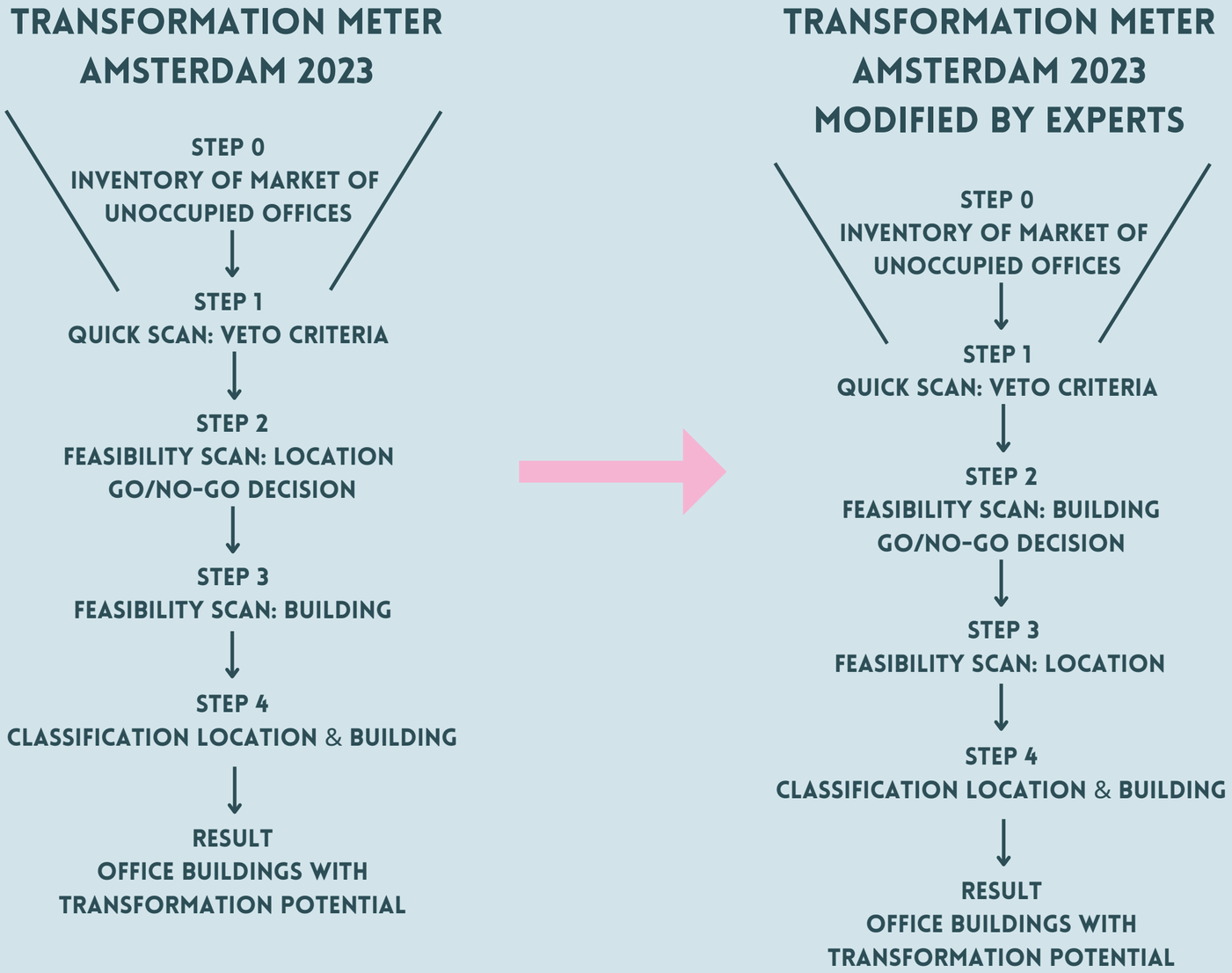
6.1 RESULTS MODIFIED TRANSFORMATION METER 2023

6.2 COMPARING OUTCOMES

When discussing the results of the assessment with two JLL experts, they quickly respond that in a study that is conducted in less desirable areas like office districts, steps 2 and 3 may need to be assessed in reversed order because, in these areas, building characteristics are more important than location. And according to theory, transformation is also certainly possible in less desirable areas, but it requires more area transformation. According to the experts, in practice, students and newcomers are willing to change their preferred locations in stressed markets like Amsterdam if the housing is affordable (JLL, 2023). In this case, the location factor does not need to be the primary consideration in the selection process and will give a 'wrong' transformation potential outcome of the office buildings.

The transformation meter is updated in order to calculate and determine what the transformation potential would be if steps 2 and 3 are reversed. Comparing the procedures to Transformation Meter 2023, the steps in figure 24 were taken.

Figure 24: Transformation Meter Amsterdam 2023 & Modified Transformation Meter Amsterdam 2023



Source: By author

6.1 RESULTS MODIFIED TRANSFORMATION METER 2023

In Amsterdam's monofunctional office areas, only 22 of the 41 vacant office buildings satisfied all of the step 1 veto criteria. The second step in this modified meter involves a further evaluation of the building using graduated criteria for these 22 vacant offices. To emphasize the importance of the building in determining the transformation potential, a Go/No Go decision has been added to the building feasibility scan.

Step 2

Step 2 consists of 28 locational gradual criteria and 14 aspects. Two thirds, or at least 19 of those 28 criteria, must be assessed with a 'yes' in order to receive a score of 1. The building factor is given more weight with this minimum requirement. Six buildings were eliminated due to location criteria, leaving only 17 buildings to complete the building feasibility scan in the original Transformation Meter 2023. In the modified version, 22 objects will be evaluated because the building scan comes first.

From the 22 buildings, only one building failed to achieve the required score of 19. It is interesting that this is Wibautstraat 137, the only building that is in the city center and had the highest location score in the original meter. Theoretically, this building would be the best for transformation because of its favorable location, but when building characteristics are more significant, this building does not move on to step 3.

Step 3

Because Wibautstraat 137 did not met the required score of 19 in step 2, there are 21 vacant office buildings with a total amount of 23.201 square meter left to test in step 3. These remaining buildings will be valued using gradual location criteria. There are 6 aspects and 18 gradual requirements. The outcome is the same as the Original Meter 2023 and described in step 2 of that tool.

As expected, only a small percentage of buildings meet requirements 4 and 5, based on distance and quality of amenities. Due to the buildings' office locations, some amenities, like basic stores or a neighborhood meeting spot, are not always within 500 meters.

The total location scores vary from 11 to 16 points.

Step 4

Step 4 is also the same as in the original meter, only is the building score this time is multiplied by five, and the location score by a factor three. The scores are displayed in the table below. As can be seen in the table below, this score corresponds to a classification of transformation potential.

Only 21 of the 41 vacant office buildings in the research area fulfilled all three steps. All of the remaining structures achieved ratings of at least 137, indicating that they all have a high or exceptional potential for transformation. 8 buildings are class 5, while 13 are class 4. La Guardiaweg 36 has the highest score, due to the good building characteristics.

Table 13: Outcome Modified Transformation Meter Amsterdam 2023

Address	Total Step 2 Building	Total Step 3 Location	Transformation score	Transfrmation Class
Hoogoorddreef 60	20	14	142	4
Radarweg 60	22	15	155	4
Pietersbergweg 273	24	15	165	5
Hullenbergweg 278	22	13	149	4
Hullenbergweg 81- 135	24	14	162	5
Hoogoorddreef 62	20	15	145	4
Hogehilweg 21	21	14	147	4
Hogehilweg 18	24	14	162	5
Hogehilweg 8	21	14	147	4
Hatostraat 28	19	14	137	4
La Guardiaweg 36	25	16	173	5
Kingsfordweg 43	25	14	167	5
Hoogoorddreef 7	20	13	139	4
Herikerbergweg 181	26	14	172	5
Herikerbergweg 74	25	14	167	5
Gatwickstraat 9	22	14	152	4
Paasheuvelweg 3	23	10	145	4
Paasheuvelweg 1	21	12	141	4
Hogehilweg 24	24	12	156	4
Herikerbergweg 145	23	12	151	4
Herikerbergweg 35	22	11	143	4

Source: By author

Table 14: Transformation Class Modified Transformation Meter 2023

Transformation Score	Transformation Class
Score location + building = 0 - 39	Class 1: No transformation potential
Score location + building = 40 - 78	Class 2: Hardly a transformation potential
Score location + building = 79 - 117	Class 3: Limited transformation potential
Score location + building = 118 - 155	Class 4: High transformation potential
Score location + building = 156 - 194	Class 5: Excellent transformation potential
Maximum score: 140 + 54	194
Total score feasibility scan: (building x 5) + (location x 3):	Score Transformation Potential

Source: By author

6.2 COMPARING OUTCOMES

To see what the impact of updated transformation meter on the outcome is, it is important to compare the outcomes of table 12 and 13.

The analysis indicates that Hatostraat 28 ranks the lowest in both cases. This is attributed to its relatively low location score and building score compared to other structures. As a result of the majority of buildings having high building scores, the updated Transformation Meter suggests that there are more buildings with transformation potential. In the original meter, 17 out of 41 buildings showed high to exceptional potential, while the updated meter identifies 21 out of 41 buildings with potential. In the updated meter, 51% of all office buildings in Amsterdam's monofunctional office areas have transformation potential, compared to 41% in the original meter. This suggests that the updated version includes additional buildings that may be suitable for transformation. In the original Transformation Meter Amsterdam, a total of 21.865 square meters were identified as potential for transformation, whereas in the modified. Amsterdam Meter, the potential increased to 23.201 square meters. Assuming a theoretical size of 50 square meters for each transformed residence, the original meter had the potential to develop 437 houses, while the modified meter indicates a potential for 464 houses to be transformed.

However, it is crucial to consider that the surrounding area of these buildings may also require transformation to meet housing needs and enhance overall attractiveness and safety. Moreover, the evaluation emphasizes the significance of considering both building characteristics and location when assessing transformation potential. While the original meter placed greater emphasis on location, the updated meter explicitly incorporates building characteristics. This refinement led to the exclusion of Wibautsraat 137 from further assessment due to its lower building score, despite having a high location score. Although Wibautsraat 137 exhibited the highest potential for transformation in the original meter, it fails to meet the building characteristics criteria in the updated meter. Additionally, it is worth noting that Hogehilweg 24 attains a Transformation Class of 5 in the modified meter, as it was excluded after step 2 in the original Amsterdam Transformation Meter due to its low location score of 12, which prevented it from advancing to step 3. The ultimate question that arises from these findings is the trade-off between the number of transformed houses and the location and amenities of the buildings. Is it more desirable to have a higher number of transformed houses in buildings that require additional area transformation, or is it preferable to focus on fewer transformed houses in buildings located in prime areas with abundant amenities?

Table 11: Outcome Transformation Meter Amsterdam 2023

Address	Total Step 2 Location	Total Step 3 Building	Transformation Score	Transformation Class
Hoogoorddreef 60	14	20	130	4
Radarweg 60	15	22	141	4
Pietersbergweg 273	15	24	147	5
Hullenbergweg 278	13	22	131	4
Hullenbergweg 81- 135	14	24	142	4
Hoogoorddreef 62	15	20	135	4
Hogehilweg 21	14	21	133	4
Hogehilweg 18	14	24	142	4
Hogehilweg 8	14	21	133	4
Hatostraat 28	14	19	127	4
Wibautstraat 137	18	20	150	5
La Guardiaweg 36	14	25	145	5
Kingsfordweg 43	13	25	140	4
Hoogoorddreef 7	14	20	130	4
Herikerbergweg 181	14	26	148	5
Herikerbergweg 74	14	25	145	5
Gatwickstraat 9	13	22	131	4

Source: By author

Table 13: Outcome Modified Transformation Meter Amsterdam 2023

Address	Total Step 2 Building	Total Step 3 Location	Transformation score	Transfrmation Class
Hoogoorddreef 60	20	14	142	4
Radarweg 60	22	15	155	4
Pietersbergweg 273	24	15	165	5
Hullenbergweg 278	22	13	149	4
Hullenbergweg 81- 135	24	14	162	5
Hoogoorddreef 62	20	15	145	4
Hogehilweg 21	21	14	147	4
Hogehilweg 18	24	14	162	5
Hogehilweg 8	21	14	147	4
Hatostraat 28	19	14	137	4
La Guardiaweg 36	25	16	173	5
Kingsfordweg 43	25	14	167	5
Hoogoorddreef 7	20	13	139	4
Herikerbergweg 181	26	14	172	5
Herikerbergweg 74	25	14	167	5
Gatwickstraat 9	22	14	152	4
Paasheuvelweg 3	23	10	145	4
Paasheuvelweg 1	21	12	141	4
Hogehilweg 24	24	12	156	4
Herikerbergweg 145	23	12	151	4
Herikerbergweg 35	22	11	143	4

Source: By author

7

CONCLUSION

To what extent can we make advantage of the shifting working patterns and transform current vacant office space in Amsterdam's business districts to create live-work mixed neighborhoods?

The changing urban dynamics and its impact on the housing and office markets in Amsterdam present both challenges and opportunities in cities (Rosenthal, Strange & Urrego, 2022; Gutpa et al., 2022; Nieuwerburgh, 2023). New hybrid and remote-working arrangements, aging inventory, competition with emerging and non-traditional submarkets, long commutes and a lack of consistent footfall due to limited residential populations continue to weigh on the short-term outlook for many office districts (JLL, 2023). The preference for working at the office and proximity to workplaces is diminishing, while the demand for access to amenities and green spaces is increasing (Lund et al., 2021). This shift in preferences exacerbates the housing crisis and contributes to the highest office vacancy rates ever observed in Amsterdam (CBRE, 2023).

To address these challenges, transformation emerges as a key intervention technique. Converting monofunctional office spaces into mixed residential-working areas is crucial for meeting housing targets and creating vibrant and attractive urban environments. Transformation aligns with the densification goals of Amsterdam and has the potential to revitalize neighborhoods, mitigate the negative externalities of vacancy, and contribute to the overall housing challenge.

The potential of a building for transformation is influenced by market, location, and building factors. While a tight market for the future function is a prerequisite for successful transformation, location plays a significant role in determining the potential for success. The research findings challenge the notion that office transformation is not feasible in non-attractive locations such as business districts (Avidar et al., 2007, Smit, 2007, Koppels et al., 2011). In fact, the transformation potential of vacant offices in these areas is even higher than anticipated by the Ministerie of Binnenlandse Zaken (2022), with 41% of the buildings exhibiting high to excellent potential for successful transformation.

By leveraging the high vacancy rates resulting from new working patterns, Amsterdam has an opportunity to transform the offices with excellent to high transformation potential in business districts into live-work mixed neighborhoods. According to theory, mixed-use development involves the combination of two or more functions, and in this case, the transformation of office spaces to include residential use expands the functions beyond just work (Hoppenbrouwer & Louw, 2005). By incorporating residential components, these areas have the potential to become vibrant mixed-use environments. This approach not only addresses the housing shortage but also enhances the quality of living and creates sustainable urban environments. The transformation of these spaces into mixed-use developments contributes to the diversity and vitality of urban areas, as they integrate residential and working functions, create vibrant communities, and maximize the usage, activity, and vitality of the city throughout the day, evening, and weekends.

The transformation of Amsterdam's vacant offices into live-work mixed neighborhoods is a promising solution that capitalizes on the changing urban dynamics of remote work, increases the quality of living, and tackles the housing shortage. With 41% of the vacant offices exhibiting strong transformation potential to develop 437 houses, Amsterdam has the opportunity to create vibrant, sustainable, and attractive urban areas that meet the evolving needs and preferences of its residents. By seizing this opportunity, Amsterdam can lead the way in leveraging the benefits of mixed-use developments and addressing pressing housing challenges while creating a dynamic and inclusive city. CBD's will shift from acting primarily as places of work towards being multi-purpose destinations.

Recommendations for praxis

An intriguing new theory regarding the relationship between building characteristics, location preferences, and transformation potential has emerged from this research. Contrary to previous studies that suggested a vacant building in a less desirable location, such as an office district, combined with favorable building characteristics would have no transformation potential, this research reveals a different perspective. It demonstrates that when building characteristics are given more weight than location preferences, the transformation potential in business districts becomes significantly higher. 51% of all office buildings in Amsterdam's monofunctional office areas have transformation potential, a significant increase from the 41% identified by the original meter.

In other words, the assessment of transformation potential shifts the focus from primarily considering location to considering the qualities and attributes of the building itself. This finding challenges earlier studies and suggests that a building with favorable characteristics can still hold potential for transformation, even within a less desirable location.

This begs the question of whether or not comparable tendencies can be observed in other cities and regions. Exploring this possibility would contribute to a greater understanding of the relationship between building characteristics, location preferences, and potential for transformation in a variety of urban contexts. If the trend observed in other areas holds true, it may be prudent for municipalities to prioritize area-based strategies within central business districts (CBDs). Municipalities can increase the potential for transformation and facilitate the development of mixed-use developments and residential properties by employing this strategy. The emphasis on a region-based strategy enables comprehensive planning and coordinated efforts to maximize the transformational benefits within CBDs.

To determine the generalizability of these findings and the efficacy of a region-based strategy, additional research in multiple cities and regions is required. Researchers and policymakers would be able to assess the consistency of the identified patterns and tailor interventions accordingly if they conducted comparative studies.

8

REFLECTION

The research titled "Maximizing the Benefits of Hybrid Working" explores the opportunities arising from the widespread adoption of remote work during and beyond the COVID-19 pandemic. Specifically, the study aims to investigate the creation of mixed-use development areas in Amsterdam, focusing on the transformation potential of vacant office buildings in monofunctional office districts. This scientific research can be put to use in practice to combat the societal issue of office vacancy with all its negative effects on its surroundings. While the thesis provides valuable insights into the qualitative aspect of transformation potential, a critical academic reflection highlights several unanswered questions, methodological limitations, and avenues for future research.

The research study leaves several questions unanswered. Firstly, the study does not consider potential unintended consequences or externalities arising from the creation of mixed-use development areas, such as changes in property values, displacement of existing communities, or increased pressure on infrastructure and services. The study should also explore the long-term effects of hybrid working on productivity, employee well-being, and the overall fabric of urban life.

The methodology employed in this research is a building-level case study, focusing on the individual transformation potential of office buildings. This decision was made considering the numerous factors that influence this potential. Through an extensive literature review, influential factors and measuring tools were identified, leading to the selection of the Transformation Meter as the primary tool for this study.

The Transformation Meter is deemed more flexible in its criteria modification compared to the ABT quickscan or Herbestemmingswijzer method. Moreover, it is accessible to both professionals and amateurs, distinguishing it from the other two tools.

The process of exploring different methodologies posed challenges. Initially, the intention was to examine the entire portfolio of Amsterdam, but this proved to be infeasible and excessively time-consuming. In response to feedback received, efforts were made to find a feasible approach within the available time frame. Consequently, the decision was made to concentrate solely on the qualitative aspect of the Transformation Meter. This choice was logical, considering the difficulties encountered in collecting the quantitative data required for steps 4 and 5 of the Transformation Meter. Additionally, even obtaining data for steps 1 to 3 was not always straightforward, often necessitating the creation of maps or calculation of criteria, resulting in a time-consuming yet rewarding process.

However, it is important to acknowledge that focusing on only one method introduces limitations to the research. Because the analysis conducted in this study solely relied on the qualitative aspect of the Transformation Meter. It must be recognized that the outcomes and conclusions might have differed if the financial feasibility and risk assessment steps (5 and 6) of the Transformation Meter had also been included. Incorporating these additional steps would have provided a more comprehensive understanding of the transformation potential of office buildings in Amsterdam's business districts.

Furthermore, it is essential to consider the variability in the definition of transformation potential among researchers, as it is influenced by factors such as the target group and specific locations under study. As a result, outcomes from previous research studies may vary due to these differing definitions and research parameters (criteria). Additionally, the outcomes may differ depending on the type of user utilizing the tool. Each user has the opportunity to modify the content of the steps, such as transforming a veto criterion into a gradual criterion and vice versa. This adaptability is a strength of the Transformation Meter; however, it can also become a weakness. Random alterations to the criteria may inadvertently exclude buildings with transformation potential or incorrectly classify buildings without potential, leading to inaccurate results. It is important to recognize that these strengths and weaknesses are stakeholder and user-specific. Therefore, the tool should be utilized as an initial indicator or feasibility scan before proceeding with further (floor)plans and cost analysis. Essentially, the tool serves as the first step towards initiating a transformation project. Consequently, providing a precise answer to the question of the exact number of suitable buildings for transformation and the potential number of transformed homes poses a challenge.

To address these limitations and improve the assessment of transformation potential, future research should aim to integrate a wider range of methodologies. This could involve combining the ABT quickscan, Herbestemmingswijzer, and Transformation Meter to obtain a more comprehensive evaluation.

Additionally, incorporating quantitative factors such as financial feasibility and risk assessment would provide a more thorough understanding of the viability and success of transformation initiatives. Considering multiple measuring tools and instruments would enable researchers to achieve a more accurate assessment of transformation potential and its implications. By leveraging the strengths of different methods, a more holistic picture can be formed. It is also crucial to establish standardized definitions of transformation potential and consistent research parameters across studies. This would facilitate better comparisons between research findings and contribute to an enhanced understanding of the topic.

In conclusion, although the current research offers valuable insights into the qualitative aspect of transformation potential, it is important to acknowledge the need for future studies to incorporate quantitative measures and broaden their scope. By adopting a more comprehensive approach that integrates various methodologies and considers additional factors, researchers can improve the accuracy and reliability of assessments regarding the suitability of buildings for transformation and the potential for developing transformed homes.

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REFERENCES

ABT. (2018). ABT Quickscan. https://www.abt.eu/expertise/speerpunten/bestaandegebouwen/haalbaarheidsonderzoek.aspx;

Accordino, J., & Johnson, G. T. (2000). Addressing the vacant and abandoned property problem. *Journal of Urban Affairs, 22*(3), 301-315. https://doi.org/10.1111/0735-2166.00058

Al Dakheel, J., Del Pero, C., Aste, N., & Leonforte, F. (2020). Smart buildings features and key performance indicators: *A review. Sustainable Cities and Society,* 61. https://doi.org/10.1016/j.scs.2020.102328

Angotti, T. & Hanhardt, E. (2001) Problems and prospects for healthy mixed-use communities in New York City, *Planning Practice & Research, 16*(2), pp. 145–154. http://dx.doi.org/10.1080/02697450120077352

AT5. (2023). *Teller huidig woningtekort regio Amsterdam staat op 45.000.* https://www.at5.nl/artikelen/219046/teller-huidig-woningtekort-regio-amsterdam-staat-op-45000

Aubry, M. (2015). Project management office transformations: Direct and moderating effects that enhance performance and maturity. *Project Management Journal, 46*(5), 19-45. https://doi.org/10.1002/pmj.21522

Avidar, P., Havik, K., & Wigger, B. (2007). Gentrification: stromen en tegenstromen. *Oase: journal for architecture, 73*, 9.

Baba, H., & Shimizu, C. (2022). The impact of apartment vacancies on nearby housing rents over multiple time periods: application of smart meter data. *International Journal of Housing Markets and Analysis*

Benraad, K., & Remøy, H. (2007). *Belevingswaarde.* Uitgeverij, 10.

Bernick, M. & Cervero, R. (1997) *Transit Villages in the 21st century.* New York, McGraw-Hill.

Binnenlandse Zaken en Koninkrijksrelaties. (2022). *Transformatie in cijfers: heden, verleden en perspectief.*

Boelhouwer, P. (2017). The role of government and financial institutions during a housing market crisis: A case study of the Netherlands. *International Journal of Housing Policy, 17*(4), 591-602. https://doi.org/10.1080/19491247.2017.1357399

BPD. (2021). *BPD Hittekaart 2021: woningdruk traditioneel hoog in Randstad* | BPD.nl. https://www.bpd.nl/actueel/persberichten/woningdruk-blijft-hoog-in-randstad-en-loopt-op-in-aantal-provincies/

Branas, C. C., Rubin, D., & Guo, W. (2012). Vacant properties and violence in neighborhoods. *International Scholarly Research Notices*. https://doi.org/10.5402/2012/246142

Breheny, M. (1992) The contradictions of the compact city: A review, in: M. Breheny (Ed.) *Sustainable Development and Urban Form*, pp. 138–159. http://dx.doi.org/10.1080/00420980500332064

Brink. (2017). *De reële transformatiepotentie in bestaand bebouwd gebied.* BPD. https://www.bpd.nl/media/120483/rapportage-transformatiepotentie-bestaande-stad-bpd.pdf

Buitelaar, E., Berge, V. D. M., Van Dongen, F., Weterings, A., & Van Maarsenveen, R. (2017). *De toekomst van kantoren : Een scenariostudie naar de ruimtebehoefte.* https://dspace.library.uu.nl/handle/1874/354556

Capital Value. (2023). *De woning (beleggings) markt in beeld.* Utrecht: Capital Value.

Centraal Bureau van de Statistiek. (2017). *Methodebeschrijving Landelijke Monitor Leegstand.* https://www.cbs.nl/-/media/_pdf/2017/07/leegstandsmonitor.pdf

Centraal Bureau voor de Statistiek. (2021a, 8 juni). *Spanning tussen vraag en aanbod woningmarkt verder toegenomen in 2020.* https://www.cbs.nl/nl-nl/nieuws/2021/23/spanning-tussen-vraag-en-aanbod-woningmarkt-verder-toegenomen-in-2020

Centraal Bureau voor de Statistiek. (2021b, november 7). *Minder kantoren getransformeerd tot woningen in 2020.* https://www.cbs.nl/nl-nl/nieuws/2021/45/minder-kantoren-getransformeerd-tot-woningen-in-2020

Centraal Bureau voor de Statistiek. (2022a). *Huishoudens nu.* https://www.cbs.nl/nl-nl/visualisaties/dashboard-bevolking/woonsituatie/huishoudens-nu#:~:text=Begin%202022%20waren%20er%208.gemiddelde%20huishoudensgrootte%20nog%203%2C53

Centraal Bureau voor de Statistiek. (2022b, July 5). *Prognose: in 2035 vooral meer inwoners in en om grotere gemeenten.* Centraal Bureau Voor De Statistiek. https://www.cbs.nl/nl-nl/nieuws/2022/27/prognose-in-2035-vooral-meer-inwoners-in-en-om-grotere-gemeenten

Centraal Bureau voor de Statistiek. (2022c). *Woonsituatie en woonbeleving van jongeren, 2012-2022.* https://www.cbs.nl/nl-nl/longread/statistische-trends/2022/woonsituatie-en-woonbeleving-van-jongeren-2012-2021?onepage=true

Centraal Bureau voor de Statistiek. (2022d) *10,5 duizend woningen door transformaties in 2021.* Centraal Bureau Voor De Statistiek. https://www.cbs.nl/nl-nl/nieuws/2022/44/10-5-duizend-woningen-door-transformaties-in-2021

Coenders, H., Hoogendoorn, D., & Buijs, M. (2022). *Verborgen leegstand in Nederland*. In colliers.com. https://www.colliers.com/download-article?itemId=63004aeb-e5bd-4251-9104-8a1b2264a1e8

Coupland, A. (1997) Reclaiming the city; Mixed Use Development. *Town Planning Review, 68*(4), 521-523.

Cushman & Wakefield. (2023). *LEEGSTAND KANTOREN OP HISTORISCH LAAG NIVEAU*. https://www.cushmanwakefield.com/nl-nl/netherlands/insights/historisch-lage-leegstand-kantorenmarkt

De Jonge, H. (2022, 10 june) *Versnelling Woningbouw* [kamerbrief].

Dieleman, M., Dijst, M. J. & Spit, T. (1999) Planning the compact city: The Randstad Holland experience, *European Planning Studies, 7*(5), pp. 605–621. https://doi.org/10.1080/09654319908720541

DiPasquale, D., & Wheaton, W. C. (1992). The markets for real estate assets and space: A conceptual framework. *Real Estate Economics, 20*(2), 181-198. https://doi.org/10.1111/1540-6229.00579

Djajadiningrat, B. (2013). *Waardering vanuit een herbestemmingspotentieel. Een methode om de waarde van structureel leegstaande kantoorgebouwen te bepalen*. https://repository.tudelft.nl/islandora/object/uuid%3A94e7e85c-4dad-40de-b284-3d6c4a98f70a

Doling, J., & Arundel, R. (2022). The home as workplace: a challenge for housing research. Housing, *Theory and Society, 39*(1), 1-20. http://dx.doi.org/10.1080/14036096.2020.184661 1

Duinen, L. B. J., Rijken, B., & Buitelaar, E. (2016). *Transformatiepotentie: woningbouwmogelijkheden in de bestaande stad*. PBL (Planbureau voor de Leefomgeving).

Hoppenbrouwer, E. & Louw, E. (2005) Mixed-use development: Theory and practice in Amsterdam's Eastern Docklands, *European Planning Studies, 13*(7), 967-983. https://doi.org/10.1080/09654310500242048

Felstead, A., & Henseke, G. (2017). Assessing the growth of remote working and its consequences for effort, well-being and work-life balance. *New Technology, Work and Employment, 32*(3), 195-212. http://dx.doi.org/10.1111/ntwe.12097

Fikse, R. (2008). *Transformatietools Uncovered: Een zoektocht naar de toepassingsmogelijkheden van de transformatie-instrumenten.* Technical University of Delft.

Furuseth, O. J. (1997) Neotraditional planning: a new strategy for building neighborhoods? Land Use Policy, 14(3), pp. 201–213. https://doi.org/10.1016/S0264-8377(97)00002-1

Gemeente Amsterdam (1984) *De stad centraal. Ontwerp structuurplan Amsterdam*. Het plan (Amsterdam: Gemeente Amsterdam).

Gemeente Amsterdam. (2022). *Monitor Kantoren Amsterdam: De post-corona kantorenmarkt*. https://assets.amsterdam.nl/publish/pages/971432/monitor_kantoren_amsterdam_stand_van_zaken_begin_2022.pdf

Geraedts, R. (2014). *Adapative capacity of buildings. A determination method to promote flexible and sustainable construction.* Technical University of Delft.

Geraedts, R. P., & Van der Voordt, D. J. M. (2003). Offices for living in: An instrument for measuring the potential for transforming offices into homes. *Open House International, 28*(3), 80-90.

Geraedts, R. P., & van der Voordt, T. (2007). *Transformatiepotentiemeter. Transformatie van kantoorgebouwe: thema's, actoren, instrumenten en projecten.* Technical University of Delft.

Geraedts, R. P., van der Voordt, D. J. M., & Remøy, H. T. (2017). *Conversion Meter; A new tool to assess the conversion potential of vacant office buildings into housing*. Green Lines Institute for Sustainable Development. https://doi.org/10.1080/09613218.2014.865922

Gool, van, P., Jager, P., Theebe, M. & Weisz, R. (2013). *Onroerend goed als belegging.* Noordhoff Uitgevers, Groningen.

Grant, J. (2002) Mixed use in theory and practice; Canadian experience with implementing a planning principle, *Journal of the American Planning Association, 68*(1), pp. 71–84. http://dx.doi.org/10.1080/01944360208977192

Gupta, A., Mittal, V., & Van Nieuwerburgh, S. (2022). *Work from home and the office real estate apocalypse* (No. w30526). National Bureau of Economic Research. https://dx.doi.org/10.2139/ssrn.4124698

Gyourko, J. E. & Rybczynski, W. (2000) Financing new urbanism projects: Obstacles and solutions, *Housing Policy Debate, 11*(3), pp. 733–750. http://dx.doi.org/10.1080/10511482.2000.9521384

Harrison, H., Birks, M., Franklin, R., & Mills, J. (2017). Case study research: Foundations and methodological orientations. *Forum qualitative social research, 18*(1). https://doi.org/10.17169/fqs-18.1.2655

Hek, M., & Kamstra, J. (2004). *Herbestemmingswijzer.* (2nd ed.) Publikatieburo.

Jacobs, J. (1961) *The Death and Life of Great American Cities* (1st ed.) Pimlico.

Koppels, P. W., Remøy, H. T., & El Messlaki, S. (2011). *The negative externalities of structurally vacant offices: An exploration of externalities in the built environment using hedonic price analysis.* Technical University of Delft.

Kvit, A., Corrigan, A. E., Locke, D. H., Curriero, F. C., & Mmari, K. (2022). Can restoring vacant lots help reduce crime? An examination of a program in Baltimore, MD. *Urban Forestry & Urban Greening,* 74, 127630. http://dx.doi.org/10.1016/j.ufug.2022.127630

Kylili, A., Afxentiou, N., Georgiou, L., Panteli, C., Morsink-Georgalli, P. Z., Panayidou, A., ... & Fokaides, P. A. (2020). The role of Remote Working in smart cities: lessons learnt from COVID-19 pandemic. Energy Sources, Part A: Recovery, *Utilization, and Environmental Effects*, 1-16. https://doi.org/10.1080/15567036.2020.1831108

Lund, S., Madgavkar, A., Manyika, J., Smit, S., Ellingrud, K., Meaney, M., & Robinson, O. (2021). *The future of work after COVID-19*. www.mckinsey.com/mgi.

Lynch, K. (2000) *Good City Form, Originally published: A theory of good city form*. (12th ed.) Cambridge, MA: MIT Press.

MacDonald, J., Jacobowitz, A., Gravel, J., Smith, M., Stokes, R., Tam, V., & Branas, C. (2023). Lessons learned from a citywide abandoned housing experiment. *Journal of the American Planning Association,* 1-14. https://doi.org/10.1080/01944363.2022.2128855

Moses, J. W., & Knutsen, T. L. (2019). *Ways of knowing: Competing methodologies in social and political research.* Bloomsbury Publishing.

Nieman Groep. (2016). *Verbouwen en transformeren met Bouwbesluit 2012.* https://www.rijksoverheid.nl/.../verbouwen-en-transformeren-met-bouwbesluit-2012

Nilles, J. M. (1972). TRAFFIC REDUCTION BY TELECOMMUTING: A STATUS REVIEW AND SELECTED BIBLIOGRAPHY. *Transportation Research Part A: General, 22*(4), 301–317. https://doi.org/https://doi.org/10.1016/0191-2607(88)90008-8

NOS. (2021). nos.nl. *Grote werkgevers gaan na corona kantoorruimte schrappen.* https://nos.nl/nieuwsuur/artikel/2366749-grote-werkgevers-gaan-na-corona-kantoorruimte-schrappen

NS. (2021). *Reizigersgedrag*. ns.nl. https://dashboards.nsjaarverslag.nl/reizigersgedrag

NVM (2022) *Kantoren in cijfers*. NVM.nl. https://www.nvm.nl/media/dnin504s/20210630-web-spread-nvm-kantoren-in-cijfers-2021.pdf

Phillips, S. (2020). Working through the pandemic: Accelerating the transition to remote working. *Business Information Review, 37*(3), 129-134. https://doi.org/10.1177/0266382120953087

Planbureau voor de leefomgeving. (2017). *Leegstand van kantoren 1991-2017.* pbl.nl. http://www.pbl.nl/infographic/leegstand-van kantoren#gemnr=599&year=2017&type=kantoren

Plegt-Vos. (2022). *The Frame Building Amsterdam*. Plegt-Vos.nl. https://www.plegt-vos.nl/projecten/the-frame-building-amsterdam/

Remøy, H. & Van der Voordt, T. (2014) Adaptive reuse of office buildings into housing: opportunities and risks, *Building Research & Information, 42*(3), 381-390. https://doi.org/10.1080/09613218.2014.865922

Remøy, H. De Jong, P., Schenk, W. (2011) "Adaptable office buildings", *Property Management, 29*(5), 443-453. https://doi.org/10.1108/02637471111178128

Remøy, H. (2010). *Out of office: a study on the cause of office vacancy and transformation as a means to cope and prevent*. Technical University of Delft.

Remøy, H., & Van der Voordt, T. (2014) Adaptive reuse of office buildings into housing: opportunities and risks, *Building Research & Information, 42*(3), 381-390, https://doi.org/10.1080/09613218.2014.865922

Remøy, H., & van der Voordt, DJM. (2007). A new life: Conversion of vacant office buildings into housing. *Facilities, 25*(3), 88-103. https://doi.org/10.1108/02632770710729683

RNHB. (z.d.). *Is het transformeren van vastgoed duurzamer dan nieuwbouw?* rnhb.nl. https://www.rnhb.nl/nieuws/zijn-transformaties-per-definitie-duurzamer-dan-nieuwbouw

Rodermond, W., & Van Gool, P. (2011). *Het taxeren van leegstaande kantoorruimte.* vastgoedbibliotheek.nl/Server/getfile.aspx?file=docs/mre/11/rodermond.pdf

Rosenthal, S. S., Strange, W. C., & Urrego, J. A. (2022). JUE insight: Are city centers losing their appeal? Commercial real estate, urban spatial structure, and COVID-19. *Journal of Urban Economics, 127*(2). https://doi.org/10.1016/j.jue.2021.103381

Rowley, A. (1996) Mixed-use development: Ambiguous concept, simplistic analysis and wishful thinking?, *Planning Practice and Research, 11*(1), pp. 85–97. https://doi.org/10.1080/02697459650036477

Savills. (2022). *Spotlight: European Remote Working: Office Demand Impact.* https://pdf.euro.savills.co.uk/european/european-remote-working-impact-analysis.pdf

Schilling, J. M. (2002). *The revitalization of vacant properties.* ICMA (International City/County Management Association), Washington, DC.

Sivak, C. J., Pearson, A. L., & Hurlburt, P. (2021). Effects of vacant lots on human health: A systematic review of the evidence. *Landscape and Urban Planning, 208*(5). http://dx.doi.org/10.1016/j.landurbplan.2020.104020

Smit, A. J. (2007). *Transformatie van verouderde bedrijventerreinen. In Transformatie van kantoorgebouwen. Thema's, actoren, instrumenten en projecten.* 306-317. Technical University of Delft.

Stanton, C. T., & Tiwari, P. (2021). *Housing consumption and the cost of remote work.* National Bureau of Economic Research. Harvard University

Sullivan, C. (2012). Remote working and work-life balance. In Work and Quality of Life: *Ethical Practices in Organizations.* Springer Netherlands. https://doi.org/10.1007/978-94-007-4059-4_15

Suzuki, M., Hino, K., & Muto, S. (2022). Negative externalities of long-term vacant homes: Evidence from Japan. *Journal of Housing Economics, 57*(2). https://doi.org/10.1016/j.jhe.2022.101856

Urban Land Institute (1987) *Mixed-use Development Handbook.* Washington, DC: Urban Land Institute.

Van Nieuwerburgh, S. (2023). The remote work revolution: Impact on real estate values and the urban environment: 2023 *Real Estate Economics, 51*(1), 7-48. https://dx.doi.org/10.2139/ssrn.4309711

Veldhoven, E., & Piepers, B. (1995). *Demise of the office.* Rotterdam: Uitgeverij, 10

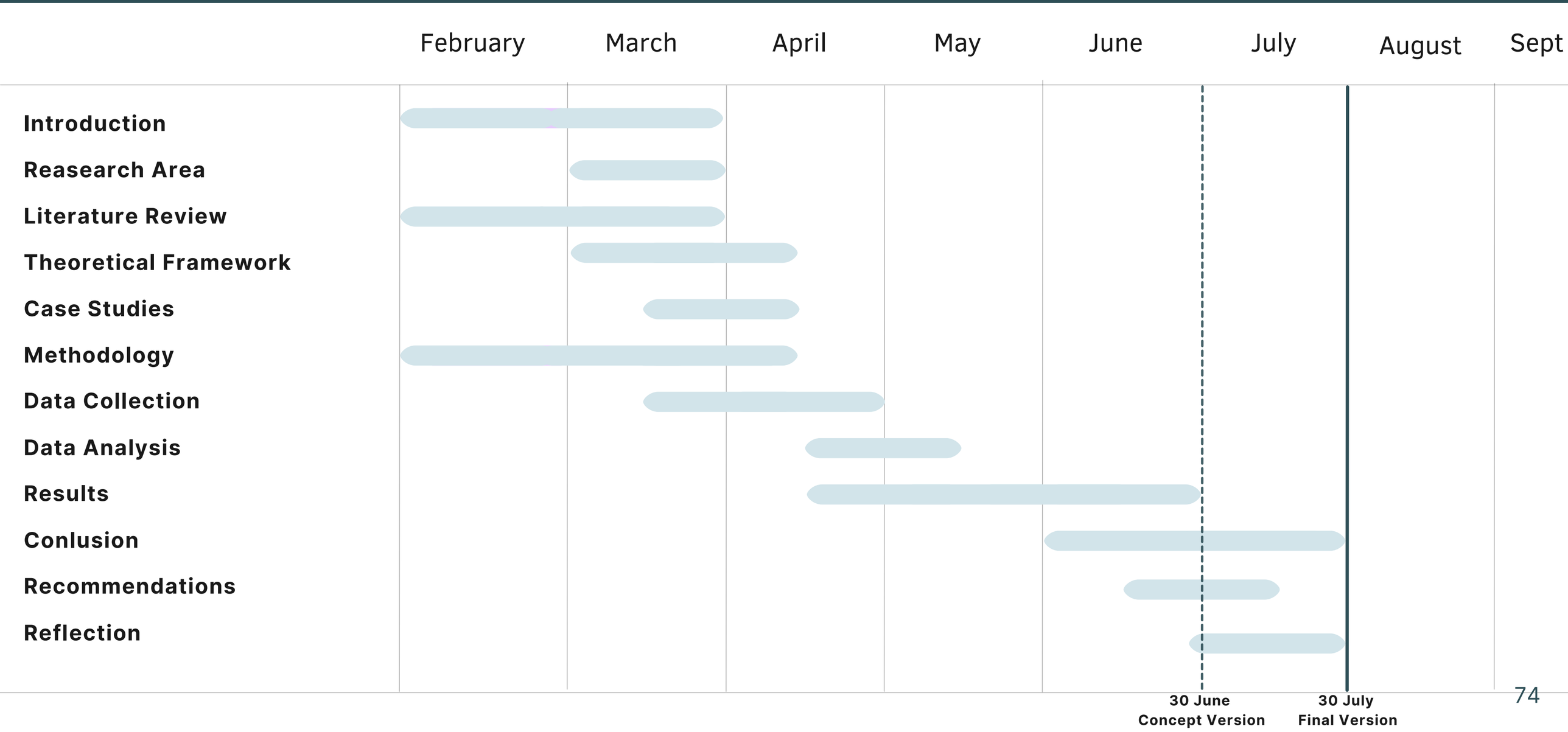
vom Hofe, R., Parent, O., & Grabill, M. (2019). What to do with vacant and abandoned residential structures? The effects of teardowns and rehabilitations on nearby properties. *Journal of Regional Science, 59*(2), 228-249. http://dx.doi.org/10.1111/jors.12413

Yu, R., Burke, M., & Raad, N. (2019). Exploring impact of future flexible working model evolution on urban environment, economy and planning. *Journal of Urban Management, 8*(3), 447–457. https://doi.org/10.1016/j.jum.2019.05.002

Zonneveld, W., & Nadin, S. (2021). The Randstad: a polycentric metropolis? *European Planning Studies*, 1–2. https://doi.org/10.1080/09654313.2021.1955456

Zuidema, M., & Van Elp, M. (2010). *kantorenleegstand probleemanalyse en oplosrichtingen*. eib.nl.https://www.eib.nl/files/Kantorenleegstand_Probleemanalyse%20en%20oplossingsrichtingen.pdf.

10. TIME PLANNING



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APPENDICES

APPENDIX 1: VACANT OFFICE SPACE AMSTERDAM

Address	City	Building name	Grade	Rent	State	Surface	Latitude	Longtitude
Donauweg 2 b	Amsterdam	Donauweg 2B	C	165	New: develo	4607	52,3960764	4,8381248
Zekeringstraat 7	Amsterdam		C	125	Existing	1130	52,3962537	4,8542599
van Houten Industriepark 11	Amsterdam		C	150	Existing	2000	52,3062441	5,035186
tt. Melissaweg 23	Amsterdam		C	150	Existing	2600	52,4067892	4,8838287
Pilotenstraat 6	Amsterdam	De Piloot	C	265	Existing	500	52,3422293	4,8430544
Overschiestraat 182	Amsterdam		C	85	Existing	1761	52,3443353	4,8368675
Overschiestraat 55	Amsterdam	Sinus Pl	C	170	Existing	1271	52,3478112	4,8400434
Joan Muyskenweg 40 - 148	Amsterdam	Ankestyn	C	185	Existing	2327	52,3254183	4,9188931
Jan Evertsenstraat 717	Amsterdam	Vliegbasis De Huygens	C	75	Existing	880	52,3696223	4,8359496
Harriet Freezerstraat 115 - 199	Amsterdam		C	150	Existing	573	52,323144	4,9725801
Gyroscoopweg 144A	Amsterdam		C	95	Existing	980	52,4015888	4,8433321
Gyroscoopweg 134 - 140	Amsterdam		C	95	Existing	644	52,4004955	4,842911
Gyroscoopweg 62	Amsterdam	AMS 1 + AMS 4	C	90	Existing	527	52,3998303	4,8428018
Gyroscoopweg 50	Amsterdam	AMS 1 + AMS 4	C	90	Existing	750	52,4001458	4,841685
Gedempt Hamerkanaal 127 -183	Amsterdam	De Overkant	C	99	Existing	5000	52,38249355	4,921938202
Entrada 300	Amsterdam	Entrada 300	C	115	Existing	723	52,331034	4,9310298
Corsicaweg 10	Amsterdam	Westhavengebouw	C	95	Existing	2785	52,4021632	4,8115896
Contactweg 129	Amsterdam		C	140	Existing	711	52,3980394	4,8531395
Buitenveer 25	Amsterdam		C	75	Existing	592	52,3081272	5,035937
Basisweg 52	Amsterdam		C	114.29	Existing	1925	52,3921306	4,8211485
Assumburg 73	Amsterdam	Assumburg	C	180	Existing	870	52,3282494	4,8672404
H.J.E. Wenckebachweg 210	Amsterdam	Arcos	B	185	New: develo	799	52,3362734	4,9376381
Oostenburgermiddenstraat 6	Amsterdam	Oostenburg	B	270	New: compl	947	52,3704934	4,9258539
Hoogoorddreef 60 62	Amsterdam	Centerpoint I	B	195	New: compl	1963	52,310907	4,9445133
Windroosplein 73	Amsterdam		B		Existing	611	52,3736678	4,9245789
Willem Fenengastraat 19 en 23	Amsterdam		B	245	Existing	1740	52,3334487	4,9171106
Weteringschans 109	Amsterdam	Weteringpoort	B	375	Existing	1048	52,3608234	4,8877485
Westerstraat 187	Amsterdam	Westerhuis	B	450	Existing	889	52,3779528	4,8819235
Wamberg 35	Amsterdam	Edge Offices	B	250	Existing	652	52,3276348	4,8858669
Vliegtuigstraat 26	Amsterdam	AF-61	B	245	Existing	570	52,3402448	4,8428206
Turbinestraat 6	Amsterdam		B	145	Existing	1878	52,3906251	4,8533522
Transformatorweg 74	Amsterdam	Quarter Plaza	B	215	Existing	1321	52,3927031	4,8477172
Spaklerweg 53	Amsterdam	Spaklerweg 53	B	145	Existing	1750	52,3301479	4,9276761
Singel 120	Amsterdam		B	295	Existing	600	52,3761118	4,8906257
Rietlandpark 309	Amsterdam	Quintet Office Park	B	245	Existing	6688	52,3742364	4,9318879
Rhijnspoorplein 10	Amsterdam	Sarphati Plaza	B	350	Existing	650	52,3608054	4,9074769
Radarweg 60	Amsterdam	Motion building	B	200	Existing	2100	52,3910663	4,835225
Radarweg 29 A/B	Amsterdam	Millennium Toren	B	235	Existing	7520	52,393327	4,8372259
Pietersbergweg 273	Amsterdam	De Poort	B	215	Existing	1848	52,2988614	4,9537167
Pietersbergweg 199	Amsterdam	Carol	B	220	Existing	593	52,2988374	4,9549282
Pieter Braaijweg 6	Amsterdam		B	185	Existing	3850	52,3297057	4,9232935
Pedro de Medinalaan 11	Amsterdam		B	199	Existing	1199	52,3634449	4,9774002
Paleisstraat 1	Amsterdam		B	375	Existing	936	52,3726371	4,8917277
Paasheuvelweg 3	Amsterdam		B	195	Existing	815	52,2995798	4,9524382
Paasheuvelweg 1	Amsterdam	Officio	B	210	Existing	769	52,3002017	4,951513
Overschiestraat 63	Amsterdam		B	200	Existing	1492	52,3444646	4,8398431
Osdorpplein 470	Amsterdam		B	185	Existing	741	52,3590883	4,802993
Naritaweg 142	Amsterdam	Paviljoen 3	B	175	Existing	2093	52,3879769	4,8219077
Naritaweg 70	Amsterdam	Sykes	B	160	Existing	1052	52,3882855	4,8251567
Max Euweplein 24 - 38	Amsterdam		B	275	Existing	792	52,3621728	4,8832714
Kuiperbergweg 50	Amsterdam		B	170	Existing	864	52,2996275	4,9413569
Kingsfordweg 151	Amsterdam	Teleport Tower	B	215	Existing	4000	52,3856056	4,8433463
Keizersgracht 390 - 392	Amsterdam		B	350	Existing	957	52,3691404	4,8840894
Karspeldreef 8	Amsterdam	The Yard	B	205	Existing	1732	52,3053741	4,9493292
Kabelweg 57	Amsterdam	Vida Gebouw	B	195	Existing	983	52,3947845	4,8462526
Kabelweg 37	Amsterdam	Coengebouw	B	210	Existing	4865	52,3924801	4,8465229
Joop Geesinkweg 901 -915	Amsterdam	The Grey	B	149	Existing	4521	52,3353783	4,9351404
Joop Geesinkweg 501 -801	Amsterdam	The Campus	B	185	Existing	2673	52,334194	4,9320822
Joop Geesinkweg 203	Amsterdam	A'dammium	B	210	Existing	1500	52,333988	4,9312236
Johan Cruijff Boulevard 83	Amsterdam		B	225	Existing	672	52,3129358	4,9424656
Jarmuiden 52	Amsterdam		B	90	Existing	530	52,3906627	4,7909676
James Wattstraat 100	Amsterdam	100 WATT	B	325	Existing	629	52,3489327	4,9200102
Hullenbergweg 278	Amsterdam	'Vogelstruys'	B	205	Existing	2243	52,3050966	4,9517278
Hullenbergweg 81 135	Amsterdam	Tricity	B	195	Existing	2545	52,3037577	4,9501022
Hoogoorddreef 62	Amsterdam	Centerpoint II	B	195	Existing	2741	52,310485	4,9446452
Hogehilweg 24	Amsterdam	Hill Side	B	215	Existing	3720	52,3066445	4,9488308
Hogehilweg 21	Amsterdam		B	195	Existing	2228	52,3077171	4,9492382
Hogehilweg 18	Amsterdam	Prismatrium	B	185	Existing	1035	52,3063212	4,9492828
Hogehilweg 8	Amsterdam	Keynes Club	B	205	Existing	948	52,3057695	4,9478449
Herikerbergweg 145	Amsterdam	Mercurius Minerva	B	205	Existing	13169	52,307676	4,9420715
Herengracht 609	Amsterdam		B	385	Existing	893	52,36564	4,899272
Herengracht 476	Amsterdam		B	315	Existing	916	52,3650263	4,891598
Helmholtzstraat 61	Amsterdam	Huygensdok	B	225	Existing	1924	52,3498847	4,9396397
Helicopterstraat 25A	Amsterdam		B	295	Existing	777	52,3403598	4,8449541
Hatostraat 28	Amsterdam		B	220	Existing	1507	52,3897057	4,8413264
Frederiksplein 1	Amsterdam		B	450	Existing	681	52,3612622	4,8999587
Elsrijkdreef 207	Amsterdam		B	145	Existing	905	52,3228958	4,9728926
De Ruijterkade 7	Amsterdam	Het Havengebouw	B	375	Existing	959	52,3814586	4,8954417
De Cuserstraat 85	Amsterdam	Cuserpark	B	325	Existing	1753	52,3233562	4,8588722
De Cuserstraat 83 91	Amsterdam	Cuserpark, Vecht	B	325	Existing	2203	52,3233418	4,8589249
De Boelelaan 30	Amsterdam	Stage	B	300	Existing	720	52,3351596	4,8863029
David Ricardostraat 1	Amsterdam	Say Buildings	B	225	Existing	4943	52,3408831	4,8270756
Cruquiusweg 102 - 104	Amsterdam		B	250	Existing	1568	52,3679779	4,9522986
Cronenburg 150 -152	Amsterdam	Cronenburg	B	235	Existing	673	52,3285776	4,8611656
Contactweg 60	Amsterdam	Contactweg 60-66	B	145	Existing	739	52,3961212	4,8556653
Burgemeester Stramanweg 102 HNK	Amsterdam	HNK	B	195	Existing	4173	52,3093001	4,9311565
Bos en Lommerplein 270	Amsterdam	Bruggebouw Noord	B	185	Existing	3752	52,3780049	4,8447233
Bijlmerplein 393	Amsterdam	De Flier	B	210	Existing	563	52,3155664	4,9537543
Bijlmerdreef 101	Amsterdam		B	195	Existing	4131	52,3145236	4,9508084
Baarsjesweg 224	Amsterdam	De Admiraal	B	200	Existing	645	52,3634931	4,8580308
Papaverhof 69	Amsterdam	Republica	A	200	New: develo	1102	52,33365719	4,91995211
Nicolaas Tetterodestraat 13	Amsterdam	Nationale Balletacademie	A	285	New: develo	1224	52,360142	4,8434597
Nachtwachtlaan 20	Amsterdam	Rembrandt Park One	A	300	New: develo	19601	52,2909008	4,952853
Meibergdreef 9	Amsterdam	Plus Ultra Amsterdam	A	260	New: develo	7368	52,3777426	4,8900343
Herengracht 54	Amsterdam	The Collection no. 8	A	450	New: develo	665	52,39341681	4,898473567
Grasweg 228	Amsterdam		A	235	New: develo	651	52,3398636	4,8697456
Strawinskylaan 3001	Amsterdam	Atrium Zuidtoren	A	450	New: compl	4515	52,34051141	4,873686351
Strawinskylaan 1865	Amsterdam	World Trade Center	A	500	New: compl	12000	52,4014707	4,8898478
NDSM-pier 2	Amsterdam	South Dock (NDSM-Pier 2)	A	285	New: compl	1253	52,3992064	4,8702529
Moermanskkade 600	Amsterdam	Flow	A	285	New: compl	1435	52,3268984	4,9150841
Joan Muyskenweg 28 -32	Amsterdam	The Joan	A	255	New: compl	15550	52,39397215	4,873918614
Houthavenweg 105	Amsterdam		A	277	New: compl	881	52,3072529	4,9416397
Herikerbergweg 288 -290	Amsterdam	Gaudi	A	260	New: compl	8660	52,3403566	4,8715919
Eduard van Beinumstraat 4 -36	Amsterdam	2Amsterdam	A	450	New: compl	9047	52,3981981	4,8486678
Dynamostraat 11	Amsterdam		A	175	New: compl	1691	52,4135074	4,8773807
Disketteweg 53	Amsterdam	CD ONE	A	195	New: compl	1250	52,3687955	4,9545549
Cruquiusweg 110	Amsterdam	Cruquiuswerf Blok D	A	225	New: compl	1381	52,3496827	4,9177074
Wibautstraat 137	Amsterdam	Delphi	A	295	Existing	657	52,3613495	4,8870523
Weteringschans 81	Amsterdam	The Collection, Chapter 9	A	450	Existing	1113	52,3658155	4,8926716
Vijzelstraat 20	Amsterdam	De Vyzel	A	395	Existing	2773	52,4050959	4,8925655
tt. Vasumweg 58 A	Amsterdam	The Curve	A	250	Existing	1442	52,3400057	4,8241514
Thomas R. Malthusstraat 1 3	Amsterdam	Adam Smith Building	A	199	Existing	6896	52,331217	4,9223695
Spaklerweg 50 -52	Amsterdam	Antonian	A	250	Existing	6420	52,3747888	4,8901043

APPENDIX 1: VACANT OFFICE SPACE AMSTERDAM

Singel 151	Amsterdam	The Collection no. 7	A	450	Existing	1282	52,3719956	4,8926323
Rokin 16	Amsterdam	Rokin Plaza	A	450	Existing	1463	52,3536546	4,8624219
Prins Hendriklaan 27	Amsterdam		A	331.91	Existing	1401	52,353877	4,861994
Prins Hendriklaan 26	Amsterdam		A	390	Existing	512	52,3478675	4,9197613
Prins Bernhardplein 200	Amsterdam	Amstelgebouw	A	325	Existing	9096	52,3398935	4,8433203
Pilotenstraat 32 45	Amsterdam	A-factorij	A	300	Existing	5773	52,3625624	4,9764813
Pedro de Medinalaan 53	Amsterdam	DeXXX	A	210	Existing	700	52,3838648	4,9015472
Overhoeksplein 1	Amsterdam	A'DAM Toren	A	350	Existing	1000	52,3900857	4,837497
Orlyplein 73 -97	Amsterdam	Busitel I	A	215	Existing	695	52,3764786	4,9070981
Oosterdoksstraat 80	Amsterdam	De Alexander	A	350	Existing	1634	52,3905681	4,9376684
Nieuwendammerkade 26A	Amsterdam		A	235	Existing	940	52,403615	4,888655
mt. Lincolnweg 38	Amsterdam	Number One	A	260	Existing	4826	52,34625	4,8729732
Minervalaan 63	Amsterdam		A	350	Existing	856	52,3912444	4,8393094
La Guardiaweg 36	Amsterdam	Bright Offices	A	235	Existing	5748	52,3864741	4,8431787
Kingsfordweg 43	Amsterdam	Q Port	A	200	Existing	3612	52,3639101	4,8938953
Keizersgracht 617	Amsterdam	De Olifant	A	460	Existing	3931	52,3711445	4,8851807
Keizersgracht 271 287	Amsterdam	5Keizers	A	425	Existing	2412	52,3717649	4,8852324
Keizersgracht 253	Amsterdam		A	295	Existing	625	52,3700256	4,8911597
Kalverstraat 110 2	Amsterdam		A	295	Existing	623	52,3770386	4,9198461
Jollemanhof 6 20	Amsterdam	Huys Azië	A	350	Existing	980	52,3415775	4,8238541
John M. Keynesplein 10	Amsterdam	Keynes Building	A	225	Existing	1700	52,3518427	4,8676974
Jan van Goyenkade 11	Amsterdam		A	437.71	Existing	594	52,354558	4,8761338
Jacob Obrechtstraat 56	Amsterdam		A	400	Existing	527	52,3364436	4,8530724
Jachthavenweg 112	Amsterdam	Harbour House	A	425	Existing	2466	52,3362114	4,854837
Jachthavenweg 111	Amsterdam	Zuiderhof II	A	225	Existing	2200	52,3083192	4,9459162
Hoogoorddreef 7	Amsterdam	Australië	A	235	Existing	1261	52,3090589	4,9474237
Hoogoorddreef 5	Amsterdam	Atlas Arena Azië	A	235	Existing	1176	52,3117947	4,9494485
Hoekenrode 1	Amsterdam	Nieuw Amsterdam	A	250	Existing	1617	52,3070902	4,9428845
Herikerbergweg 181	Amsterdam	Diana & Vesta	A	225	Existing	3260	52,3084793	4,9429726
Herikerbergweg 74 .	Amsterdam	Jupiter	A	230	Existing	1561	52,3075831	4,943596621
Herikerbergweg 1 - 35	Amsterdam	Apollo	A	245	Existing	4128	52,366431	4,889374
Herengracht 459	Amsterdam	Gouden Bocht	A	425	Existing	3164	52,336308	4,8739783
Gustav Mahlerplein 3 -117	Amsterdam	Symphony Offices	A	425	Existing	3249	52,3910728	4,8430135
Gatwickstraat 9	Amsterdam	Quarter Podium	A	215	Existing	1463	52,3445728	4,926126
Fahrenheitstraat 99	Amsterdam	Fahrenheitstraat 99	A	315	Existing	1060	52,3136838	4,9391598
De passage 126	Amsterdam	New Loft Office	A	265	Existing	2500	52,3100817	4,9409277
De entree 230	Amsterdam	Entrée II	A	235	Existing	2015	52,3119428	4,9408994
De entree 201	Amsterdam	B-Vital	A	260	Existing	19553	52,3123802	4,9401631
De entree 99 197	Amsterdam	Oval Tower	A	240	Existing	9180	52,3107039	4,9418065
De entree 11	Amsterdam	Alpha Tower	A	265	Existing	1990	52,3963825	4,8764384
Danzigerbocht 23	Amsterdam		A	189	Existing	2100	52,3139034	4,9474525
Bijlmerdreef 24	Amsterdam	Acanthus	A	250	Existing	12000	52,3357345	4,8889413
Barbara Strozzilaan 336	Amsterdam	Eurocenter II	A	275	Existing	1459	52,3888773	4,9046349
Asterweg 1 -15	Amsterdam	Max & Moore	A	260	Existing	2515	52,3498635	4,8711904
Apollolaan 153	Amsterdam	Apollo	A	395	Existing	533	52,3361124	4,8846098
Antonio Vivaldistraat 66	Amsterdam	Vivaldi	A	375	Existing	805	52,344695	4,9175637
Amstelplein 6	Amsterdam	Mondriaan Toren	A	390	Existing	5755	52,39530397	4,905893707

APPENDIX 2: VACANT OFFICE SUPPLY MONOFUNCTIONAL AREAS

	Address	City	Building name	Grade	Rent	State	Surface sqm	Latitude	Longtitude
1	**Pilotenstraat 6**	Amsterdam	De Piloot	C	265	Existing	500	52,3422293	4,8430544
2	**Gedempt Hamerkanaal 127 -183**	Amsterdam	De Overkant	C	99	Existing	5000	52,38249355	4,921938202
3	**Hoogoorddreef 60**	Amsterdam	Centerpoint I	B	195	New: complet	1963	52,310907	4,9445133
4	**Vliegtuigstraat 6**	Amsterdam	AF-61	B	245	Existing	570	52,3402448	4,8428206
5	**Radarweg 60**	Amsterdam	Motion building	B	200	Existing	2100	52,3910663	4,835225
6	**Pietersbergweg 273**	Amsterdam	De Poort	B	215	Existing	1848	52,2988614	4,9537167
7	**Pietersbergweg 199**	Amsterdam	Carol	B	220	Existing	593	52,2988374	4,9549282
8	**Paasheuvelweg 3**	Amsterdam		B	195	Existing	815	52,2995798	4,9524382
9	**Paasheuvelweg 1**	Amsterdam	Officio	B	210	Existing	769	52,3002017	4,951513
10	**James Wattstraat 100**	Amsterdam	100 WATT	B	325	Existing	629	52,3489327	4,9200102
11	**Hullenbergweg 278**	Amsterdam	'Vogelstruys'	B	205	Existing	2243	52,3050966	4,9517278
12	**Hullenbergweg 81 135**	Amsterdam	Tricity	B	195	Existing	2545	52,3037577	4,9501022
13	**Hoogoorddreef 62**	Amsterdam	Centerpoint II	B	195	Existing	2741	52,310485	4,9446452
14	**Hogehilweg 24**	Amsterdam	Hill Side	B	215	Existing	3720	52,3066445	4,9488308
15	**Hogehilweg 21**	Amsterdam		B	195	Existing	2228	52,3077171	4,9492382
16	**Hogehilweg 18**	Amsterdam	Prismatrium	B	185	Existing	1035	52,3063212	4,9492828
17	**Hogehilweg 8**	Amsterdam	Keynes Club	B	205	Existing	948	52,3057695	4,9478449
18	**Herikerbergweg 145**	Amsterdam	Mercurius Minerva	B	205	Existing	13169	52,307676	4,9420715
19	**Helicopterstraat 25A**	Amsterdam		B	295	Existing	777	52,3403598	4,8449541
20	**Hatostraat 28**	Amsterdam		B	220	Existing	1507	52,3897057	4,8413264
21	**De Boelelaan 30**	Amsterdam	Stage	B	300	Existing	720	52,3351596	4,8863029
22	**Strawinskylaan 3001**	Amsterdam	Atrium Zuidtoren	A	450	New: complet	4515	52,34051141	4,873686351
23	**Strawinskylaan 1865**	Amsterdam	World Trade Center	A	500	New: complet	12000	52,4014707	4,8898478
24	**Eduard van Beinumstraat 4 -36**	Amsterdam	2Amsterdam	A	450	New: complet	9047	52,3981981	4,8486678
25	**Wibautstraat 137**	Amsterdam	Delphi	A	295	Existing	657	52,3613495	4,8870523
26	**Prins Bernhardplein 200**	Amsterdam	Amstelgebouw	A	325	Existing	9096	52,3398935	4,8433203
27	**Pilotenstraat 32 45**	Amsterdam	A-factorij	A	300	Existing	5773	52,3625624	4,9764813
28	**Orlyplein 73 -97**	Amsterdam	Busitel I	A	215	Existing	695	52,3764786	4,9070981
29	**La Guardiaweg 36**	Amsterdam	Bright Offices	A	235	Existing	5748	52,3864741	4,8431787
30	**Kingsfordweg 43**	Amsterdam	Q Port	A	200	Existing	3612	52,3639101	4,8938953
31	**Jachthavenweg 112**	Amsterdam	Harbour House	A	425	Existing	2466	52,3362114	4,854837
32	**Jachthavenweg 109**	Amsterdam	Zuiderhof II	A	225	Existing	2200	52,3083192	4,9459162
33	**Hoogoorddreef 7**	Amsterdam	Australië	A	235	Existing	1261	52,3090589	4,9474237
34	**Herikerbergweg 181**	Amsterdam	Diana & Vesta	A	225	Existing	3260	52,3084793	4,9429726
35	**Herikerbergweg 74**	Amsterdam	Jupiter	A	230	Existing	1561	52,3075831	4,943596621
36	**Herikerbergweg 35**	Amsterdam	Apollo	A	245	Existing	4128	52,366431	4,889374
38	**Gustav Mahlerplein 3 -117**	Amsterdam	Symphony Offices	A	425	Existing	3249	52,3910728	4,8430135
39	**Gatwickstraat 9**	Amsterdam	Quarter Podium	A	215	Existing	1463	52,3445728	4,926126
40	**Barbara Strozzilaan 336**	Amsterdam	Eurocenter II	A	275	Existing	1459	52,3888773	4,9046349
41	**Antonio Vivaldistraat 66**	Amsterdam	Vivaldi	A	375	Existing	805	52,344695	4,9175637
42	**Amstelplein 6**	Amsterdam	Mondriaan Toren	A	390	Existing	5755	52,39530397	4,905893707

APPENDIX 3: STEP 1: TRANSFORMATION METER AMSTERDAM 2023

Address	6+ months	Zoning Permit	Ceiling height
Pilotenstraat 6	Yes	Enkelbestemming bedrijf	
Gedempt Hamerkanaal 127 -183	No - verhuurd		
Hoogoorddreef 60	Yes	Gemengd	2.8
Vliegtuigstraat 6	Yes	Enkelbestemming bedrijf	
Radarweg 60	Yes	Gemengd	2.7
Pietersbergweg 273	Yes	Gemengd	3.0
Pietersbergweg 199	No - 2 maanden		
Paasheuvelweg 3	Yes	Gemengd	2.8
Paasheuvelweg 1	Yes	Gemengd	2.65
James Wattstraat 100	Yes	Enkelbestemming kantoor	
Hullenbergweg 278	Yes	Gemengd	2.7
Hullenbergweg 81 135	Yes	Gemengd	3.1
Hoogoorddreef 62	Yes	Gemengd	2.8
Hogehilweg 24	Yes	Gemengd	2.7
Hogehilweg 21	Yes	Gemengd	2.6
Hogehilweg 18	Yes	Gemengd	2.6
Hogehilweg 8	Yes	Gemengd	2.9
Herikerbergweg 145	Yes	Gemengd	2.8
Helicopterstraat 25A	No - verhuurd		
Hatostraat 28	Yes	Gemengd	2.8
De Boelelaan 30	No - te klein		
Strawinskylaan 3001	Yes	Enkelbestemming kantoor	
Strawinskylaan 1865	No - verhuurd		
Eduard van Beinumstraat 4 -36	No - verhuurd		
Wibautstraat 137	Yes	Gemengd	2.6
Prins Bernhardplein 200	Yes	Enkelbestemming kantoor	
Pilotenstraat 32 45	Yes	Enkelbestemming bedrijf	
Orlyplein 73 -97	No - 4 maanden		
La Guardiaweg 36	Yes	Gemengd	2.7
Kingsfordweg 43	Yes	Gemengd	3.0
Jachthavenweg 112	Yes	Enkelbestemming kantoor	
Jachthavenweg 109	Yes	Enkelbestemming kantoor	
Hoogoorddreef 7	Yes	Gemengd	2.7
Herikerbergweg 181	Yes	Gemengd	2.7
Herikerbergweg 74	Yes	Gemengd	2.9
Herikerbergweg 35	Yes	Gemengd	2.8
Gustav Mahlerplein 3 -117	No - verhuurd		
Gatwickstraat 9	Yes	Gemengd	2.6
Barbara Strozzilaan 336	Yes	Enkelbestemming kantoor	
Antonio Vivaldistraat 66	Yes	Enkelbestemming kantoor	
Amstelplein 6	Yes	Enkelbestemming kantoor	

APPENDIX 4: STEP 2: TRANSFORMATION METER AMSTERDAM 2023

Address	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Total
Hoogoorddreef 60	0	1	1	1	0	1	1	1	1	1	1	1	0	1	1	1	1	0	14
Radarweg 60	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	0	15
Pietersbergweg 273	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	15
Paasheuvelweg 3	0	0	0	0	0	0	1	1	1	1	0	1	1	1	1	1	1	0	10
Paasheuvelweg 1	0	1	1	0	0	0	1	1	1	1	0	1	1	1	1	1	1	0	12
Hullenbergweg 278	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	13
Hullenbergweg 81 135	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Hoogoorddreef 62	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	15
Hogehilweg 24	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	12
Hogehilweg 21	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Hogehilweg 18	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Hogehilweg 8	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Herikerbergweg 145	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	12
Hatostraat 28	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	13
Wibautstraat 137	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	0	15
La Guardiaweg 36	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	13
Kingsfordweg 43	0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	12
Hoogoorddreef 7	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Herikerbergweg 181	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Herikerbergweg 74	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	14
Herikerbergweg 35	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	0	11
Gatwickstraat 9	0	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	12

APPENDIX 5: STEP 3: TRANSFORMATION METER AMSTERDAM 2023

Address	Bouwjaar	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	Totaal
Hoogoorddreef 60	1984	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	1	1	20
Radarweg 60	1992	1	0	0	1	1	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	22
Pietersbergweg 273	2000	1	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
Hullenbergweg 278	2000	1	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	22
Hullenbergweg 81- 135	1999	1	1	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
Hoogoorddreef 62	1988	1	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1	0	1	1	0	0	0	1	1	1	20
Hogehilweg 21	1982	1	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	21
Hogehilweg 18	1991	1	1	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	24
Hogehilweg 8	1981	1	0	0	0	1	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	0	0	1	1	1	1	21
Hatostraat 28	1993	1	0	1	1	1	0	1	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	0	0	0	1	0	1	19
Wibautstraat 137	1980	1	0	0	1	1	0	0	0	1	1	0	1	0	1	1	1	1	1	1	1	1	1	0	1	0	1	0	1	18
La Guardiaweg 36	2010	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25
Kingsfordweg 43	2005	1	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	25
Hoogoorddreef 7	1981	1	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	1	1	1	20
Herikerbergweg 181	2012	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	26
Herikerbergweg 74	2011	1	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	25
Gatwickstraat 9	1992	1	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1	1	22

APPENDIX 6: OUTCOME TRANSFORMATION METER AMSTERDAM 2023

Address	Total Step 2 Location	Total Step 3 Building	Transformation Score	Transformation Class
Hoogoorddreef 60	14	20	130	4
Radarweg 60	15	22	141	4
Pietersbergweg 273	15	24	147	5
Hullenbergweg 278	13	22	131	4
Hullenbergweg 81- 135	14	24	142	4
Hoogoorddreef 62	15	20	135	4
Hogehilweg 21	14	21	133	4
Hogehilweg 18	14	24	142	4
Hogehilweg 8	14	21	133	4
Hatostraat 28	14	19	127	4
Wibautstraat 137	18	20	150	5
La Guardiaweg 36	14	25	145	5
Kingsfordweg 43	13	25	140	4
Hoogoorddreef 7	14	20	130	4
Herikerbergweg 181	14	26	148	5
Herikerbergweg 74	14	25	145	5
Gatwickstraat 9	13	22	131	4

APPENDIX 7: OUTCOME MODIFIED TRANSFORMATION METER AMSTERDAM 2023

Address	Total Step 2 Building	Total Step 3 Location	Transformation score	Transfrmation Class
Hoogoorddreef 60	20	14	142	4
Radarweg 60	22	15	155	4
Pietersbergweg 273	24	15	165	5
Hullenbergweg 278	22	13	149	4
Hullenbergweg 81- 135	24	14	162	5
Hoogoorddreef 62	20	15	145	4
Hogehilweg 21	21	14	147	4
Hogehilweg 18	24	14	162	5
Hogehilweg 8	21	14	147	4
Hatostraat 28	19	14	137	4
La Guardiaweg 36	25	16	173	5
Kingsfordweg 43	25	14	167	5
Hoogoorddreef 7	20	13	139	4
Herikerbergweg 181	26	14	172	5
Herikerbergweg 74	25	14	167	5
Gatwickstraat 9	22	14	152	4
Paasheuvelweg 3	23	10	145	4
Paasheuvelweg 1	21	12	141	4
Hogehilweg 24	24	12	156	4
Herikerbergweg 145	23	12	151	4
Herikerbergweg 35	22	11	143	4